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"Navigating the Human-AI Collaboration in Education: Challenges and Opportunities"

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WELCOME MESSAGE FROM THE ORGANIZING COMMITTEE

Assalamu'alaikum warrahmatulah wabarakatuh

I would first like to express my gratitude for the blessings and guidance that have brought us together for this conference.

It is my pleasure to welcome you to the 13th International Conference on Educational Research and Innovation (ICERI) at Universitas Negeri Yogyakarta. This year's theme is "Navigating Human-AI Collaboration in Education: Challenges and Opportunities," with a special focus on Artificial Intelligence in education.

We would like to welcome and recognize our esteemed keynote and invited speakers: Dr. Fauzan Adziman, M.Eng., Director General of Research and Development, the Ministry of Higher Education, Science, and Technology, Indonesia; Prof. Oh Jin Park, Ph.D., CEO, 3PLINK, Korea; Prof. Nur Hidayanto Pancoro Setyo Putro, Ph.D., Vice-Rector for Academic Affairs, Universitas Negeri Yogyakarta, Indonesia; Assoc. Prof. Chailerd Pichitpornchai, Ph.D., Director of International Institute for Learning, Mahidol University, Thailand; and Assoc. Prof. Kuan-Ting Lai, AIoT Laboratorium, National Taipei University and Technology. Thank you to all our speakers for sharing your valuable time and wisdom at this conference.

This conference is a forum for participants to share and discuss the latest advancements and issues in Education. We have received more than 1000 abstracts. We hope you find the keynote presentations, plenary panels, and paper presentations interesting and illuminating. We encourage you to participate in the discussion, take advantage of the many benefits the Conference offers, and connect with new friends.

We are very honored to welcome you to Yogyakarta. The city is the capital and administrative center of the Special Region of Yogyakarta, Indonesia. Yogyakarta is a large urban area that preserves Javanese culture and traditions. It is home to the Sultan's palace, several universities, and the famous World Heritage Site of Borobudur. I hope you have a memorable experience exploring the city, the palace, and this World Heritage Site.

Thank you to all Committee members for making this conference possible. I warmly welcome you to Yogyakarta, and wish you an inspiring conference experience.

Wassalamu'alaikum warrahmatulah wabarakatuh

Prof. Dr. Yudik Prasetyo, S.Or., M.Kes.
Director of the Directorate for Research and Community Service
Universitas Negeri Yogyakarta

RECTOR' SPEECH

Assalaamu'alaikum Warahmatullaahi Wabarakaatuh

I gratefully welcome all participants to the 2025 International Conference on Educational Research and Innovation (ICERI). This conference is a crucial opportunity for the academic community, education practitioners, and policymakers from various countries to discuss and collaborate in responding to global dynamics in education, particularly in the era of collaboration between humans and artificial intelligence.

The development of digital technology, particularly artificial intelligence, has brought about major changes in the way we learn, teach, and conduct research. However, this progress also demands that we ensure that technology remains aligned with humanitarian values, ethics, and social justice. This is where human AI collaboration becomes crucial, not to replace humans, but to strengthen their capacity to create more adaptive, inclusive, and meaningful learning.

Universitas Negeri Yogyakarta is strongly committed to being an active part of this transformation. Through strategic policies in developing a smart campus, improving digital literacy among its academic community, and strengthening interdisciplinary research in the field of artificial intelligence in education, UNY continues to encourage innovation oriented towards human well-being and the sustainability of education. We believe that research and learning that utilize technology wisely will expand access, improve quality, and foster national competitiveness on the global stage.

ICERI 2025 is a concrete manifestation of this collaborative spirit. Through this forum, we hope to forge a cross-national knowledge network capable of generating strategic ideas for the future of ethical and equitable AI-based education. May the discussions during this conference inspire and provide new direction for the development of more humane educational policies, research, and practices.

Finally, I would like to express my appreciation to all the committee members, speakers, and participants for their dedication and participation. Let us continue to move together toward a future of intelligent, ethical, and humanity-oriented education.

Have a great conference.

Wassalaamu'alaikum Warahmatullaahi Wabarakaatuh

Prof. Dr. Sumaryanto, M.Kes., AIFO
Rector of Universitas Negeri Yogyakarta

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FROM DRAFT TO PUBLICATION: ASSISTANCE WITH PUBLICATION OF SCIENTIFIC ARTICLES FOR TEACHERS OF VOCATIONAL SCHOOL 5 YOGYAKARTA

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Abstract. The publication of scientific articles is a crucial pillar in teacher professional development, serving as a means of disseminating knowledge and a reflective instrument for evaluating teaching practices. The scientific writing and journal publication training program for teachers at SMKN 5 Yogyakarta and members of the Textile Craft Subject Teachers' Conference in the Yogyakarta region was designed to improve their writing skills and academic publication capacity. The program was implemented through three sessions: an offline workshop on writing structure and techniques, online training on background development, and guidance on results, discussions, and conclusions. Participants were also facilitated with online consultations, article submission simulations, and periodic evaluations. The program evaluated both the process and outcomes. During the training, participants demonstrated high enthusiasm, active participation in discussions, and a commitment to refining their manuscripts through intensive communication with their mentors. As a result, 23 articles were successfully written, generally of good quality, although further guidance was needed to meet stricter scientific publication standards. These findings indicate that the training improved teachers' conceptual knowledge, technical skills, and motivation in writing scientific articles. The program's success also underscores the importance of ongoing support so that teachers not only produce publishable manuscripts but also contribute to the development of educational knowledge and practice, particularly in the field of textile crafts.

INTRODUCTION

This publication of scientific articles is one of the main pillars in the continuous professional development of educators [1; 2], because it functions not only as a means of disseminating scientific knowledge, but also as a reflective and evaluative instrument in educational practice. Scientific publications enable teachers to document, critique, and develop evidence-based pedagogical innovations for the academic community and educational practitioners..

In the context of modern education which continues to develop along with the dynamics of science and technology, the role of teachers is no longer limited to delivering teaching materials in class, but also includes active contributions to the development of science [3; 4]. One form of this contribution is through scientific publications that can be a reference for the academic community and education practitioners [5].

Scientific publications not only serve as a medium for disseminating scientific knowledge, but also as a means of critical reflection for educators in evaluating the learning practices they implement [6]. Through publications, teachers can review their teaching experiences, identify strengths and weaknesses, and develop more effective learning strategies [7]. This process encourages teachers to apply analytical and evidence-based thinking in pedagogical decision-making, thereby improving the quality of learning provided to students..

In addition, scientific publications also play a role in building an academic culture that encourages teachers to continuously update their knowledge in accordance with the latest developments in educational theory and practice [8]. Scientific publications not only share insights, but also provide feedback that strengthens teachers' professionalism, making them more reflective, innovative, and adaptive to educational challenges [9].

By writing about their learning experiences and innovations, teachers provide insights for educators, policy makers, and the community, while also building an academic culture in schools [10], where teachers are not only consumers of knowledge but also producers who actively contribute to the development of educational theory and practice (Roth 2013).

SMKN 5 Yogyakarta as an educational institution that is oriented towards strengthening teacher capacity in the academic realm has initiated various professional development programs, one of which was the implementation of a scientific paper writing workshop in the previous year, namely 2024.

This workshop equipped teachers with academic writing techniques and guided them in drafting scientific articles, so that most participants succeeded in producing manuscripts that had the potential to be published.

However, teachers face obstacles in selecting appropriate journals, understanding the style of the environment, meeting academic standards, and responding to peer-review feedback in the publication process [11]. Lack of experience in dealing with revisions given by reviewers often becomes a challenge for teachers in their efforts to publish scientific articles effectively. Apart from technical constraints, psychological factors such as low self-confidence, fear of being rejected by journals, and minimal ongoing mentoring also limit the publications of teachers at SMKN 5 Yogyakarta..

Based on the identified problems, further assistance is needed that includes technical aspects, publication strategies, journal selection, and peer-review preparation, so that SMKN 5 Yogyakarta teachers can improve their academic capacity and successfully publish articles, while strengthening the vocational education scientific ecosystem.

THEORETICAL BASIS

1. Overview of Scientific Papers

A scientific paper is a written form of scientific work—such as an article, paper, or book—and requires writing skills, systematic argumentation, and academic standards to be accepted within the scientific community. Oral scientific work, such as seminar or conference presentations, emphasizes communication skills, audience interaction, and adapting to questions, with the same goals as written work: to disseminate knowledge, facilitate discussion, and promote scientific advancement.

Therefore, both are essential components in the process of disseminating information and developing scientific knowledge. Understanding these differences helps academics and researchers choose the delivery method that best suits their goals and audience, so that their work can be more effectively recognized and appreciated by the scientific community.

A scientific paper is a written report presenting the results of research or studies, compiled in accordance with scientific principles and academic ethics, with a focus on clarity of problem, accuracy of method, validity of data, objectivity of analysis, and inclusion of relevant references to contribute to the development of science. Scientific papers are not simply written documents, but a means for sharing knowledge, testing theories, and developing concepts. Through peer review, works that meet high quality standards are published, enabling constructive dialogue and effective collaboration among researchers.

Scientific writing is also often called academic writing [12], because they are usually written by university campuses, lecturers, students, or anyone involved in the academic world and the development of science. Scientific papers play a vital role in the development of science and technology, enabling researchers to provide in-depth explanations of natural and social phenomena [13]. This explanation aims to understand the basic principles underlying the phenomenon, thereby enriching existing knowledge and paving the way for further research. Furthermore, scientific papers also serve to predict events or developments that may occur in the future [14; 15]. Through in-depth data and analysis, researchers can predict outcomes, identify trends, and anticipate changes to support planning and decision-making.

Apart from explaining and predicting, scientific papers function as supervision, namely using science and technology to control conditions in order to achieve the desired results [16]. For example, in medicine, quality scientific papers can help develop new protocols for disease treatment, while in the environmental field, scientific research can be used to design effective climate change mitigation strategies. Thus, scientific papers not only document new findings but also guide the responsible application of science, serving as a key pillar of scientific development, encouraging innovation, and improving the quality of human life.

Scientific papers play a strategic role in the development of science, disseminating innovative findings or ideas, expanding the exchange of knowledge, enriching academic discourse, and bridging the gap between research and its application in real life.

Scientific papers also build researchers' reputations and credibility, as publication in leading journals demonstrates the quality, originality, and relevance of research recognized by the global scientific community. Furthermore, scientific papers also serve as a foundation for collaboration between researchers, both domestically and internationally. Through the dissemination of information and research results, scientists can share insights, identify opportunities for collaboration, and collaboratively solve complex problems.

Thus, the existence of scientific papers not only plays a role in the development of science itself, but also in strengthening the global knowledge network and accelerating technological progress and innovation in various fields. Day, R. A. & Gastel, [17], in this connection, it has been conveyed, namely “Communication to other scientists ensures that new findings become part of a growing body of publicly available knowledge that information about how we understand the world around us”.

Scientific writings vary, from research reports, papers, or journal articles, and are divided into scientific and popular—the latter using simpler language and systematics, not necessarily unscientific. This is in line with the meaning of the term "popular" in the Indonesian Dictionary, which states that the word "popular" means known and liked by many people (generally). It can also mean according to the needs of society in general, or easily understood by many people. Popular scientific articles use relaxed, concise, and easy-to-understand language with an attractive presentation, are not bound by strict scientific rules, and are intended for public consumption, not academic purposes. In general, scientific and popular writings have an outline: introduction, discussion, and conclusion. Non-popular scientific works usually also include an abstract, methods, and bibliography.

2. Scientific Writing in the Context of Teacher Professional Development

Teachers, in the context of scientific writing, can be viewed as part of an effort to increase their capacity and professionalism. For example, Article 1, paragraph 1 of Law Number 14 of 2005 concerning Teachers and Lecturers states that "Teachers are professional educators with the primary task of educating, teaching, guiding, directing, training, assessing, and evaluating students.".

Becoming an effective professional educator requires a commitment to continuously engaging with developments in the surrounding sciences. A teacher must not only possess adequate knowledge of the material they teach, but also proactively follow the latest developments in science and education. This is crucial to ensure they stay abreast of current discourse and theories relevant to the subjects they teach.

By engaging deeply in scientific developments, teachers can update and enrich their teaching materials, ensuring that the knowledge imparted to students remains relevant and up-to-date. Teachers' lag in keeping up with scientific developments can diminish the quality of education, while active engagement encourages innovative teaching methods, enhancing the learning experience and improving student academic achievement.

Therefore, professional teachers must make engagement with scientific developments a part of their responsibility, through reading literature, attending discussions, seminars, and workshops, and actively participating in the production of scientific discourse, in order to optimally support student learning and potential development. This can be achieved, among other things, when teachers are willing and able to publish their own scientific papers.

In addition to its substantial significance, scientific papers are also a technical prerequisite for teachers applying for promotion or academic positions. The technical provisions referred to are regulated, among other things, by Regulation of the Minister of Administrative and Bureaucratic Reform Number 16 of 2009, which regulates Teacher Functional Positions and their Credit Points. In addition to the main elements of teaching activities, teachers must also fulfill the elements of professional development through the publication of scientific activities or innovative works.

3. Overview of Scientific Journals

Scientific journals can be understood as periodical publications published by professional organizations or academic institutions with the aim of disseminating knowledge and research results in a particular field of science [18 19; 20]. Journals serve as a platform for the publication of scientific works—research results and theoretical analyses—that have undergone peer review to ensure their quality, accuracy, and contribution to knowledge.

As periodical publications, scientific journals are published regularly—monthly, quarterly, or annually—through a process of selection, peer review, revision, and finalization, to provide a platform for sharing findings, innovations, and theories that drive scientific advancement..

In addition to publication, scientific journals maintain scientific standards through peer review, ensuring only high-quality research is published, and play a role in advancing science, supporting collaboration, and inspiring further research. In this regard, Adnan, Z. & Zifirdaus [21] for example, referring to scientific journals as forums intended for communication purposes between members of the scientific community, which generally correspond to their interests and concerns..

ACTIVITY METHOD

The method of implementing community service activities, in the form of workshops or training in writing scientific papers and publication in journals for teachers at SMKN 5 Yogyakarta and teachers who are members of the MGMP Textile Craft SMK in Yogyakarta, is as follows.

1. The lecture method specifically relates to understanding the paradigms of scientific writing; the process of writing a scientific paper; and the process of publishing a scientific paper in a scientific journal.
2. The assignment method relates to writing a scientific paper and is accompanied by guidance until it is ready for publication in a scientific journal.

RESULTS OF ACTIVITY IMPLEMENTATION

Community service activities in the form of workshops on writing and publishing scientific works are aimed at teachers of SMKN 5 Yogyakarta and members of the Textile Craft Subject Teachers' Conference in Yogyakarta, to improve their skills and knowledge in compiling quality scientific works..

This workshop provides intensive training in scientific writing and publication, from research planning to manuscript editing, including journal selection and peer review, so that teachers can improve their practical skills and capacity to contribute to science and craft education.

This activity involves teachers from SMKN 5 Yogyakarta and members of the Textile Craft Subject Teachers' Conference in Yogyakarta to build a local academic community, encourage the exchange of ideas, research collaboration, and help overcome publication challenges, thereby strengthening the role of teachers as agents of change in education and science.

Regarding the results of the implementation of community service activities, in the form of workshops or training in writing scientific papers and publications in journals for teachers at SMKN 5 Yogyakarta and teachers who are members of the members of the Textile Craft Subject Teachers' Conference in Yogyakarta, two things can be conveyed, namely first related to the process and second the results of the written work products produced. The description of the research results as intended is as follows.

1. Discussion

A training program for scientific writing and journal publication for teachers at SMKN 5 Yogyakarta and members of the Textile Craft Subject Teachers' Conferen at SMK in the Yogyakarta region was comprehensively and systematically designed over three meetings. This series of activities was intended to improve teachers' capacity and skills in producing scientific works worthy of publication in academic journals.

The first meeting is scheduled for August 22, 2025, and will be held offline at SMKN 5 Yogyakarta. This initial session serves as the main foundation, where participants will receive intensive training on the structure and techniques of writing the body of a scientific article. The material will not only cover aspects of writing formatting that comply with academic standards, but also how to organize the substance to be more coherent, logical, and focused. This is important considering that most participants already have drafts of their articles, but they are still in very diverse conditions, both in terms of writing format and presentation of the substance. Therefore, this first meeting aims to align perceptions and equip participants with stronger basic skills so that their manuscripts can be reorganized and developed into scientific articles ready for publication.

The second meeting will be held on August 23, 2025. At this stage, the training focus shifts to one of the most crucial components of a scientific article: the background section. Participants will be invited to learn how to develop a good research background, starting with clearly presenting the problem context, reviewing previous studies, and explicitly formulating the research gap. The goal is for participants to more precisely articulate the reasons why their research is important and the expected contribution it will make. The third meeting will take place on August 29, 2025. In this closing session, the material will focus on reviewing and strengthening the research results, discussion, and conclusions sections. Participants will be encouraged to understand how to present research data clearly, conduct logical and in-depth analysis, and summarize research findings concisely but meaningfully. With this training, teachers are expected to be able to demonstrate the relevance of their research results from both theoretical and practical aspects. The fourth meeting, held on August 30, 2025, will continue the material on reviewing and strengthening research results, discussion, and conclusions, presenting data clearly, analyzing logically, and summarizing findings concisely but meaningfully.

In addition to the three main meetings, the program also provides a space for independent learning. Participants are encouraged to actively refine their respective article manuscripts based on the feedback they receive. To support this process, facilitators provide online consultation services so teachers can consult at any time if they encounter any writing difficulties. After the writing period is complete, each participant is required to submit a revised article. The manuscript will then undergo a review process by a mentoring team. The review results, including corrective notes and constructive feedback, will be provided to authors so they can improve the quality of their articles before final publication.

Overall, this activity is not only intended as technical writing training, but also as a means of ongoing development to familiarize teachers with producing scientific papers. It is hoped that through this process, teachers will not only understand the academic standards applicable to journal publication but also be able to put them into practice. Thus, the resulting articles will not merely fulfill administrative requirements but will truly make a meaningful scientific contribution to the development of educational knowledge and practice in Indonesia.

With this systematic division of activities, it is hoped that teachers will not only gain practical skills in scientific writing and publication, but also be able to apply these skills effectively in their own writing,

contributing to the development of knowledge in the field of textile crafts. The following is an overview of the documentation related to the implementation of these training activities:

Figure 1. Implementation of Training From Draft to Publication for Teachers at SMKN 5 Yogyakarta and Textile Craft MGMP Teachers at SMK in Yogyakarta.
(Source: Community Service Team Documentation, Agustus 2025)

Figure 2. Implementation of Training From Draft to Publication for Teachers at SMKN 5 Yogyakarta and Textile Craft MGMP Teachers at SMK in Yogyakarta.
(Source: Community Service Team Documentation, Agustus 2025)

Figure 3. Implementation of Training From Draft to Publication for Teachers at SMKN 5 Yogyakarta and Textile Craft MGMP Teachers at SMK in Yogyakarta.
(Source: Community Service Team Documentation, Agustus 2025)

Figure 4. Implementation of Training From Draft to Publication for Teachers at SMKN 5 Yogyakarta and Textile Craft MGMP Teachers at SMK in Yogyakarta.
(Source: Community Service Team Documentation, Agustus 2025)

Figure 5. Implementation of Training From Draft to Publication for Teachers at SMKN 5 Yogyakarta and Textile Craft MGMP Teachers at SMK in Yogyakarta.
(Source: Community Service Team Documentation, Agustus 2025)

2. Activity Evaluation

Evaluation of the implementation of training activities on writing scientific papers and journal publications aimed at teachers of SMKN 5 Yogyakarta and members of the MGMP Textile Crafts of Vocational Schools in the Yogyakarta region was carried out with an emphasis on two main aspects, namely the process and results.

From the process side, evaluation is carried out continuously, including observations of material delivery, scientific writing practices, method effectiveness, participant participation, and interaction, to assess the increase in participants' knowledge and skills in preparing scientific articles.

Meanwhile, evaluation of the results is carried out after the training, assessing the quality of scientific work—originality of ideas, quality of writing, and relevance to the field—as well as the impact of the training on the writing skills and publication abilities of participants..

Observations showed that participants were highly enthusiastic, actively participating in the material, asking questions, and expressing their views, reflecting their interest and commitment to mastering scientific article writing skills.

During the article writing assignment process, good communication dynamics were also evident. Participants actively engaged with the mentoring team, both via email and telephone, to discuss the progress of their articles and obtain feedback. This indicates a commitment to improving and perfecting their writing according to the directions given.

Judging from the results, the number of scientific articles successfully completed and submitted was 23. Quantitatively, this number is not particularly large, but in terms of quality, most of the articles can be categorized as quite good. Nevertheless, several weaknesses remain that need to be addressed to ensure the articles meet stricter scientific publication standards. The deficiencies identified relate to specific technical and substantive aspects that require refinement.

As a follow-up, each participant received individual guidance to improve the manuscript, increase the quality of the article before publication, so that they were able to produce work worthy of publication and make a real contribution to their field of knowledge..

Overall, the evaluation showed the training was effective, increasing theoretical knowledge, improving scientific writing skills, while identifying areas for improvement.

CONCLUSION

Based on the results of the implementation of the community service program which focuses on training in writing scientific papers and journal publications, involving teachers of SMKN 5 Yogyakarta and members of the Textile Craft MGMP of SMK in Yogyakarta, several important conclusions can be formulated.

First, during the training, participants demonstrated high enthusiasm and active participation, recognizing that scientific writing skills are essential for teacher professionalism, career development, and contributions to education. Second, participants successfully produced 23 scientific articles of considerable quality; follow-up, including intensive guidance, was required to refine the manuscripts to ensure they were suitable for publication in credible academic journals.

Overall, this training raised participants' awareness of the importance of scientific writing and emphasized the need for ongoing support to ensure high-quality work and significant contributions to the development of knowledge and educational practices in Indonesia.

Based on the results of the community service activities, including scientific writing and journal publications, conducted by teachers at SMKN 5 Yogyakarta and teachers within the Textile Craft MGMP (Vocational High School Textile Craft MGMP) in Yogyakarta, as discussed above, several important suggestions are proposed to various parties, as follows:

First, teachers are expected to continue developing their scientific writing skills, as the professionalism of educators encompasses the dissemination of knowledge to the public, making improving writing skills crucial.

Developing writing skills enriches teachers' competencies and contributes to the advancement of science. This allows them to share findings and ideas, strengthen their role as educators, and support the creation of knowledge and solutions in the field of education. By continuing to write scientifically, teachers expand their professional impact, contribute to science, connect theory and practice, and support improvements in the quality of education and its benefits to society.

Second, to improve teacher professionalism, relevant agencies need to develop an institutional framework that supports scientific publication, including providing dedicated journals for teachers' writing.

Currently, empirical evidence shows that teachers have limited access to scientific publications. Many existing scientific journals are generally located in higher education institutions and are often aimed more at lecturers and academic researchers than at teachers in the field. This limited access creates gaps in opportunities for teachers to publish their work and research.

Therefore, scientific journals specifically for teachers are crucial for disseminating research, innovation, and experience, improving the quality of knowledge, supporting professional recognition, expanding academic networks, and strengthening the role of teachers as agents of change in education.

Based on the implementation of community service activities in the form of scientific writing and journal publication, several important suggestions are available.

First, teachers are expected to continue writing scientific articles, as professionalism encompasses disseminating knowledge, sharing ideas and findings, enriching competencies, strengthening their role as educators, and providing benefits to society and education.

Second, the Department of Education needs to provide a dedicated journal for teachers to facilitate publication, support the dissemination of work, increase professional appreciation, expand networks, and strengthen teachers' role as agents of change and professional development.

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Ethical Implementation of AI-Based Gesture Recognition for Monitoring Student Engagement: A Teacher Training Program in Secondary Education

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Abstract. This community service program was carried out at SMPN 12 Yogyakarta to address the challenge of monitoring student engagement during classroom activities. Teachers often found it difficult to objectively assess student participation, especially in large classes or technology-assisted learning environments. To overcome this, an Artificial Intelligence (AI)-based system utilizing gesture recognition and a web-integrated feedback dashboard was introduced. The program consisted of several stages: needs analysis, teacher training workshops, system implementation, and evaluation. A total of 20 teachers participated in the activities, which included pre-tests, post-tests, and satisfaction surveys. The pre-test and post-test results showed an improvement in teachers' understanding of AI concepts and applications, although the statistical analysis indicated that the increase was not significant ($p > 0.05$). However, the average post-test score was above the minimum competency benchmark, demonstrating improved conceptual clarity. In addition, the evaluation survey revealed high satisfaction, with scores ranging from 4.37 to 4.79 out of 5, particularly on the relevance of the materials and the trainers' expertise. Teachers were also able to operate the gesture-based engagement detection system and utilize the real-time dashboard for feedback, though some required further guidance in interpreting data. The program concluded that AI-based gesture recognition can serve as an ethical and practical tool for monitoring student engagement and providing formative feedback in secondary education. This initiative not only enhanced teachers' digital literacy but also positioned SMPN 12 Yogyakarta as a model of innovative and ethical AI integration in schools.

Keywords: Artificial Intelligence, Student Engagement, Gesture Recognition, Learning Analytics, Teacher Training

INTRODUCTION

The integration of digital technology in education has advanced rapidly, shifting the focus from merely providing infrastructure to strengthening teachers' pedagogical capacity in leveraging these tools. Student engagement has been consistently recognized as a critical determinant of academic achievement, motivation, and learning retention (Fredricks et al., 2004; Bond et al., 2020). However, monitoring engagement in classroom settings, particularly in large classes, remains a challenge for teachers, as traditional observation methods are often subjective, inconsistent, and difficult to standardize.

In recent years, Artificial Intelligence (AI) has been increasingly explored as a solution to enhance evidence-based teaching practices. Computer vision techniques, especially pose estimation models such as BlazePose and MoveNet, enable real-time tracking of student gestures in a non-intrusive manner (Bazarevsky et al., 2020; Chen et al., 2022). Unlike facial recognition approaches, gesture-based recognition provides an ethical alternative by avoiding the collection of sensitive biometric data, thus aligning with UNESCO's (2023) guidelines on human-centered AI in education.

At the same time, Learning Analytics Dashboards (LADs) have emerged as practical tools for translating raw data into meaningful insights for both teachers and students (Ifenthaler & Yau, 2020; Schwendimann et al., 2021). By visualizing engagement indicators, LADs enable formative feedback that can guide instructional adjustments and foster student self-awareness. Yet, the successful adoption of such systems depends heavily on teacher readiness, digital literacy, and ongoing capacity building (Prieto-Alvarez et al., 2023).

This study builds upon these trends by reporting on a teacher training program conducted in a secondary school setting. The program introduced an AI-based gesture recognition system integrated with a web dashboard, designed to provide ethical, objective, and real-time monitoring of student engagement. Beyond technological deployment, the program emphasized capacity building through workshops, mentoring, and reflective practices.

Specifically, this study aimed to (1) evaluate the effectiveness of teacher training in enhancing AI literacy, (2) assess teacher acceptance and satisfaction with the system, and (3) explore the pedagogical implications of gesture-based engagement monitoring for classroom practice.

LITERATURE REVIEW

Student Engagement in Learning

Student engagement has been widely recognized as a multidimensional construct encompassing behavioral, emotional, and cognitive aspects (Fredricks et al., 2004). Behavioral engagement observable through gestures, participation, and attention plays a central role in shaping classroom dynamics and learning outcomes. Empirical studies demonstrate that higher engagement levels are positively associated with academic performance and motivation (Bond et al., 2020).

Computer Vision and Gesture Recognition in Education

The advancement of computer vision, particularly in pose estimation, has created opportunities for objective engagement monitoring. Models such as BlazePose (Bazarevsky et al., 2020) and MoveNet (Chen et al., 2022) allow real-time tracking of body keypoints, enabling the detection of classroom behaviors such as raising hands, leaning forward, or maintaining attentive posture. Gesture-based monitoring offers both practical and ethical benefits by avoiding invasive methods such as facial recognition (Wang & Zhao, 2023).

Learning Analytics Dashboards (LADs)

Learning Analytics Dashboards translate raw data into actionable insights by visualizing engagement indicators, participation levels, and performance trends. Their implementation has been shown to improve teacher decision-making and student self-regulation (Ifenthaler & Yau, 2020; Schwendimann et al., 2021). However, usability and teacher acceptance remain critical factors for sustained adoption (López-Pernas et al., 2022).

Ethical Considerations in AI for Education

The application of AI in educational settings raises ethical questions related to privacy, transparency, and accountability. UNESCO (2023) emphasizes the need for human-centered and equitable AI. Gesture-based recognition aligns with these principles by reducing reliance on sensitive biometric identifiers, while still generating valuable pedagogical insights (Holmes et al., 2022; Zawacki-Richter et al., 2023).

RESEARCH METHOD

Research Design

This study adopted a participatory action research design, integrating elements of community service and empirical evaluation. The intervention was implemented through a structured teacher training program focusing on the introduction, operation, and pedagogical use of an AI-based gesture recognition system with a web-integrated dashboard. The design emphasized collaboration with school stakeholders to ensure contextual relevance and sustainability.

Participants

The program involved 20 teachers from SMPN 12 Yogyakarta, representing various subject areas. Participants were purposively selected based on their active teaching role and willingness to engage in technology-enhanced learning initiatives. All participants provided informed consent prior to their involvement.

Intervention Procedures

The intervention was carried out in four stages:

- Preparation and Coordination

Preliminary meetings were conducted with school leaders and teachers to identify needs, assess available infrastructure, and establish program objectives.

- Workshops and Training Sessions

A series of workshops introduced teachers to fundamental concepts of Artificial Intelligence, ethical considerations, and practical applications in education. Facilitators demonstrated the gesture recognition system and its integration with a learning analytics dashboard. Teachers participated in hands-on sessions to practice system operation.

- System Implementation

Teachers applied the system in classroom contexts. The AI-based model captured and analyzed student gestures (e.g., raising hands, sitting posture) as indicators of engagement. Data were visualized through a web-based dashboard to support real-time feedback and reflection.

- Evaluation and Reflection

Teacher understanding of AI concepts and system operation was measured using pre-test and post-test instruments. Additionally, participant satisfaction was assessed through a Likert-scale survey, while classroom observations and reflective discussions provided qualitative insights.

Data Analysis

Data were analyzed using paired sample t-tests to determine significant differences between pre-test and post-test scores. Descriptive statistics summarized survey results.

System Implementation

During the implementation phase, the AI-based gesture recognition system was deployed in classroom settings. The system workflow is presented in Figure 1

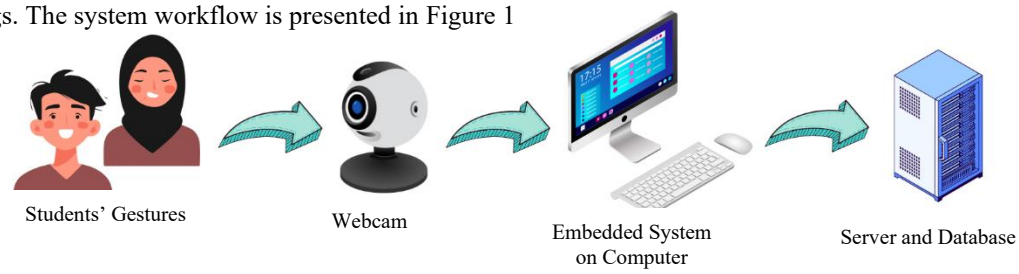

Figure 1. Workflow of the Gesture Recognition System

As illustrated in Figure 1, the process begins with students' gestures and expressions as input, which are captured by a webcam in real time. The captured data are then processed through an embedded system on a computer, which detects relevant gesture-based indicators of engagement. Finally, the processed information is transmitted to a server and database, allowing for centralized storage, further analysis, and visualization through the integrated web-based dashboard.

This workflow ensured that data collection was non-intrusive and ethically compliant, as the system relied solely on body gestures without storing sensitive biometric features. Moreover, the design allowed for scalability and flexibility, enabling future enhancements such as integration with additional learning analytics features.

RESULTS AND DISCUSSION

Teacher Knowledge: Pre-Test and Post-Test Results

The descriptive statistics of the knowledge assessment are presented in Table 1. The average pre-test score was 90.53 (SD = 10.79), while the post-test mean increased to 93.16 (SD = 10.03). Although the mean

improvement indicates a positive learning trend, the paired sample t-test yielded p = 0.350, suggesting that the difference was not statistically significant.

Tabel 1. Descriptive Statistics of Pre-Test and Post-Test Results

Test	Mean	N	Std. Deviation	*p*-value
Pre-Test	90.5263	19	10.79	0.350
Post-Test	93.1579	19	10.03	

As illustrated in Figure 2, both pre-test and post-test scores were generally high, with most teachers achieving above 90. The reduced variability in the post-test suggests improved consistency across participants, even though the overall mean difference was modest. This pattern indicates that the training was effective in harmonizing teachers' conceptual understanding of AI, though not sufficient to produce statistically significant gains in such a short timeframe.

Figure 2. Comparison of Pre-Test and Post-Test Scores

These findings echo prior research emphasizing that short-term interventions are useful for raising awareness but insufficient for deep knowledge transformation (Ifenthaler & Yau, 2020; Holmes et al., 2022). Sustained professional development, iterative practice, and reflective mentoring are needed to translate conceptual learning into meaningful pedagogical application.

Teacher Satisfaction with the Program

Beyond cognitive outcomes, the satisfaction survey revealed strong positive responses from participants. The highest-rated aspects were the relevance of materials (M = 4.79), facilitators' mastery (M = 4.75), and clarity of delivery (M = 4.68). The lowest score was for facilities (M = 4.37), reflecting infrastructural limitations such as internet connectivity and device availability. Despite these constraints, the overall satisfaction rating remained very high (M = 4.73).

To triangulate these findings, Figure 3 presents an additional analysis of satisfaction data across four broader dimensions.

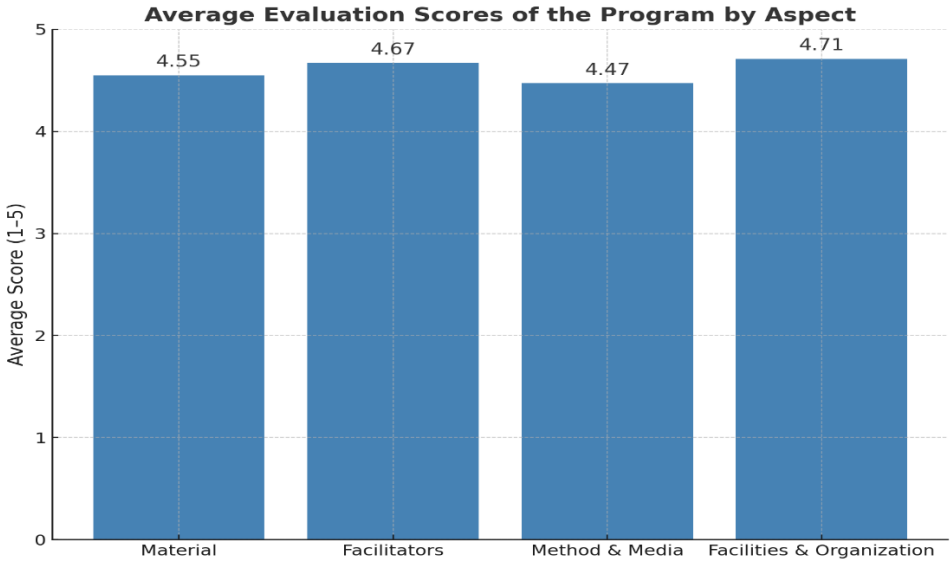

Figure 3. Average Evaluation Scores of the Program by Aspect

As illustrated in Figure 3, Facilities & Organization achieved the highest score (M = 4.71), followed by Facilitators (M = 4.67) and Material (M = 4.55). The lowest-rated aspect was Method & Media (M = 4.47), although still within the "very good" category. This indicates that while the program was well-received overall, further refinement in instructional methods and media utilization could enhance training effectiveness.

Implementation of the Gesture Recognition System

During classroom implementation, teachers successfully operated the gesture recognition system and accessed engagement analytics through the web-integrated dashboard. They reported that the visualization of participation indicators supported formative feedback practices, enabling them to acknowledge student contributions more objectively.

However, some teachers expressed challenges in interpreting dashboard data and aligning it with instructional decisions. This suggests the necessity of further training in data literacy—that is, the ability to translate analytics into actionable pedagogical strategies. Moreover, infrastructural issues such as unstable internet connectivity occasionally disrupted system performance, echoing the satisfaction survey's findings regarding facilities.

Discussion

The results provide several key insights. First, while knowledge gains were modest, the high satisfaction ratings and successful system use indicate strong teacher readiness for AI adoption in classroom practice. This aligns with prior findings that acceptance and perceived usefulness are crucial precursors to sustainable technology integration (Prieto-Alvarez et al., 2023).

Second, the gesture-based system proved to be an ethical and feasible approach to monitoring engagement. Unlike facial recognition methods, the use of body keypoints preserved student privacy while still producing actionable insights. This finding reinforces UNESCO's (2023) recommendation for human-centered AI applications in education.

Finally, the study highlights the importance of capacity building beyond initial training. Teachers require not only technical skills but also pedagogical frameworks to interpret engagement data effectively. Future implementations should incorporate ongoing mentoring and peer-sharing mechanisms to maximize impact.

CONCLUSION

This study demonstrates the feasibility and acceptance of an AI-based gesture recognition system integrated with a learning analytics dashboard as an ethical approach to monitoring student engagement in secondary education. The teacher training program successfully improved participants' conceptual understanding of AI and

fostered high levels of satisfaction, even though the statistical improvement in test scores was not significant. Importantly, the system enabled teachers to provide more objective and formative feedback, contributing to a culture of evidence-based teaching.

From a theoretical perspective, the study extends the discourse on student engagement by highlighting gesture-based indicators as valid, ethical, and practical alternatives to traditional observation and biometric-intensive methods. From a practical perspective, the findings emphasize that teacher training initiatives must go beyond technical skills to include data literacy and pedagogical integration, ensuring that analytics are meaningfully translated into instructional decisions.

At the policy level, this initiative aligns with international guidelines on human-centered AI in education, demonstrating how ethical AI applications can be scaled in school contexts without compromising learner privacy. Replication of this model in other institutions would require attention to infrastructure readiness, sustained mentoring, and institutional support to maximize long-term impact.

Future work should focus on longitudinal studies to assess sustained changes in teacher practice, student outcomes, and the broader school culture of technology adoption. By doing so, gesture-based engagement monitoring can serve not only as a technological innovation but also as a transformative pedagogical tool in the pursuit of equitable, ethical, and effective education.

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Internalizing Multicultural Values Through Pedagogical Competence: Enhancing Teacher Capacity For Inclusive Learning In Elementary School

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Abstract. Multicultural education is essential for fostering a harmonious society within the challenges of variety. This study seeks to assess the efficacy of a training program in enhancing teachers' pedagogical proficiency, particularly in the incorporation of multicultural values into the educational process. This research used a quantitative methodology utilizing a one-group pretest-posttest design, comprising 30 educators from the Yogyakarta State University (UNY) Laboratory School at the elementary level. Data was gathered using assessment tools that evaluated teacher competency before to and following training. Data analysis employing the Wilcoxon Signed-Rank Test indicated a notable enhancement in instructor competency. The median pre-test score of 30 rose to 36 on the post-test. The statistical test results indicate an Asymp. Sig. (2-tailed) value of 0.000 ($p < 0.05$), confirming that the training intervention significantly enhances pedagogical competence. This research verifies that structured training can effectively enhance teachers' ability to promote the internalization of multicultural values in students, hence fostering the development of tolerant and diversified character traits in kids.

Keywords: Pedagogical proficiency, multicultural education, educator preparation, multicultural principles, primary education.

INTRODUCTION

Indonesia is a country abundant in cultural, ethnic, religious, and linguistic diversity [1]. This richness serves as a cornerstone of national identity, although it may also engender susceptibility to social strife if the principles of tolerance and respect are not well assimilated throughout society[2]. In this situation, multicultural education arises as a vital and indispensable strategy. Multicultural education is fundamentally a process of cultivating attitudes and actions that humanistically honor difference and heterogeneity, aiming to foster an understanding of unity within diversity as the essential basis for patriotism [3].

Multicultural education functions not only as a subject matter but also as a reform tactic inside the educational system. The objective is to cultivate civilization and social harmony by fostering the capacity to acknowledge and embrace diversity among students [4], [5]. James A. Banks, a prominent authority in multicultural education, delineates five essential elements for educators to develop programs attuned to diversity: content integration, knowledge production processes, prejudice reduction, equitable pedagogy, and school cultural empowerment [6]. Consequently, this education not only ensures equitable possibilities for all individuals but also actively instructs on the appreciation of many cultures without bias [7].

Despite the prolonged adoption of multicultural education in Indonesia, its execution frequently remains confined to the cognitive domain, mostly including the basic transmission of knowledge regarding cultural facts.

This shallow procedure frequently fails to cultivate character and profoundly alter students' conduct. The overarching objective of multicultural education is to surpass these limitations, aiming to cultivate individuals who are not only academically proficient but also exhibit social awareness, empathy, and a dedication to universal principles such as tolerance, democracy, and justice [8]. Consequently, a transition in emphasis is required from merely imparting knowledge to assimilating values. Internalizing multicultural values involves instilling these values in kids, integrating them into their daily beliefs and behaviors [9].

The preliminary needs assessment performed at Labschool UNY Elementary School in February 2025 identified a substantial disparity between theory and practice. The interview with the principal underscored several problems, including students' necessity for direction in realizing their potential and interests, as well as educators' difficulties in executing inclusive pedagogical practices, particularly in assisting students with special needs. This investigation highlights an immediate necessity to educate students on the significance of tolerance regarding gender, religion, and sexual orientation disparities. The findings validate that, notwithstanding theoretical agreement on multicultural education, its practical application encounters limitations that are experimentally linked to the significance of multicultural instruction in diverse educational settings [10].

In this context, educators are pivotal in the execution and assimilation of multicultural ideas within the educational process. This accomplishment is significantly reliant on the teacher's exceptional educational expertise. Law Number 14 of 2005 about Teachers and Lecturers delineates four primary elements of teacher competence: educational, personality, social, and professional. Pedagogical competence, as delineated in Government Regulation Number 19 of 2005 Article 28 paragraph (3) letter a, refers to a teacher's capability to oversee student learning, devise and execute educational activities, evaluate learning outcomes, and foster student development to actualize their varied potential. The significance of this skill is undeniable, as an absence of pedagogical proficiency might render teachers uneasy, inadequate, and hesitant to execute teaching responsibilities effectively [11]. The difficulties in establishing multicultural education stem not just from policy but also from the teachers' own capabilities.

Consequently, systematic activities are essential to enhance teachers' pedagogical competency, facilitating effective diversity management at UNY Laboratory School and its incorporation into the sustainable learning process. This program seeks to aid instructors in promoting the internalization of multicultural values among students, therefore fostering a supportive, inclusive, and equitable educational environment. This research seeks to assess the efficacy and influence of enhancing teachers' pedagogical competence on the internalization of multicultural values in students, aiming to significantly contribute to the advancement of diversity-responsive educational practices in elementary school environments. This study aims to utilize SD Labschool UNY as the research site, with the expectation that its findings will yield valuable insights for the development of a teacher training model aimed at enhancing multicultural pedagogical competence, ultimately fostering a generation that excels academically and possesses robust social intelligence.

RESEARCH METHOD

A. Problem Solving Framework

The problems encountered in the Jl. Bantul No.50, Gedongkiwo, Kec. Mantrijeron, Kota Yogyakarta, Daerah Istimewa Yogyakarta where Labschool UNY is located will be solved through educational activities with the following details.

Input

a. Issues in the pedagogical competence of teachers at UNY Labschool Elementary School indicate the need for training to develop the pedagogical competence of elementary school educators in stimulating the internalisation of students' multicultural values in the independent curriculum learning process through the following activities.

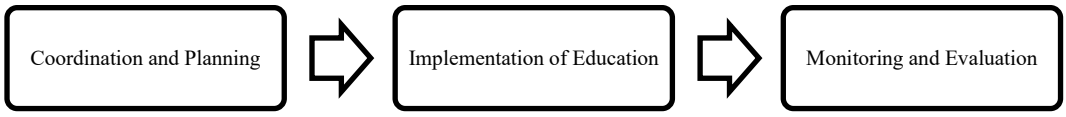

FIGURE 2. Flow of implementation

b. The training to improve the pedagogical competence of UNY Labschool primary school teachers in implementing the independent curriculum includes lectures, discussions, question and answer sessions, followed by simulations. This training is targeted at 30 participants from UNY Labschool primary schools. This training guides primary school teachers in understanding, planning and implementing the school curriculum, which aims to improve teachers' pedagogical competencies in supporting the learning process that internalises the multicultural values of students. The level of knowledge and understanding of the training participants is measured using the Wilcoxon test, which compares the pretest and posttest with the

aim of determining the improvement in the pedagogical abilities of the participants before and after the training.

Output

Some of the outputs of this study include:

Primary school teachers at Labschool UNY have an understanding and skills regarding multicultural values that must be internalised by students.

The realisation of independent curriculum learning tools that encourage the internalisation of multicultural values.

An increase in the pedagogical abilities of primary school teachers at Labschool Universitas Negeri YogyakartaTarget Audience

This training involved various parties. The target audience for the training was 30 primary school teachers from the Yogyakarta State University Labschool. Partners contributed by providing the training location and necessary facilities throughout the event. Some of the facilities provided included a comfortable room, tables and chairs, an LCD projector, an audio system, microphones, and documentation facilities. In addition, the partners also took part in the event organising team, with roles such as emcee, security manager, catering manager, and equipment manager. The partners collaborated with the UNY service team in preparing the training event on developing the pedagogical competencies of primary school teachers in internalising the multicultural values of students.

B. Activity Method

The following is the flow of activities in Community Service Education on the 3R Concept (Reduce, Reuse, and Recycle) for School-Age Children.

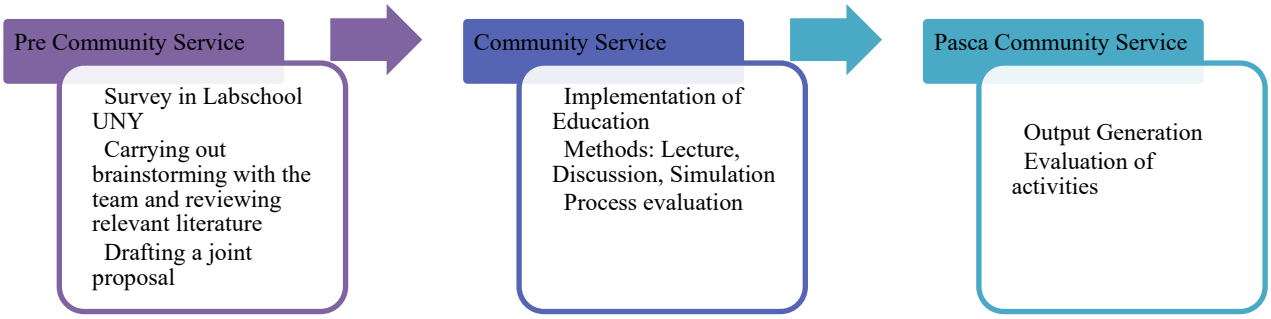

FIGURE 3. Method Flow

RESULTS AND DISCUSSION

Results of Activity Implementation

The training aimed at improving teachers' pedagogical skills to foster the absorption of students' multicultural values in the learning process was held at the UNY Laboratory School's pendopo for primary level educators. This course aims to enhance conceptual understanding, strengthen attitudes, and develop practical skills for elementary school teachers to facilitate the internalization of multicultural values in students through the learning process. Educators are anticipated to proficiently design, incorporate, and assess multicultural value-oriented pedagogical practices within the classroom.

The Pre-training activities encompass various stages, including: performing initial observations at the UNY Laboratory School at the elementary level, interviewing the principal and classroom teachers about the necessity for pedagogical enhancement, conducting internal team discussions to formulate training strategies, examining pertinent literature on multicultural education, and preparing a collaborative activity proposal.

The training activity is scheduled for Friday, August 29, 2025, at the Pendopo Labschool UNY, situated at Jl. Bantul No. 50, Gedongkiwo, Kec. Mantrijeron, Kota Yogyakarta, Daerah Istimewa Yogyakarta. The training activities encompass: administering a pretest to evaluate teachers' preliminary comprehension, delivering training through the brainstorming technique to investigate teaching experiences pertinent to multiculturalism, presenting conceptual content on multicultural values in education, engaging in simulations of multicultural-based learning, and utilizing worksheets to aid teachers in the development of instructional materials.

Thirty teachers from the UNY Laboratory School participated in a training program aimed at improving their pedagogical skills to foster the absorption of multicultural values in children during the learning process at the elementary level. The festivities commenced with a pause to conduct the Asr prayer initially. Prof. Dr. Edi Purwanta, M.Pd., as the leader of the service team, delivered an address and formally inaugurated the training event aimed at augmenting teachers' pedagogical competence in fostering the internalization of multicultural values among students during the learning process at the UNY laboratory school at the elementary level. In his

address, he asserted that this initiative is a strategic endeavor to enhance teachers' capacity to incorporate multicultural values into education, ensuring that students are not only academically proficient but also embody tolerance, mutual respect, and the ability to coexist harmoniously amidst diversity. He also underscored the significance of pedagogical competence that is responsive to contemporary demands, particularly educators' capacity to design, execute, and assess learning that is aligned with multicultural values. Consequently, this course aims to equip educators with the requisite information, attitudes, and skills for implementation in their daily instructional practices.

FIGURE 5. Participant Photo Group

Subsequent to the pretest, the session proceeded with content delivered by Dr. Aprilia Tina Lidyasari, M.Pd. The content addressed "Implementing Multicultural Education in Learning." On this occasion, she addressed the concept of multicultural education, the objectives of multicultural education-based learning, and the indicators of intercultural education. She also introduced the Culturally Responsive-Sustaining Education (CR-S) framework applicable to the multicultural education learning process. During the presentation, he also displayed the scholarly article and the educator's guide for assimilating multicultural principles in education. He also encouraged participants to collaboratively present examples of learning activities that can instill the principles of intercultural education. He closed the topic by delivering a message and motivation to the educators to maintain enthusiasm in studying and to provide optimal instruction for students, particularly in accommodating student diversity.

FIGURE 6. Sharing Session with Experts

After the presentation of the material, there was a question and answer session and discussion. The UNY Labschool teachers were very enthusiastic and asked several questions, namely about how to implement the Culturally Responsive-Sustaining Education (CR-S) approach in teaching modules and how to assess students. After the discussion session, there was a simulation of the practice of creating teaching modules based on multicultural education in accordance with the guidelines for teachers in internalising multicultural values in learning. This simulation and practice session was guided by Diajeng Tyas Phinru P, M.Pd. She provided teaching modules that could be used for practice, then the teachers worked on the teaching module format that had been presented independently. During this session, Prof. Dr. Edi Purwanta, M.Pd also accompanied the simulation and practice process of the participants.

FIGURE 7. Practical Session on Teaching Module Development

Following the practical session and simulation of developing instructional modules, the findings were then presented. During this session, participants are encouraged to present the outcomes of the teaching modules they independently developed in the prior session. Following the presentation of the prepared training modules, the service team offers recommendations and critiques concerning the modules created. The service team awarded door prizes to the group who excelled in producing their instructional modules. Furthermore, at the conclusion of the event, the service team identified some participants who effectively and optimally built their teaching modules.

FIGURE 8. Presentation of results and appreciation to participants

The execution of the TRAINING entitled "Training to Enhance Teachers' Pedagogical Competencies in Fostering the Internalization of Multicultural Values in Students During the Learning Process at the UNY Laboratory School Elementary Level" proceeded seamlessly and adhered to the event schedule, concluding at 5:00 PM WIB. All participants diligently engaged in the exercises till the training's conclusion. The concluding activity involved a final attendance verification and the administration of a posttest questionnaire. The pretest and posttest results from the training aimed at augmenting teachers' pedagogical competence in fostering the internalization of multicultural values among students during the learning process at the UNY laboratory school at the elementary level demonstrated a notable enhancement, as illustrated in the subsequent image.

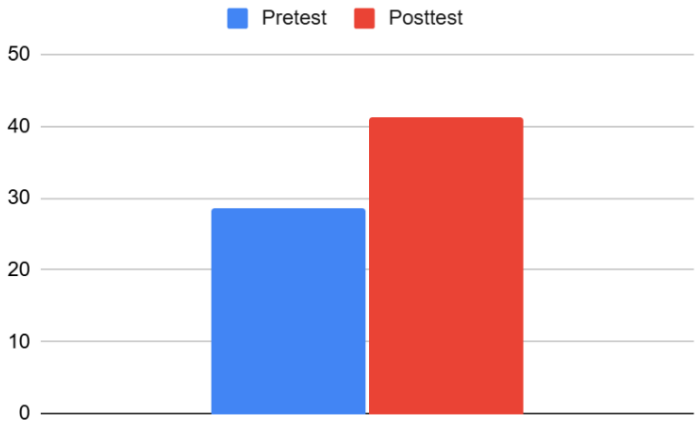

FIGURE 9. Average pretest and posttest questionnaire scores

The effective training program improves instructors' pedagogical skills in incorporating and promoting multicultural ideals. The quantitative data clearly indicates a substantial rise in scores. Prior to the training, the median pre-test score for educators was 30. Upon completion of the comprehensive training program, the median

post-test score rose to 36. This rise signifies that the participants successfully comprehended and assimilated the materials and methods employed in the training. The outcomes of the statistical analysis employing the Wilcoxon Signed-Rank Test further corroborate this conclusion. The test produced a significance value of 0.000, significantly below than the 0.05 criterion. This statistic empirically demonstrates that training exerts a substantial impact on enhancing teacher ability, rather than being a mere coincidence. Consequently, it can be inferred that this training intervention effectively addresses the deficiency in instructors' pedagogical competences, thereby positively influencing the internalization of multicultural values in students.

TABLE 1. Results of the Wilcoxon Pretest-Posttest Test of Teacher Pedagogical Competence

	Sig. Value (2-tailed)	Information	Interpretation
Pretest-Posttest	0.000	Sig. < 0.05	Hypothesis rejected

B. Discussion

The study results revealed a substantial enhancement in teacher competency through both quantitative and qualitative findings. The rise in the median score from 30 on the pre-test to 36 on the post-test quantitatively reflects the efficacy of the training program in reconciling the disparity between teachers' theoretical knowledge and practical skills. This enhancement is manifested in three principal dimensions: knowledge, wherein educators exhibit a deeper comprehension of multicultural education principles and the Culturally Responsive-Sustaining (CR-S) framework; attitudes, marked by educators' acknowledgment of the significance of incorporating multicultural values into everyday instruction; and skills, demonstrated by their capacity to develop more systematic and applicable teaching resources. This discovery corroborates prior studies demonstrating that professional development effectively improves teachers' multicultural competency, particularly in comprehending the cultures of migrant students and associated challenges [21], [22]. This increase may enhance teachers' capacity to create favorable learning environments by acknowledging each student's individuality [23], thereby underscoring that ongoing education and training are vital for the successful execution of multicultural education [24].

The enhancement of educational ability identified in this study encompasses not only the cognitive domain but also the affective and psychomotor domains. Effective intercultural education necessitates not only information but also emotional disposition and practical skills. This augmentation enables educators to employ culturally pertinent pedagogical methods and cultivate classroom settings that actively appreciate and endorse diversity [25], [26]. Consequently, educators can more efficiently foster the internalization of multicultural values in students, potentially diminishing prejudice and discrimination [27], [28]. This study underscores the necessity of ongoing enhancement, despite teachers employing several competences, including pedagogy, to adapt to the always evolving socio-cultural dynamics [29].

The significance of this instruction is inextricably linked to the progressively international educational landscape. Educators must no longer perceive multicultural education as fixed information, but instead as a dynamic instructional practice that requires continual evolution. This training assists educators in cultivating the global competencies and intercultural abilities necessary for equipping students to navigate an increasingly interconnected society [30]. Therefore, targeted training programs aimed at improving teacher competency are essential, particularly as numerous educators remain in the ethnocentric phase of the intercultural sensitivity model [17], [18]. Teachers incorporating multicultural values must also enhance their capacity to recognize and address unconscious biases and stereotypes that may emerge in the educational setting [31]. This training also promotes the development of pedagogy that fosters critical thinking in students about social and cultural justice concerns [32]. This signifies that ongoing professional development for educators is essential for maintaining curriculum and pedagogical approaches that are attuned to students' socio-cultural dynamics [33], [34], transcending the ethnocentric phases frequently encountered [35].

The efficacy of this training program hinges on two principal factors: the application of interactive learning methods, including debates and simulations, and the provision of advice and constructive feedback from mentors. These elements promote profound thinking and concurrent practice, which were essential in altering instructors' pedagogical topic understanding. The successful execution of multicultural pedagogy necessitates backing from school policies that foster an inclusive atmosphere and allocate sufficient resources [30]. Educators must also be provided with evaluative tools that extend beyond cognitive assessment to include students' emotive and behavioral aspects. This highlights the necessity for a comprehensive strategy in teacher competency development that emphasizes cognitive, affective, and psychomotor dimensions to facilitate the incorporation of multicultural values [18].

This research, albeit yielding substantial findings, possesses notable limitations that warrant consideration. The research design employed is a one-group pretest-posttest without a control group. This design does not permit the removal of exogenous variables, such as historical influences or participant development, that may transpire during the training time. Consequently, while a discernible enhancement is evident, the internal validity of these

findings cannot be asserted as being absolute. The limited sample size of 30 teachers restricts the capacity to extrapolate the findings to a broader demographic of educators, both within UNY Laboratory School and across other educational establishments. Third, data gathering systems that concentrate exclusively on written assessments may not adequately capture the comprehensive changes in teacher competency. Assessment through classroom observation or comprehensive interviews might yield a more comprehensive understanding of a teacher's capacity to implement multicultural ideals effectively in the educational process.

Given these constraints, it is advisable for future research to employ a more stringent experimental design, such as a randomized controlled trial, to enhance internal validity. It is advisable to engage a larger and more heterogeneous sample population. Moreover, subsequent study might employ a mixed-methods approach by integrating quantitative and qualitative data, like classroom observations or case studies, to more thoroughly assess the training's impact. Ultimately, research must be undertaken over an extended duration to assess the sustainability of training benefits and their enduring influence on teachers' behavioral modifications.

CONCLUSION

A comprehensive and critical study indicates that the implemented training program has significantly enhanced instructors' pedagogical competency, as seen by a notable rise in test scores and Wilcoxon test outcomes. The rise in the median score from 30 to 36 signifies not just a statistical change, but a genuine indication of the program's effectiveness in closing the divide between teachers' understanding of multicultural education's significance and their actual capacity to apply it.

This achievement underscores the essential importance of comprehensive training design, which emphasizes not merely theoretical instruction but also practical application and collaboration among educators. Enhanced competencies will enable teachers to incorporate values of tolerance and appreciation for diversity into their lesson plans and serve as agents of cultural change within the school environment. They may establish inclusive classrooms that appreciate and honor every uniqueness, while also serving as exemplars for children. This conclusion unequivocally asserts that investing in teacher professional development is a strategic and vital measure for establishing a robust educational foundation, which will ultimately yield a generation of successors who are tolerant and equipped to confront the complexities of a diverse society in the future.

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GOOD CITIZENS: POLICIES ON MORAL AND CIVIC EDUCATION IN INDONESIA

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Abstract. The formation of good citizens is a central aim of educational policy, shaped by each nation's political system, historical context, and cultural traditions. This study examines Indonesia's evolving civic and moral education policies through the lens of citizenship frameworks by Westheimer & Kahne (2004), Veugelers (2019), and Banks (2017). By reviewing key documents across four political eras—Sukarno's guided democracy, Soeharto's New Order, the early reform period, and the post-reform phase—it traces shifting interpretations of citizenship rooted in Pancasila. Sukarno emphasized anti-colonialism and socialism, while Soeharto redefined civic identity in response to Cold War tensions and the 1965 crisis. The Reformation era introduced democratic and anti-corruption values, culminating in the Pancasila Student Profile, which foregrounds school-based civic education. This historical analysis reveals how political transitions have shaped Indonesia's vision of responsible and engaged citizenship, highlighting the dynamic relationship between ideology, governance, and educational practice.

Key words: educational policies, good citizen, moral and civic education, national education

INTRODUCTION

How a nation envisions its ideal citizens is deeply embedded in its educational policies, shaped by political systems, historical experiences, and cultural traditions? Comparative studies, including those by David Kerr (1999, 2015) and Murray Print (1999), highlight that civic education frameworks reflect these foundational influences.

In Indonesia, the transition from authoritarian rule to a democratizing era has prompted significant shifts in how citizenship is cultivated through national education policies. Recent studies suggest a movement from a minimalist to a more maximalist civic education typology, particularly since the reform era.

This paper seeks to map Indonesia's moral and civic education policies using a typology of good citizens drawn from Westheimer & Kahne (2004), Veugelers (2019), and Banks (2017). These frameworks offer valuable lenses for analyzing the evolving orientation of citizenship formation across different political periods—from Sukarno's guided democracy to the post-reformation era—revealing how Indonesia's civic ideals have been continually redefined in response to changing national contexts

METHOD

Comparative studies of moral and civic education policies in nations striving to cultivate good citizens inevitably involve certain risks. These include the fluid nature of policy shifts driven by national political agendas, and the limitations of applying theoretical frameworks from unrelated contexts to a country's unique policy landscape.

To address these complexities in the Indonesian context, this study conducts a document-based analysis of moral and civic education policies across four distinct political eras: Sukarno's guided democracy, Soeharto's New Order, the Reformation period, and the post-Reformation era. The sources reviewed include curriculum guidelines, textbooks, and instructional materials related to civic and moral education.

By applying the citizenship typologies developed by Westheimer & Kahne (2004), Veugelers (2019), and Banks (2017), this study illustrates how different political eras in Indonesia have conceptualized and promoted distinct models of good citizenship. These frameworks—ranging from personally responsible to participatory and justice-oriented citizens—serve as analytical tools to examine the shifting priorities and values embedded in civic education policies. Through this approach, the study reveals how Indonesia's civic education has evolved in

response to changing political and ideological landscapes, reflecting broader efforts to shape citizens who align with the goals of each governing regime.

RESULTS AND DISCUSSION

In this section, the manuscript will present policy formulas for developing good citizens in each era. During the Sukarno era, the study of moral and civic education was introduced extensively in the 1964 New Style Curriculum (Kurikulum Gaya Baru, KGB 1964), although textbooks had been available since the early 1960s. The book Civics (1962) was used as teaching material that introduced the history of the national independence struggle, the history of Pancasila (five principles) as the foundation of the state and the national philosophy and ideology, the 1945 constitution, the history of the 1955 Asia-Africa Conference in Bandung, the rights and obligations of citizens, and Sukarno's speeches and political programs. During this era, citizens were taught a socialist-revolutionary character because of the government's enthusiasm at that time to mobilize decolonization of Asian-African countries and the Cold War in Southeast Asia.

In the Soeharto era, the policy of forming good citizens, in addition to being an antithesis to the Sukarno government, also intensified Pancasila education as a prevention of the influence of communism after the 1965 tragedy. Pancasila education in a number of nomenclatures such as Pancasila Moral Education (1975 and 1984 curriculum) and Pancasila and Citizenship Education (1994 curriculum) is a model of Pancasila indoctrination from the Pancasila Appreciation and Implementation Guidelines (P4) policy in the school pathway. Textbooks on the formation of good citizens contain an explanation of the values of Pancasila version P4, the 1945 constitution and the General Outlines of State Policy. The character of good citizens is formed in such a way as to support the stability of national development.

In the reform era, educational policies aimed at cultivating good citizens underwent a significant transformation, notably abandoning the P4 framework that had dominated civic education during the Soeharto period. A shift toward standardized materials and competency-based approaches marked a departure from earlier ideological models. Moral and civic education began to draw on universal principles supported by scientific reasoning, with frameworks influenced by institutions such as the Center for Civic Education (1994). The concept of good citizenship was redefined to emphasize moral, political, and legal literacy, encouraging students to engage rationally and critically in the public sphere.

In the post-reform period, however, Pancasila regained prominence as the foundation for civic identity, especially with the introduction of the Independent Curriculum in 2022. The “Pancasila Student Profile” emerged as a central construct, integrating 21st-century citizenship competencies with core Pancasila values. This profile is reinforced not only through formal instruction but also through cross-disciplinary and cultural programs within schools.

The final section of this manuscript explores how the citizen typologies proposed by Westheimer & Kahne (2004), Veugelers (2019), and Banks (2017) align with the shifting dynamics of Indonesia’s national education policies, particularly in the formulation of curricular programs and school textbooks aimed at developing good citizens. These typologies—ranging from personally responsible to participatory and justice-oriented citizens—serve as analytical lenses to examine how Indonesian civic and moral education policies have evolved across different political eras. However, the idealization of good citizenship in Indonesia has followed a pendular trajectory, oscillating between normative aspirations and pragmatic political interests. This fluctuation reveals that the typology embedded in policy documents is not always consistent or ideal, but rather shaped by the prevailing ideological and governance frameworks of each period. By tracing these tendencies, the study highlights the complex interplay between educational ideals and political realities in shaping civic identity.

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ENHANCING EARLY CHILDHOOD TEACHERS' KNOWLEDGE AND ATTITUDES TOWARD DIFFERENTIATED INSTRUCTION THROUGH A COLLABORATIVE WORKSHOP BETWEEN UNY AND HIMPAUDI SLEMAN

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Abstract. Differentiated instruction is an essential approach in Early Childhood Education (ECE) to ensure that every child receives learning experiences aligned with their readiness, interests, and learning profiles. Yet, many ECE teachers struggle to fully understand and implement this approach in practice. This community service program aimed to strengthen teachers' knowledge and attitudes toward differentiated instruction through a collaborative workshop organized by the Faculty of Education, Universitas Negeri Yogyakarta (UNY), and HIMPAUDI Kapanewon Sleman. The program combined lectures, guided lesson plan development, diagnostic assessment practice, and evaluation using pretest and posttest. Pretest results showed that teachers had a general understanding of differentiated instruction, with 100% correctly identifying its definition and rationale. However, knowledge of specific aspects, such as the main components (83.9%) and examples of practice (93.5%), needed improvement. In terms of attitudes, 64.5% strongly agreed that children learn differently, but only 51.6% strongly agreed on the importance of further training. After 32 hours of training, posttest results indicated notable improvement. A total of 96.2% of teachers accurately explained objectives, functions of assessment, and examples of differentiation, while 100% reported confidence in implementing the approach. Moreover, over 96% strongly agreed that differentiation is essential, felt prepared to design varied activities, and were motivated to apply it in their classrooms. In conclusion, the workshop effectively enhanced teachers' understanding and readiness to apply differentiated instruction, providing a replicable model for building nonformal ECE teachers' capacity in promoting child-centered learning.

Keywords: Early Childhood Education, differentiated instruction, workshop, teacher development

INTRODUCTION

Differentiated instruction is a pedagogical approach that emphasizes providing learning experiences aligned with children's readiness, interests, and learning profiles (Tomlinson, 2021). In the context of Early Childhood Education (ECE), this approach is particularly relevant because young children exhibit diverse developmental trajectories in cognitive, socio-emotional, and motor domains. A uniform and rigid teaching method often fails to accommodate these differences, leading to disparities in learning outcomes.

In Indonesia, the implementation of differentiated instruction in ECE remains challenging. Many teachers, particularly those working in nonformal ECE institutions, have not received adequate training in this area. Most teachers tend to adopt classical, one-size-fits-all methods, resulting in practices that are not fully child-centered.

Additional barriers such as limited resources, restricted access to academic references, and a lack of professional development opportunities further hinder teachers from effectively applying differentiated instruction in their classrooms (Kurniasih & Priyanti, 2023; Yuliantina & Boki, 2023).

As a higher education institution, Universitas Negeri Yogyakarta (UNY) holds both a moral and academic responsibility to contribute to teacher capacity building through community engagement programs. Collaboration with HIMPAUDI Sleman is a strategic effort since HIMPAUDI plays a pivotal role in facilitating professional growth for ECE teachers. This collaboration bridges academic theory and field practice, allowing teachers to gain both conceptual understanding and practical skills to implement differentiated instruction.

To address the challenges faced by teachers, this community service program was designed as a collaborative workshop aimed at enhancing ECE teachers' knowledge and attitudes toward differentiated instruction. The workshop combined conceptual input through lectures with practical sessions such as lesson plan development, diagnostic assessment simulations, and reflective discussions. The program was therefore expected not only to increase teachers' theoretical knowledge but also to strengthen their confidence and readiness to apply differentiated instruction in their daily practice.

This article aims to describe the implementation of the collaborative workshop between UNY and HIMPAUDI Sleman, analyze improvements in teachers' knowledge and attitudes toward differentiated instruction as reflected in pretest and posttest results, and provide recommendations for replicable models of teacher professional development in nonformal ECE contexts. Through this study, the authors seek to contribute to strengthening ECE teachers' capacity in Indonesia and promoting child-centered practices within nonformal early education settings.

LITERATURE REVIEW

Differentiated instruction is an approach that adapts content, process, and product of learning to meet learners' needs, interests, and profiles (Tomlinson, 2021). It is based on the premise that each child learns differently and thus requires flexibility in instructional design and delivery. In ECE, the approach is especially critical because children's developmental levels vary widely. Some children may demonstrate advanced cognitive skills, while others excel in socio-emotional or motor development (Lally, 2016). Consequently, teachers are expected to design varied activities that allow each child to reach optimal development according to their unique potential .

Despite its recognized importance, research indicates that many ECE teachers face difficulties in applying differentiated instruction. Several studies found that a lack of conceptual understanding, insufficient training, and limited access to instructional resources are major obstacles. As a result, teachers often rely on uniform instructional strategies that neglect individual differences (Hanayanti et al., 2023; Wardana, 2024). (Noviandari, 2024)further highlights structural challenges, such as limited facilities, high teacher-to-student ratios, and administrative pressures, which restrict teachers from conducting diagnostic assessments and planning individualized learning experiences. Addressing these barriers requires professional development programs that are practical, contextually relevant, and applicable to everyday classroom realities.

Workshops are recognized as an effective strategy for teacher professional development, as they provide opportunities for interactive learning that combines theoretical input with practical application (Noviandari, 2024). In the ECE context, workshops are particularly valuable because teachers need not only conceptual knowledge but also practical skills in designing differentiated learning activities. Collaboration between universities and professional organizations such as HIMPAUDI enhances workshop effectiveness. Universities contribute theoretical and research-based knowledge, while HIMPAUDI plays a crucial role in facilitating teacher participation, identifying field needs, and ensuring program sustainability. This synergy makes collaborative workshops a strategic model for strengthening the capacity of nonformal ECE teachers (Radić-Bojanić & Pop-Jovanov, 2018; Rani Rani et al., 2023).

Previous studies further support the effectiveness of professional development programs focused on differentiated instruction. Study demonstrated that training in differentiation improved teachers' ability to design and implement varied instructional strategies. In Indonesia, hands-on workshops encouraged teachers' confidence in conducting diagnostic assessments and applying differentiated practices in their classrooms (Hidayat et al., 2024; Wulandari et al., 2023). These findings underscore the potential of collaborative workshops to bridge the gap between theoretical urgency and practical challenges, making the UNY–HIMPAUDI initiative both timely and relevant.

METHOD

This community service program adopted a participatory training approach, which allowed active engagement of ECE teachers throughout the process, from conceptual learning to practical application.

The program was conducted in Kapanewon Sleman and involved **32 ECE teachers from HIMPAUDI**. The stages of the workshop included:

1. **Interactive lectures** on the concept of differentiated instruction, covering its definition, rationale, main components, and implementation in ECE settings.
2. **Lesson plan workshops** where teachers were guided in designing daily lesson plans (RPPH) that incorporated differentiation in content, process, and product.
3. **Diagnostic assessment simulations** to identify children's readiness, interests, and learning profiles.
4. **Group discussions and reflections** to share experiences and identify practical challenges in classrooms.
5. **Evaluation** through pretest–posttest of knowledge, attitude questionnaires, and observation of participant engagement.

Data analysis combined quantitative and qualitative approaches. Quantitative data were obtained from pretest and posttest results, while qualitative data were drawn from observation notes and group discussions.

RESULTS AND DISCUSSION

RESULTS

Pretest Findings

The pretest results showed that all teachers (100%) were able to explain the definition and rationale of differentiated instruction. However, only 83.9% could correctly identify its main components, such as differentiation of content, process, and product. In addition, 93.5% of teachers were able to provide simple examples of practice, although these did not fully reflect the principles of differentiation.

In terms of attitudes, 64.5% strongly agreed that children learn differently, while only 51.6% strongly agreed that further training on differentiated instruction was essential. This indicated that although teachers had a basic understanding, their commitment to continuous professional development still needed reinforcement.

Workshop Process

During the workshop, teachers demonstrated active participation. They were enthusiastic in designing lesson plans with facilitators' guidance, practicing diagnostic assessments, and discussing classroom challenges. The participatory approach fostered teachers' confidence as they immediately applied the concepts learned.

Posttest Findings

After 32 hours of training, significant improvement was observed. A total of 96.2% of teachers were able to explain objectives, the functions of assessment, and provide accurate examples of differentiation. All teachers (100%) expressed confidence in implementing differentiated instruction. Regarding attitudes, more than 96% strongly agreed that differentiation is essential, felt prepared to design varied learning activities, and were motivated to apply it in their classrooms.

DISCUSSION

The findings indicate that the collaborative workshop between UNY and HIMPAUDI Sleman was effective in enhancing ECE teachers' knowledge and attitudes toward differentiated instruction. The improvement from pretest to posttest results aligns with other study that professional development programs integrating theory and practice have significant impacts on teachers' pedagogical competence.

The fact that teachers gained greater confidence after practicing lesson planning and diagnostic assessment highlights the importance of **hands-on training**. This is consistent with (Cahyanto et al., 2024) study, which demonstrated that practical training is more effective in equipping teachers with the skills necessary for differentiation than theoretical lectures alone.

The shift in teachers' attitudes toward more positive perceptions of differentiated instruction further suggests that the workshop not only enhanced cognitive understanding but also influenced the affective dimension. This is crucial, as teachers' motivation and willingness to apply new strategies strongly determine the sustainability of differentiated practices in classrooms (Blaz, 2016; Mastuti et al., 2022; Tezcan & Temel, 2023).

Moreover, the collaboration between the university and the professional organization proved strategic. UNY contributed theoretical foundations and academic supervision, while HIMPAUDI facilitated teacher networks and identified field-based needs. This ensured that the training was not only theoretically sound but also contextually relevant and practically applicable.

The findings also reveal that ECE teachers inherently possess the motivation and potential to improve instructional quality, provided they have access to relevant professional development opportunities. Their limitations in practice stem largely from external barriers, such as a lack of training, limited mentoring, and scarce resources (Fina Fadila & Riska Ayu Saputri, 2024; Rao et al., 2022). Collaborative workshops such as this one serve as a bridge to close the gap between teachers' practical needs and the academic support provided by universities.

From a pedagogical perspective, implementing differentiated instruction in ECE contributes directly to inclusive education (Navarro et al., 2015). Children with special needs, diverse learning styles, and varied sociocultural backgrounds are more likely to be accommodated when teachers are skilled in designing differentiated activities. Thus, differentiation not only improves overall instructional quality but also plays a key role in ensuring equity in early childhood education (Hau, 2022; Utami & Hidalgo, 2022).

The results also underscore the necessity of continuity in teacher professional development. While the 32-hour workshop produced significant outcomes, teacher capacity building should not end with a single intervention. Ongoing mentoring through teacher learning communities, peer coaching, or continuous workshops is essential to embed differentiation into everyday teaching culture. Such approaches ensure that teachers' professional growth is not temporary but sustainable.

More broadly, this program supports national policy directions in Indonesia, which emphasize child-centered learning and inclusive practices in ECE. Collaborative workshops like this one provide concrete models for grassroots implementation of these policies (Radić-Bojanić & Pop-Jovanov, 2018). Therefore, replication and adaptation of similar initiatives across regions are crucial to expand the reach and ensure that more ECE teachers are well-equipped to implement differentiated instruction.

CONCLUSION

The collaborative workshop organized by UNY and HIMPAUDI Sleman proved effective in enhancing ECE teachers' knowledge and attitudes toward differentiated instruction. Teachers not only developed a more comprehensive understanding of the concept but also gained confidence and motivation to apply it in their classrooms.

This collaborative workshop model can be replicated in other regions as a strategy for strengthening the capacity of nonformal ECE teachers. The program's success also underscores the importance of synergy between higher education institutions and professional organizations in supporting teacher professional development, ultimately advancing child-centered learning practices in Indonesia's early education landscape.

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IMPROVING KNOWLEDGE AND SKILLS THROUGH RIBBON EMBROIDERY AND PACKAGING TRAINING FOR PKK BUMIJO YOGYAKARTA MEMBERS

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Abstract. This community service activity aims to improve the knowledge and skills of PKK Bumijo Yogyakarta members through ribbon embroidery and product packaging training. The background of this activity is the limited basic skills, lack of innovation, and low competitiveness of products made by PKK Bumijo members. The method used was Participatory Action Research (PAR), involving 30 participants through the stages of planning, implementation, evaluation, analysis, and reflection. The evaluation instruments consisted of pre-tests and post-tests to measure knowledge, as well as product assessment sheets to assess skills. The results of the activity showed a significant increase in the participants' knowledge and skills. The average post-test score was higher than the pre-test score, indicating the effectiveness of the training in transferring knowledge about ribbon embroidery techniques and packaging principles. The products produced after the training also showed an improvement in quality in terms of neatness, design creativity, and visual appeal of the packaging. In addition, the active participation of participants in each stage of the training showed positive group dynamics, which reinforced the success of the program. This activity is relevant in strengthening the capacity of PKK members as a basis for women's empowerment at the family and community levels. For sustainability, this can be done by forming small business groups, developing product marketing strategies, and supporting partnerships so that the skills acquired can continue to be developed into competitive productive businesses.

Keywords: training, ribbon embroidery, packaging, PKK, community empowerment

INTRODUCTION

Community-based creative economy development is a crucial strategy in efforts to enhance family welfare while fostering community independence[1]. Amidst the current economic dynamics, creative skills not only serve as a means of cultural expression, but also have significant economic added value when managed productively[2]. Empowering communities through creative economic skills training can encourage the creation of new business opportunities, expand employment, and increase the competitiveness of local products in an increasingly competitive market[3]. Furthermore, this type of empowerment contributes to strengthening the capacity of individuals and groups to manage local resources, enabling them to play an active role in community-based economic development. Thus, creative economic skills occupy a strategic position as an empowerment tool that is not only oriented towards increasing income, but also towards strengthening the independence and social resilience of the community.

Family Welfare Empowerment (PKK) is a community organization that plays a strategic role in developing women's capacity at the family and community levels[4]. As a volunteer-based organization , PKK serves not only as a forum for family development, but also as a driving force for various programs to improve skills and welfare[5]. The presence of PKK at the sub-district and village levels makes it at the forefront of supporting government programs while bridging the real needs of the community[6]. In developing women's capacity, PKK functions as a collective learning arena where its members can improve the knowledge, skills, and social networks needed to

develop productive businesses. This role is increasingly relevant in the era of the creative economy, when women are not only required to play a role in the household, but also contribute to strengthening the family economy through innovative and competitive productive activities.

One skill that currently has high economic prospects is ribbon embroidery[7]. Ribbon embroidery can be applied to various products in a variety of forms with high aesthetic value, such as accessories, clothing, and home decorations[8]. Product packaging skills are an important aspect in increasing attractiveness and selling value, because creative and functional packaging can expand marketing reach while enhancing product image[9]. However, the potential of these two skills has not been fully utilized by the community, especially in the Bumijo Village PKK environment. Limited access to training, low technical knowledge, and a lack of innovation in design and packaging are the main obstacles. As a result, the products produced often lack competitiveness and are unable to penetrate a wider market. Therefore, ribbon embroidery and packaging training is considered an important empowerment strategy that not only improves technical skills but also opens up opportunities to increase family income through community-based creative enterprises.

Based on initial observations, although the PKK plays an important role in increasing women's capacity, there are still a number of issues that hinder the optimization of its members' creative economic potential. The main problem faced by the Bumijo Village community is the limited basic skills in the field of crafts, especially ribbon embroidery, which prevents members from producing good quality products for marketing. In addition, the lack of innovation in design and product variety makes it difficult for their products to compete with similar products that are more creative and follow market trends. Another contributing factor is the lack of knowledge about attractive packaging techniques that meet modern marketing standards. The accumulation of these limitations results in low product competitiveness and limits market access.

IMAGE 1. Observations in Bumijo Village

Based on these issues, the objectives are to provide training in ribbon embroidery and creative, high-quality product packaging, while evaluating the success of the training by comparing conditions before and after the activities. A more specific objective is to measure the extent to which this intervention can improve participants' knowledge and skills. Thus, the results of this study are expected to provide an empirical picture of the effectiveness of training in improving individual and group capacity, as well as a basis for developing more sustainable community empowerment strategies based on creative economic skills.

METHOD

Approach

This community service activity uses a Participatory Action Research (PAR) approach with a focus on evaluating training outcomes. The PAR approach was chosen because it allows for the active involvement of participants in the entire series of activities, from identifying needs to evaluating achievements[10]. Thus, the training is not only oriented towards skills transfer, but also encourages a sense of ownership and shared responsibility for the sustainability of the program.

Training Subjects

The subjects of the activity were members of the Bumijo Village PKK, Yogyakarta, with a total of 30 participants. All participants were fully involved in every stage of the activity, including the planning, implementation, and follow-up processes. The subjects were selected purposively based on the active involvement of PKK members in organizational activities and their interest in developing creative economic skills.

Training Instruments

The main instruments used in the evaluation included pre-tests and post-tests to measure the participants' increased knowledge of basic ribbon embroidery techniques and product packaging principles. In addition, skills

were assessed through direct evaluation of the ribbon embroidery products produced by the participants, taking into account aspects of neatness, creativity, and functionality. To complement the data, program evaluation instruments in the form of observation sheets and short questionnaires were also used to explore participants' perceptions of the benefits and success of the activity.

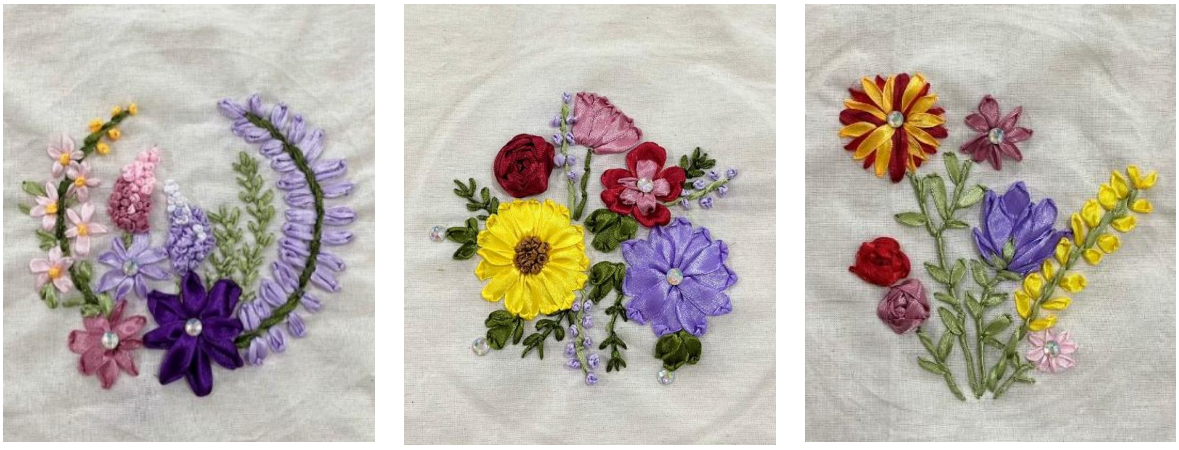
Data Analysis

The data obtained was analyzed using quantitative and qualitative descriptive approaches. Quantitative analysis was performed by calculating the average value and percentage increase in pre-test and post-test scores, as well as product assessment scores. Qualitative analysis was conducted through descriptions of field observation results and participant testimonials to understand the factors that influenced the program's achievement. The combination of these two analytical approaches is expected to provide a comprehensive picture of the effectiveness of the training in improving participants' knowledge and skills, while also identifying the potential for program sustainability in the PKK environment.

RESULT AND DISCUSSION

Ribbon Embroidery Training

The ribbon embroidery training for Bumijo PKK members was carried out according to the planned stages, including basic introduction, simple technique practice, and more complex motif combinations. In the initial stage, participants were introduced to various types of ribbons, needles, and fabrics used, accompanied by demonstrations of basic techniques such as straight stitch and ribbon stitch. Previously, the technical team had prepared three ribbon embroidery designs as examples that participants could use as guidelines.



Design 1 Design 2 Design 3

IMAGE 2. Example of Ribbon Embroidery Products

After understanding these basics, participants were gradually guided to try more creative embroidery variations, such as combinations of flowers and leaves, to produce more aesthetic patterns. During the training process, there was a noticeable improvement in the participants' fine motor skills, neatness, and precision in completing each piece of work.

IMAGE 3. Participants' Enthusiasm for the Training

Observations show that most participants who initially had no experience in ribbon embroidery were able to produce fairly neat works after attending two to three practice sessions. The products produced not only have aesthetic value, but also show creativity in choosing ribbon colors and combining motifs. This indicates that the training process was effective in improving the participants' technical skills, in line with previous research findings which stated that practice-based training can accelerate the transfer of handicraft skills[11]. Thus, this activity proves that ribbon embroidery skills can be taught systematically and measurably, and have the potential to be developed into products of economic value if they continue to be trained and combined with design innovations.

IMAGE 4. Results of Ribbon Embroidery Training

Product Packaging Training

In addition to ribbon embroidery training, the activity also focused on improving participants' skills in product packaging. This material was provided because packaging not only protects the product but also plays a crucial role in attracting consumer interest and building a business's image. In the initial stage, participants were introduced to the basic principles of good packaging, including material selection, visual design, and product information that needs to be included on the label. Next, participants were involved in the practice of making simple but attractive packaging, using easily obtainable materials while still considering functional and aesthetic aspects.

IMAGE 5. Product Packaging Training Results

The results of the activity showed that most participants understood the importance of packaging as part of a marketing strategy. Products that were previously packaged simply began to receive more creative design touches after the training, such as the use of plastic mica, labeled cardboard boxes, and decorative ribbons to strengthen product identity. These changes not only increased visual appeal but also gave a professional impression to the products. Field observations showed an increase in participants' confidence when displaying well-packaged products, as they realized that packaging could add value and expand market opportunities. This is in line with Arsyad's (2020) research, which confirms that product packaging plays a strategic role in increasing the competitiveness of micro businesses. With thus, packaging training has proven to strengthen participants' skills not only in terms of technical craftsmanship but also in terms of product marketing.

Participant

The level of participant involvement in the ribbon embroidery and product packaging training activities can be categorized as high. This is evident from the consistent attendance of participants from the planning stage to the evaluation, with an average attendance rate of over 85%. The active involvement of participants was not only demonstrated through their physical presence, but also through their enthusiasm in attending each training session, from the introductory session to the hands-on practice. Some participants even took the initiative to ask further questions about embroidery techniques and alternative packaging materials that could be used, indicating an intrinsic drive to improve their skills.

IMAGE 6. Participant Participation

In addition, the group dynamics in the training activities also showed positive collaboration among PKK members. Participants helped each other in practicing embroidery techniques, shared experiences related to material selection, and discussed packaging designs that suited the characteristics of the products. This collaboration strengthened the spirit of learning together and created an atmosphere conducive to skill improvement. This high level of participation can be understood as a result of the participatory approach used in the training, where participants are directly involved in the learning process and are given space to express themselves and innovate. Thus, the active participation of participants is an important factor that determines the success of activities, while also opening opportunities for the sustainability of the program through PKK group initiatives in the future.

IMAGE 7. Group photo with PKK members of Bumijo Village

Impact of Ribbon Embroidery Training and Packaging Training

The impact of the training was measured using pre-test and post-test instruments, product assessment instruments, and training evaluation instruments. The pre-test and post-test results showed a significant increase

in the knowledge and skills of participants after attending the ribbon embroidery and product packaging training. At the time of the pre-test, most participants were only able to answer basic questions related to embroidery techniques and packaging principles, with average scores that were still relatively low. This reflects the limited initial knowledge and lack of practical experience of the Bumijo PKK members. However, after undergoing a series of structured and practice-based training, the average post-test scores increased significantly. Participants were able to correctly answer most questions related to ribbon embroidery techniques, motif variations, and packaging design and function principles.

TABLE 1. Pre-test and Post-test Scores

Participant Code	Pre-test Score	Post-test Score
P1	73	90
P2	80	96
P3	66	80
P4	76	83
P5	63	80
P6	76	86
P7	63	80
P8	70	86
P9	73	86
P10	83	96
P11	63	86
P12	76	90
P13	30	76
P14	46	80
P15	50	83
P16	73	86
P17	46	80
P18	70	86
P19	66	86
P20	56	86
P21	76	90
P22	76	93
P23	53	80
P24	63	86
P25	60	86
P26	73	86
P27	76	93
P28	66	80
P29	63	86
P30	70	86

Based on the data processing results, the average pre-test score of the participants was 65.83, while the average post-test score increased to 85.80. The difference in the average score of 19.97 points indicates an increase in the participants' understanding of the training material. When calculated as a percentage, there was an increase of 30.33% compared to the condition before the training.

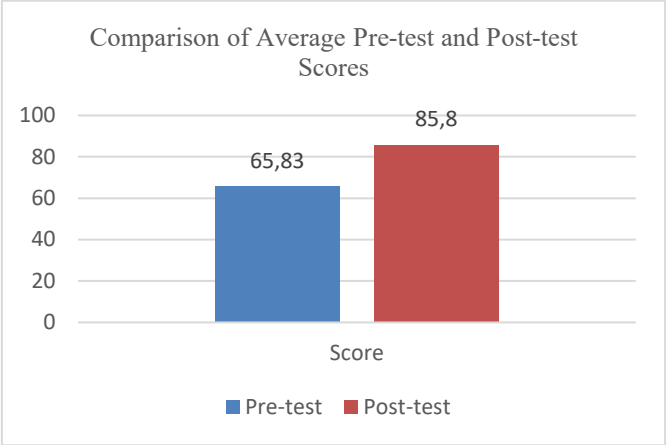


IMAGE 8. *Comparison of Average Pre-test and Post-test Scores*

Furthermore, the following is a table of the frequency distribution of pre-test and post-test scores:

TABLE 2. Frequency Distribution of Pre-test and Post-test Scores.

Score Range	Pre-test Frequency	Frekuensi Post-test
≤ 40	1	0
41 – 60	6	0
61 – 80	22	7
81 – 100	1	23

Based on Table 1, the distribution of pre-test scores shows that most participants (22 people) were in the 61–80 range, while only 1 person achieved a score of 81–100, and there were still 6 people with scores of 41–60 and 1 person with a score of ≤40. This condition illustrates that before the training, the majority of participants had moderate initial understanding, with only a few participants having good mastery of the material.

This improvement indicates that the training method used a combination of material explanation, demonstration, and hands-on practice with personal guidance successfully transferred knowledge and skills effectively. Participants who previously had little knowledge of ribbon embroidery techniques were able to identify various types of stitches, practice them well, and apply them to tote bags after the training.

In addition to increased knowledge, the skills evaluation also showed significant progress. The ribbon embroidery products produced after the training showed significant improvements in terms of neatness, color composition, and design variety. Similarly, in terms of packaging, participants began to be able to produce packaging that was more attractive, informative, and in line with simple marketing standards.

TABLE 3. Skill Scores

Participant Code	Ribbon Embroidery Score	Packaging Score
P1	73	90
P2	80	96
P3	66	80
P4	76	83
P5	63	80
P6	76	86
P7	63	80
P8	70	86
P9	73	86
P10	83	96
P11	63	86
P12	76	90
P13	30	76
P14	46	80
P15	50	83
P16	73	86
P17	46	80
P18	70	86

P19	66	86
P20	56	86
P21	76	90
P22	76	93
P23	53	80
P24	63	86
P25	60	86
P26	73	86
P27	76	93
P28	66	80
P29	63	86
P30	70	86

These results are in line with previous research which states that practice-based training is effective in improving technical skills while strengthening participants' confidence[7]. Thus, the pre-test and post-test data not only show the success of knowledge transfer, but also indicate a transformation of skills that are more applicable and useful for increasing the creative economic capacity of PKK members. The action phase also included an evaluation conducted with the help of a questionnaire. Participant satisfaction was evaluated to assess the effectiveness of the ribbon embroidery training, covering the aspects of the material, content, and delivery. The assessment was given by 30 respondents using a scale of 1–5, where 1 meant very dissatisfied and 5 meant very satisfied. The following is a table categorizing the training evaluation questionnaire:

TABLE 4. Evaluation Questionnaire Categorization

Average Score Range	Category Interpretation	Meaning
4,50 – 5,00	Very Satisfactory	Participants are very satisfied, the activity exceeded expectations
3,50 – 4,49	Satisfactory	Participants were satisfied; the activity met expectations.
2,50 – 3,49	Fair	Participants rated the activity as fairly good, but there are still important things that need to be improved.
1,50 – 2,49	Poor	Participants are dissatisfied; many aspects need improvement.
1,00 – 1,49	Very poor	Participants are very dissatisfied, the activity is far below expectations.

The following table summarizes the average scores and interpretations of each statement:

TABLE 5. Average Scores and Interpretations of the Training Evaluation Questionnaire

No.	Question	Average score	Interpretation
Satisfaction with the Presenter			
1.	The presenter has a good grasp of the material being presented	4,4	Satisfactory
2.	The presenter is able to answer participants' questions clearly.	4,6	Very Satisfactory
3.	The presenter is friendly and communicative.	4,44	Satisfactory
4.	The presenter provided relevant and easy-to-understand examples.	4,4	Satisfactory
5.	The presenter uses easy-to-understand language.	4,36	Satisfactory
Satisfaction with the material			
6.	The material is organized systematically and is easy to understand	4,56	Very Satisfactory
7.	The material covers comprehensive information related to ribbon embroidery techniques.	4,4	Satisfactory
8.	The training material is easy to apply in practice.	4,64	Very Satisfactory
9.	The training material is supplemented with in-depth practical examples.	4,28	Satisfactory
10.	The material is accompanied by written guides or easily accessible modules.	4,4	Satisfactory
Satisfaction with delivery			
11.	The material is presented clearly and is easy to understand	4,24	Satisfactory
12.	The use of teaching aids (visual media or props) supports understanding.	4,32	Satisfactory
13.	The training was conducted according to the established schedule.	4,2	Satisfactory
14.	Presentation of material actively involves participants	4,4	Satisfactory
15.	Sufficient time for discussion and Q&A	4,12	Satisfactory

Based on the table, the satisfaction indicator for the presenter has an average score of 4.44, which shows that participants consider the presenter to be competent in their field. The satisfaction indicator for the material has an

average score of 4.6, which indicates that the training material presented was very satisfactory. Meanwhile, satisfaction with the delivery has an average score of 4.26, indicating that the delivery was satisfactory. With high average scores on all indicators, it can be concluded that the ribbon embroidery training activity in Bumijo Village was carried out effectively, met participants' expectations, and provided tangible benefits in improving participants' knowledge and skills.

Supporting and Hindering Factors

The success of the ribbon embroidery and packaging training cannot be separated from the supporting factors that played an important role in improving the participants' learning outcomes. The dominant internal factor was the high level of motivation to learn among PKK members, which was reflected in their consistency in attending all training sessions and their earnestness in completing each practical task. In addition, the basic skills possessed by some participants prior to the training also accelerated the knowledge transfer process. The pre-test results showed that although the initial level of knowledge was relatively low, some participants already had a basic understanding of crafts, so they were able to adapt more quickly when receiving new material. The solidarity of the PKK group also became a strong social asset, as participants helped each other and provided feedback on each other's work.

On the other hand, there were also a number of obstacles that needed to be considered. The main obstacle was the relatively short training period, which meant that the material on packaging and design development could not be explored in depth. In addition, the varying initial abilities of the participants also affected the speed at which results were achieved, with some participants requiring more intensive assistance to master basic embroidery techniques. Externally, limited supporting resources, such as ribbon raw materials and packaging equipment, posed a challenge in maintaining the quality of the practice. However, personal mentoring strategies, small group divisions, and the use of easily obtainable local materials proved to be effective in reducing these obstacles. This is reflected in the post-test results, where all participants showed an increase in their average scores, albeit at varying levels of achievement. Thus, the supporting and inhibiting factors that arose during the training can provide important lessons for improving program design at the sustainability stage.

The results of the ribbon embroidery and product packaging training activities for members of the Bumijo PKK align with the findings of various previous studies, which confirm the effectiveness of practice-based training in enhancing community skills. Research shows that hands-on training programs are effective in improving community skills in ribbon embroidery and product packaging. Programs that combine theoretical lessons with practical exercises have proven successful in increasing participants' knowledge and abilities. In ribbon embroidery training for members of the "Armalah" widows' association, participants mastered all materials, boosted their knowledge and creativity, and successfully created various ribbon embroidery products[12]. Similarly, opak product packaging training in Balikpapan enabled participants to properly operate plastic sealing equipment, resulting in neat and attractive packaging[13]. In Margamulya Village, packaging training led to a 93.3% increase in participants' product packaging knowledge and provided skills in logo creation and innovative packaging design[14]. These practical training methods effectively strengthen community entrepreneurial skills and product development marketability. The results of this study reinforce these findings, in which participants not only experienced an increase in knowledge scores based on pre-test and post-test results, but were also able to produce tangible works in the form of ribbon embroidery and more creative and professional product packaging.

However, there are contextual differences that need to be highlighted. While previous studies focused more on individual technical skill development, the training at PKK Bumijo emphasized a group-based approach that involved social solidarity among members as a reinforcement of the learning process. This model enables a collaborative learning atmosphere, which has a positive impact on increasing participants' confidence in practicing new skills. Thus, the findings of this study not only confirm the effectiveness of the training as in previous studies but also provide an additional contribution in the form of proof that a participatory approach at the community level can strengthen training outcomes and increase the potential for program sustainability.

The implications of ribbon embroidery and product packaging training for Bumijo PKK members are not only seen in short-term skill improvement but also in the potential sustainability of the program in the future. The success in improving participants' knowledge and skill scores shows that this activity can be the initial foundation for the development of community-based creative businesses. The spirit of participation and solidarity among members that was built during the training has the potential to become social capital for forming a joint business group under the auspices of the PKK. With better technical skills in ribbon embroidery and packaging knowledge, PKK members have the opportunity to produce products that are not only aesthetically valuable but also competitive in local and online markets.

In addition, another implication that can be drawn is the need for continuous support from various parties, including the village government, partner institutions, and academics, so that the training results do not stop at the level of temporary practice- . Follow-up programs can take the form of entrepreneurship assistance, digital marketing training, or access to small business capital. With this continuity, training activities not only increase

individual capacity but also contribute to strengthening the family economy and empowering women at the community level. Thus, this program can be seen as an applicable, sustainable model of community empowerment oriented towards strengthening group-based creative economies.

CONCLUSION

First, the results of ribbon embroidery and packaging training for PKK Bumijo members showed a significant improvement in both knowledge and skills. This can be seen from the difference in pre-test and post-test scores, as well as the quality of the products produced by the participants, which are increasingly neat, creative, and attractive to the market. Second, this training program has proven to be relevant in strengthening the capacity of PKK members, particularly in the field of creative economic skills. In addition to providing technical knowledge, this activity also builds self-confidence, group solidarity, and broadens participants' understanding of the importance of product innovation and marketing strategies through proper packaging. Third, to ensure the sustainability of the program, follow-up actions are needed in the form of establishing small business groups under the auspices of the PKK, strengthening marketing networks, and support from the government and strategic partners. Thus, the skills acquired do not stop at the training level but can be developed into productive businesses that contribute to improving family welfare and community empowerment at the community level.

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Teachers' Pedagogical Practices in Implementing Reading Comprehension Strategies in Vocational High Schools

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Abstract. This study investigates vocational high school teachers' pedagogical practices in teaching reading comprehension, addressing the need for more context-specific strategies in vocational education. Using a qualitative descriptive design, data were collected from nine teachers through questionnaires and semi-structured interviews. The findings reveal that Problem-Based Learning (PBL) and Project-Based Learning (PjBL) are the most preferred instructional models, complemented by methods such as group discussions, simulations, and guided questioning. Teachers emphasized that these student-centered approaches enhance learners' motivation, collaboration, and problem-solving skills, while direct instruction remains essential for clarifying complex concepts. Intensive reading, collaborative paragraph analysis, and small-group discussions were identified as the dominant reading comprehension techniques. Unlike previous studies focusing on general secondary education, this research highlights how PBL and PjBL make reading instruction more meaningful and relevant to vocational contexts. The study concludes that integrating problem- and project-oriented models can strengthen students' critical thinking and contextual understanding, offering a practical alternative to traditional teacher-centered practices.

INTRODUCTION

Reading competence is widely acknowledged as a key determinant of students' academic success and lifelong learning. In vocational high schools, reading plays a particularly crucial role, as students are required to comprehend technical manuals, workplace documents, and job-related texts essential for their professional careers. However, research consistently shows that vocational students often struggle with reading comprehension due to low motivation, limited exposure to authentic materials, and insufficiently contextualized teaching strategies [1,2].

Previous studies have primarily focused on general secondary education, with little emphasis on vocational settings where literacy demands are more workplace oriented [3,4]. This has led to a limited understanding of how teachers design and implement effective reading instruction in vocational classrooms. Moreover, although national policies such as the *Merdeka Curriculum* [5] and vocational orientation [3] highlight the importance of integrating literacy into vocational education, empirical evidence on pedagogical practices remains scarce.

To address this gap, the present study investigates vocational high school teachers' pedagogical practices in teaching reading comprehension, with particular attention to the use of student-centered models such as Problem-Based Learning (PBL) and Project-Based Learning (PjBL). By examining teachers' perceptions, challenges, and strategies, this study seeks to contribute to a deeper understanding of literacy pedagogy in vocational contexts and provide practical insights for enhancing reading instruction tailored to vocational students' needs.

LITERATURE REVIEW

Reading Instruction in Vocational Education

Reading literacy is critical in vocational education, where students are expected to comprehend technical texts and workplace-related documents. Integrating literacy into vocational curricula not only supports academic

achievement but also enhances workplace readiness [6]. However, studies indicate that vocational students often struggle with specialized vocabulary and limited exposure to authentic texts [7,8].

Teachers' Role and Reading Strategies

Teachers play a central role in scaffolding reading comprehension and motivating learners. In the Indonesian vocational context, Kuncoro & Turahmat (2025) observed the use of scaffolding, n Teaching at the Right Level (TaRL) dan Culturally Responsive Teaching (CRT) [9]. Internationally, Yongxu & Dinghong (2025) emphasizes that teacher expertise in adapting strategies to specific vocational needs is crucial for sustaining literacy engagement[10].

Authentic Materials and Pedagogical Challenges

Authentic texts such as workplace manuals, advertisements, and job-related articles are considered effective for enhancing relevance [11,12]. Nonetheless, several studies have documented significant obstacles faced by vocational teachers, including limited access to learning resources and technological infrastructure [13], challenges in implementing Computer-Assisted Instruction [14], and insufficient technical support and digital learning materials despite strong digital competencies [15]. Additionally, language teachers report difficulties in contextualizing content to vocational specializations due to gaps in educational background, practical skills, and school infrastructure [16].

Professional Development and Teacher Capacity

Several scholars argue that teacher professional development remains a persistent challenge. Camilleri & Camilleri (2023) note that the lack of ongoing training constrains effective literacy instruction [17], while Yang (2025) stresses the importance of capacity-building in integrating new technologies and industry-specific expertise. These studies converge on the idea that teachers' ability to adapt pedagogy is key to improving vocational literacy outcomes.

Research Gap

While research on reading instruction in general secondary education is abundant, empirical studies on vocational high schools remain scarce. Few investigations have examined teachers' perspectives on how reading is taught in vocational contexts, especially regarding the integration of student-centered models such as Problem-Based Learning (PBL) and Project-Based Learning (PjBL). Addressing this gap, the present study explores how vocational teachers perceive and enact reading instruction to enhance comprehension skills relevant to students' future careers.

RESEARCH METHOD

This study employed a qualitative descriptive design to explore teachers' pedagogical practices in teaching reading comprehension at vocational high schools (SMK) in Sidrap Regency, Indonesia. The participants were nine Indonesian language teachers from twelve vocational high schools, all of whom taught Grade 10 students across different vocational study programs. Participants were selected through purposive sampling, with the inclusion criterion of a minimum of three years of teaching experience to ensure sufficient pedagogical maturity.

Data were collected using two instruments: a structured questionnaire and semi-structured interviews. The questionnaire consisted of multiple-choice items with open-ended options, focusing on learning models, teaching methods, and teaching techniques. It provided an overview of the pedagogical strategies commonly applied by teachers. The interviews, meanwhile, offered deeper insights into teachers' experiences, challenges, and reflections in teaching reading comprehension. Prior to use, both instruments underwent content validation by language education experts, whose feedback improved the clarity and relevance of the items and interview guidelines.

Data collection was carried out in two stages. First, the questionnaire was distributed to identify common practices in teaching reading comprehension. Second, follow-up interviews were conducted with the nine teachers to gain richer perspectives and to triangulate the findings. The quantitative data from the questionnaire were analyzed descriptively using frequencies and percentages. Meanwhile, the qualitative data from the interviews were analyzed thematically through open coding, categorization, and theme development. This combined approach provided both a broad overview and an in-depth understanding of teachers' pedagogical practices.

RESULTS AND DISCUSSION

Results

Before presenting the detailed results, it is important to provide an overview of the participants' responses regarding their preferred learning models, teaching methods, and reading comprehension techniques. Table 1 summarizes the survey findings from nine vocational high school teachers, highlighting the frequency and percentage of each category. This table serves as a foundation for understanding the dominant pedagogical practices and strategies that teachers employ to facilitate reading comprehension in Grade 10 classrooms. The subsequent discussion will integrate these quantitative insights with qualitative data from interviews to offer a comprehensive view of teachers' instructional approaches.

Table 1. Summary of Survey Results on Learning Models, Methods, and Techniques (n = 9)

Aspect	Category	Freq. (f)	Perc. (%)	Interpretation
Preferred Learning Model	Problem-Based Learning (PBL)	5	55.6%	Most favored; appeals due to real-world, problem-solving context.
	Project-Based Learning (PjBL)	4	44.4%	Values creativity and real-life relevance.
	Direct Instruction	3	33.3%	Still appreciated for clarity and structure.
	Cooperative Learning	1	11.1%	Least chosen; possibly unfamiliar or poorly implemented.
Teaching Methods Used	Group Discussion	7	77.8%	Dominant; emphasizes interactive and collaborative engagement.
	Question–Answer	3	33.3%	Used as immediate comprehension check.
	Simulation	2	22.2%	Less frequent; constrained by time/resources.
	Lecture	0	0%	Almost abandoned; signifies shift from passive instruction.
Techniques to Enhance Reading Comprehension	Intensive Reading (Guided Questions)	5	55.6%	Dominant; fosters deep text analysis.
	Small-Group Discussion	5	55.6%	Co-dominant; supports collaborative interpretation.
	Collaborative Paragraph Analysis	2	22.2%	Used sporadically; needs more scaffolding.
	Extensive Reading	0	0%	Not used; focus remains on depth over breadth.

To complement the survey findings, follow-up interviews were conducted with the same teachers to gain deeper insights into their instructional practices. Table 2 presents a summary of teachers' responses regarding their preferred learning models, frequently used teaching methods, and reading comprehension techniques. This qualitative data provides contextual explanations and reflections behind the patterns observed in the survey, highlighting teachers' reasoning, experiences, and pedagogical choices in facilitating reading comprehension.

Table 2. Key Findings from Teachers' Interviews

Aspect	Summary
Preferred Learning Model	Most teachers preferred Problem-Based Learning (PBL) (4 teachers) and Project-Based Learning (PjBL) (3 teachers), while 2 teachers applied Direct Instruction.
Frequently Used Method	The dominant method was Group Discussion (5 teachers), followed by Question–Answer (3 teachers), and Simulation (1 teacher).

Reading Comprehension Technique	Techniques included Intensive Reading (4 teachers), Small-Group Discussion (3 teachers), and Collaborative Paragraph Analysis (2 teachers).

Discussions

The The survey and interview findings consistently show a preference for student-centered models, particularly Problem-Based Learning (PBL) and Project-Based Learning (PjBL). PBL was valued for engaging students with authentic, real-world problems and promoting critical thinking, whereas PjBL fostered creativity and relevance to students' vocational tasks. One teacher remarked, *"I often use PBL because students engage more with real-life problems, and it encourages them to think critically rather than just memorize."* Another added, *"Project-based learning allows students to connect what they read with their actual work skills, which makes reading meaningful."* This alignment between quantitative and qualitative data reflects teachers' inclination toward constructivist approaches, consistent with Vygotsky's (1978) social constructivist theory [18].

Group Discussion emerged as the dominant teaching method, facilitating collaborative sense-making, while Question–Answer techniques provided immediate scaffolding. The minimal use of lecture methods indicates a shift away from passive instruction, though direct guidance remains necessary for clarity. In terms of reading comprehension, both data sources highlight Intensive Reading and Small-Group Discussion as widely applied strategies. These methods allow for in-depth text analysis while encouraging peer-supported meaning-making. Conversely, the underutilization of Collaborative Paragraph Analysis and Extensive Reading suggests opportunities to expand interpretative practices and enhance reading fluency.

Overall, the convergence of survey and interview data illustrates a strong movement toward blended constructivist practices, where collaborative and problem-based approaches dominate, yet elements of traditional methods persist for clarity and guidance. These findings align with previous studies emphasizing active, student-centered learning in vocational contexts [19] and underscore the need for targeted professional development. Enhancing teacher capacity to integrate underused techniques can help balance deep comprehension with broader literacy development, ultimately improving students' reading skills in vocational settings.

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CONCLUSION

This study highlights that teachers in vocational high school reading comprehension classes predominantly adopt student-centered learning models, particularly Problem-Based Learning (PBL) and Project-Based Learning (PjBL), with limited reliance on Direct Instruction. The most frequently applied methods are group discussions and question-and-answer sessions, while the main techniques focus on intensive reading, small-group discussion, and collaborative paragraph analysis.

The findings indicate that teachers value active, collaborative, and contextualized learning to enhance students' reading comprehension. At the same time, the selective use of direct instruction suggests that some students still require structured guidance to fully understand reading materials.

In conclusion, integrating active learning strategies such as PBL and PjBL, supported by interactive methods, can foster students' motivation, collaboration, and comprehension skills. Future research is recommended to investigate the long-term impact of these approaches and their adaptability across diverse educational contexts.

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DEVELOPMENT OF CULTURAL DOCUMENTATION ALBUM FOR INDIGENOUS COMMUNITY OF KASEPUHAN CIPTAGELAR, WEST JAVA

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Abstract. This study aims to develop a cultural documentation album for the Kasepuhan Ciptagelar indigenous community in Sukabumi, West Java, as a visual and educational medium for preserving and transmitting local wisdom. The research adopted the Research and Development (R&D) method using a qualitative–participatory approach based on Borg and Gall's model. Data were collected through field observation, in-depth interviews, visual documentation, and validation by experts. The resulting 250-page album—available in both print and digital prototype—consists of five thematic sections: cosmology, architecture, rituals, social systems, and arts. Validation by two media experts and two content experts produced an average score of 4.8 (highly feasible), confirming the product's strong visual quality, contextual narrative coherence, and authentic representation of Ciptagelar's cultural philosophy. Revisions based on expert and community feedback enhanced narrative depth and design consistency. The album is declared feasible for usability testing and publication, serving as a model for participatory visual ethnography and cultural preservation.
Keywords: Kasepuhan Ciptagelar, cultural documentation, local wisdom, participatory R&D, visual ethnography

INTRODUCTION

The Kasepuhan Ciptagelar community in Sukabumi, West Java, represents one of the last Sundanese traditional societies that preserve their ancestral belief systems and agrarian traditions amid rapid modernization. The community's worldview integrates cosmology, agriculture, and architecture into a harmonious pattern that reflects balance between human, nature, and the divine. The maintenance of traditional farming without tractors, radio-based internal communication, and annual rituals such as Seren Taun are manifestations of a living heritage that retains both symbolic and functional meanings.

Despite its richness, Ciptagelar's cultural system has not been comprehensively documented. Most cultural knowledge remains orally transmitted, risking gradual erosion without systematic preservation. Previous documentation efforts were partial and scattered, limiting their accessibility to educators, researchers, and the public. Therefore, this research seeks to create a comprehensive visual documentation album that captures the Ciptagelar community's daily life, architectural forms, rituals, and artistic expressions as a medium of cultural education and preservation.

The study positions cultural documentation as a bridge between traditional knowledge and modern learning paradigms. By integrating participatory ethnography with design-based development, this project contributes to cultural sustainability while empowering the indigenous community to represent their own narratives authentically.

LITERATURE REVIEW

Visual Ethnography and Cultural Documentation

Visual ethnography allows researchers to represent cultural phenomena through participatory visual narratives, combining observation, interpretation, and collaboration (Pink, 2013). In the context of cultural preservation, visual media provide not only aesthetic representation but also serve as epistemic tools for understanding the dynamics of traditional life. Green (2023) emphasizes that digital documentation with participatory frameworks enhances accessibility and reinforces community ownership of their heritage.

This study builds upon such frameworks by integrating visual storytelling with participatory validation, ensuring that documentation reflects the emic perspective of the Ciptagelar people rather than an external interpretation.

Local Wisdom and Vernacular Knowledge

Local wisdom (kearifan lokal) embodies the adaptive knowledge and moral values guiding community interaction with nature (Maunati, 2019). In Ciptagelar, this wisdom manifests in ecological farming practices, communal resource management, and architectural patterns that harmonize with the surrounding landscape. The spatial orientation of traditional houses, communal rice barns (leuit), and sacred areas reveals an intricate cosmological logic reflecting balance and sustainability.

These principles align with global notions of sustainable development, positioning local culture as a foundation for resilience and environmental ethics (Rachman, 2020).

Participatory R&D for Educational Media

The Borg and Gall (1989) R&D model provides a systematic structure for developing educational media through iterative stages of validation and revision. When applied to cultural documentation, this model ensures that the resulting product not only conveys accurate information but also meets educational standards. Rahmawati et al. (2023) note that integrating participatory design and digital media can transform cultural artifacts into interactive learning materials. Therefore, this research applies participatory R&D to produce a visual documentation album that combines ethnographic rigor, pedagogical value, and aesthetic integrity.

RESEARCH METHOD

This study employs the Research and Development (R&D) method with a qualitative-participatory approach. The development process followed a modified Borg and Gall model consisting of seven stages: (1) preliminary study, (2) field data collection, (3) preparation of visual narrative, (4) album design and layout development, (5) expert validation, (6) product revision, and (7) usability testing.

Figure 1. Research and Development Model Adapted for Cultural Documentation Album

Fieldwork was conducted in Kasepuhan Ciptagelar, Sukabumi Regency, West Java. The research team lived within the community for seven days to observe rituals, architecture, and daily activities, ensuring deep engagement with cultural contexts. Key informants included Abah Ugi Sugriana Rakasiwi (traditional leader), Bang Yoyo Yogasmana (public relations officer), and several local people.

Figure 2. Conceptual Framework of the Kasepuhan Ciptagelar Cultural Documentation Process

Data collection used multiple instruments: participatory observation, interviews, focus group discussions, document analysis, and photographic documentation. Data analysis involved descriptive and interpretative techniques supported by triangulation, peer debriefing, and community validation to ensure authenticity and reliability.

RESULTS AND DISCUSSION

Cultural and Spatial Context

The Kasepuhan Ciptagelar settlement is located within the Halimun mountain ecosystem at an altitude of approximately 1,200 meters. The settlement structure reflects Sundanese cosmology, oriented along a sacred axis from Pasir Pangkulahan (mountain) to the lebak (valley). The alun-alun serves as the spatial and ritual center, surrounded by residential clusters, public halls, and rice barns.

Through visual documentation, the research team recorded traditional buildings, agricultural areas, and ritual sites, illustrating how spatial design reinforces communal harmony and cosmological order.

Traditional Architecture and Vernacular Expression

Ciptagelar's architecture demonstrates environmental adaptation and cultural symbolism. Houses are built on stilts using local bamboo and wood with ijuk (palm fiber) roofs. The Imah Gede (main house), Bale Sawala (meeting hall), and Leuit Jimat (sacred rice barn) form an architectural triad representing leadership, community, and sustenance. The Leuit Jimat embodies spiritual and economic security, safeguarding the community's rice supply and symbolizing gratitude toward nature.

Figure 3. Traditional architecture in Ciptagelar

Architectural documentation included detailed photographs and textual metadata describing materials, structures, and cultural meanings, emphasizing the interdependence between built form and belief systems.

Rituals, Arts, and Social System

The study documented major rituals—Ngaseuk, Mipit, Nganyaran, and Seren Taun—that define the agricultural calendar and reinforce communal solidarity. The Seren Taun festival, in particular, symbolizes thanksgiving and is marked by offerings, dances, and traditional music performances such as angklung buhun.

Social organization in Ciptagelar is based on kinship and mutual cooperation (gotong royong). The role of Abah as the spiritual and administrative leader ensures the transmission of moral and cultural values. Media innovations like Radio and TV Swara Ciptagelar illustrate the community's selective adaptation of technology to sustain cultural continuity (Nugraha, 2021).

Figure 4. Rituals and ceremony in Ciptagelar

Validation Results

Expert validation involved two media experts and two content experts who evaluated the product using quantitative and qualitative criteria.

- Media experts assessed design consistency, photography quality, typography, and visual layout.
- Content experts reviewed narrative accuracy, clarity, educational relevance, and cultural authenticity.

The overall mean score was 4.8 (Highly Feasible), indicating excellent quality and readiness for educational application. Feedback recommended enhancing bilingual captions, improving visual contrast, and adding a glossary of Sundanese terms. These suggestions were incorporated into the revised version.

The final album—50 pages in total—features five chapters: cosmology, architecture, rituals, social systems, and arts. Each section integrates photographs with contextual explanations and narrative storytelling, resulting in a coherent ethnographic visualization of Ciptagelar's living culture.

Figure 5. Some pages of documentation album

Interpretative Analysis

The participatory process enabled mutual learning between researchers and the community, strengthening authenticity and ethical representation. The album functions as a dialogic platform, presenting culture through the community's perspective while adhering to academic documentation standards.

The findings highlight the resilience of Ciptagelar's cultural system in balancing tradition and adaptation. Their vernacular wisdom, ritual practices, and architectural harmony exemplify sustainable living models relevant to contemporary cultural and environmental discourse.

CONCLUSION

The research successfully developed a comprehensive cultural documentation album of the Kasepuhan Ciptagelar community. The product integrates visual ethnography, educational design, and participatory validation, resulting in a feasible and contextually rich cultural medium. Validation results by experts confirmed high quality in both content and media aspects, with a mean score of 4.8.

This documentation serves as an important step toward preserving local wisdom and promoting intercultural understanding. It is recommended that further development include an interactive digital version and integration into cultural education curricula. The album has potential to be registered for intellectual property protection to ensure community ownership and long-term sustainability

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STRENGTHENING LOCAL CULTURE THROUGH EDUCATIONAL INNOVATION: THE EXPERIENCE OF INDONESIAN SCHOOL IN YANGON

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Abstract. Education that is responsive to cultural diversity has become a key strategy in maintaining and strengthening cultural identity amidst the currents of globalization. Schools play a strategic role in preserving local culture through various educational programmes, one of which is the "Gelar Karya" (Showcase of Works) programme. In this context, preserving local culture is an essential aspect of safeguarding national identity and strengthening the sense of belonging to the nation. The subjects of this training were teachers, parents, and students at the Indonesian School in Yangon, Myanmar. The implementation method of this community engagement programme included training and mentoring using a Participatory Training Model. This model was chosen because it emphasises the learning process, in which training participants are actively involved in all aspects of the programme, from planning, implementation, to evaluation. The primary focus of the training was to motivate participants and to engage them actively in the "Gelar Karya" activities. The training methods applied consisted of lectures, discussions, and guided practice, with a division of approximately 30% theory and 70% practice. The results of the training indicate that the programme of training and mentoring for the local cultural showcase at the Indonesian School in Yangon successfully strengthened collaboration between students and parents in preserving Indonesian culture on a global stage. This initiative not only fostered pride in national cultural identity but also served as an effective medium of cultural diplomacy through education, while ensuring the sustainable transmission of local values to the younger generation abroad.

Keywords: Cultural Identity; Local Culture Preservation; Participatory Training.

INTRODUCTION

In the era of globalization, local cultures face major challenges in maintaining their existence [1], [2], [3]. Local culture is not only the identity of a nation but also plays a vital role in shaping the character of the younger generation [4], [5], [6], [7], [8]. Education that is responsive to cultural diversity serves as a key strategy for preserving and strengthening cultural identity amidst the current wave of globalization. Schools have a strategic role in safeguarding local culture through various educational programs, one of which is the Gelar Karya (Creative Exhibition) program. In this context, preserving local culture becomes an essential aspect of maintaining national identity and strengthening the sense of nationality [5], [9], [10]. Culture does not merely represent ancestral heritage but also shapes the values and character of individuals within diaspora communities [11], [12], [13].

For citizens living abroad, preserving local culture functions as a bridge that connects them to their cultural roots and national identity. Culturally based education can help diaspora children understand their cultural heritage and develop pride in their country of origin [14], [15], [16], [17]. Moreover, the continued preservation of culture helps build a solid community in their host countries, thereby strengthening social ties and preventing the loss of cultural identity due to excessive assimilation [10], [18], [19]. Cultural preservation also has a significant diplomatic dimension. UNESCO emphasizes that cultural diversity is an essential asset for fostering intercultural dialogue and enhancing cross-cultural understanding [20], [21]. Through various cultural activities—such as arts, language, and traditions—citizens living abroad can contribute to introducing their native culture on the global stage while also strengthening diplomatic relations between their home and

host countries. Thus, preserving local culture among citizens living abroad is not only crucial for maintaining individual and community identity but also provides broader benefits in supporting international relations and promoting cultural diversity as part of world civilization.

Sekolah Indonesia Yangon (SIY), as an educational institution for Indonesian citizens residing in Myanmar, bears the responsibility of introducing and reinforcing Indonesian local culture among its students. However, several challenges arise in its implementation, including limited resources, insufficient teacher understanding, and low student participation in cultural activities [22], [23], [24]. Therefore, training and mentoring within the Gelar Karya program have become urgent needs to optimize the school's role in strengthening local culture.

The Gelar Karya training and mentoring program aims to enhance teachers' competence in teaching local culture and to encourage active student participation in culturally based activities. Furthermore, the program also involves parents to ensure the sustainability of cultural preservation within family environments. Hence, the training subjects include teachers, students, and parents at Sekolah Indonesia Yangon. This program aligns with the concept of culture-based education, which emphasizes contextual and experiential learning [25], [26], [27]. The principle of culturally responsive teaching is also an important approach in creating inclusive and empowering learning environments [14], [28], [29], [30]. Through this activity, it is expected that students will be able to recognize, appreciate, and preserve Indonesian culture in their surroundings, even while living abroad.

In addition, this program is also consistent with Indonesia's cultural diplomacy efforts to promote its rich cultural heritage at the international level [31]. The representation of culture through education not only impacts school-based learning but also contributes to shaping the image and diplomacy of the nation globally [18], [30], [32]. Therefore, this activity not only benefits students and schools but also serves as part of Indonesia's cultural diplomacy strategy in Myanmar.

The implementation of the Gelar Karya Program at Sekolah Indonesia Yangon faces various challenges that must be addressed through training and mentoring. Based on the identified obstacles, there are two main priority areas in this training: (1) enhancing teacher competence in culture-based learning, and (2) increasing student and parental participation in strengthening local culture.

First, Enhancing Teacher Competence in Culture-Based Learning. Teachers play a strategic role in teaching and instilling local cultural values in students [33], [34], [35], [36]. However, in practice, there remain limitations in teachers' understanding and skills in integrating local culture into learning [37]. Several issues faced by teachers include: (1) a lack of knowledge and culturally based teaching methods, making cultural materials less engaging for students; (2) minimal use of media and technology in delivering cultural content, resulting in less interactive learning experiences; (3) limited access to teaching materials relevant to Indonesian cultural contexts, particularly for schools abroad. Therefore, this training focuses on providing materials and strategies to enhance teachers' abilities to design creative and engaging culture-based learning, as well as to utilize technology as an educational support tool.

Second, Increasing Student and Parent Participation and Involvement in Strengthening Local Culture. Cultural preservation does not rely solely on the role of teachers but also requires the active involvement of students and parents in every stage of the learning process. However, there are several challenges in this aspect, including [1]: (1) Low awareness and interest among students in participating in culture-based activities due to the dominant influence of foreign cultures; (2) Limited parental involvement in supporting culture-based education at home, which results in a lack of cultural reinforcement outside school; (3) Limited extracurricular programs focusing on local culture, providing few opportunities for students to explore and appreciate their cultural heritage; and (4) To address these challenges, training programs will be designed to encourage students to actively engage in cultural activities through experiential learning approaches. In addition, parents will receive guidance on how they can play an active role in supporting and preserving local culture within the family environment.

To overcome the problems identified in the implementation of the *Gelar Karya* Program, the solutions to be applied include training, mentoring, and collaboration among stakeholders (teachers, students, and parents). The steps include: (1) Improving teacher competence in culture-based learning [2]; (2) Increasing student participation in culture-based activities [1]; (3) Enhancing parental involvement in cultural preservation; and (4) Strengthening Indonesia's cultural diplomacy in Myanmar. Through these solutions, it is expected that the *Gelar Karya* training and mentoring program will not only improve teachers' skills and student-parent involvement but also reinforce Indonesian cultural identity abroad.

The theoretical foundations used to address the aforementioned issues include: (1) Local Culture-Based Education; (2) The Role of Schools in Cultural Preservation; (3) Student Involvement in Culture-Based Education; (4) The Role of Parents in Strengthening Cultural Identity; and (5) Cultural Diplomacy in the Context of Education. Local culture-based education is a learning approach that integrates cultural values, traditions, and practices into the education curriculum [1]. This approach emphasizes the importance of cultural context in the learning process, enabling students to understand and appreciate their own cultural

identity. Culture-based education helps students [2]: (1) Deepen their understanding of history and cultural identity; (2) Develop critical thinking skills through reflection on cultural values; and (3) Increase motivation and engagement through more personalized learning experiences.In Indonesian schools abroad, culture-based education is particularly important because students are exposed to foreign cultures that may influence their identities [3]. Therefore, integrating local culture into education becomes a strategic effort to preserve Indonesia's cultural heritage.

Schools play a strategic role in cultural preservation through both curricular and extracurricular programs [4]. According to Sedyawati [5], schools function as: (1) Cultural education centers, where students learn about traditions and cultural values; (2) Agents of cultural preservation, through arts, music, dance, and traditional skills activities; and (3) Spaces for cultural creativity, encouraging students to innovate in expressing local culture. In the context of the Indonesian School in Yangon, this role becomes even more crucial as students live in a different cultural environment. The school must therefore develop culture-based learning strategies that can strengthen Indonesian national identity abroad.

Student involvement in culture-based learning is essential to enhance their understanding and appreciation of their own culture. Experiential learning can increase students' interest and motivation in understanding their culture [6]. This approach is supported by the *Culturally Responsive Teaching* model developed by [2], which emphasizes that students are more active when learning materials are relevant to their cultural backgrounds. Methods to increase student engagement in cultural programs include: (1) Culture-based project learning, such as art performances and cultural exhibitions; (2) The use of technology in cultural learning, such as digital storytelling and interactive multimedia; and (3) Cultural extracurricular activities, such as traditional dance, music, and cuisine. Parents play an important role in preserving culture through informal education at home. According to Vygotsky [7], [8] in sociocultural learning theory, social interactions within the family significantly influence children's cultural identity formation. Strategic roles of parents in supporting culture-based education include: (1) Introducing culture from an early age through folklore, traditional music, and regional games; (2) Encouraging children's participation in cultural activities, such as traditional art courses; and (3) Serving as role models for cultural preservation by practicing cultural values in daily life. In the context of the Indonesian School in Yangon, parental involvement is even more critical due to the differing cultural environment. Therefore, mentoring and workshops for parents are essential components to ensure the continuity of cultural education at home.

The *Gelar Karya* Program functions not only as an educational initiative but also as a form of Indonesia's cultural diplomacy. Cultural diplomacy is a strategy to introduce and promote national identity through education, arts, and culture [4], [9], [10]. According to UNESCO, cultural diplomacy through education offers several key benefits [11]: (1) Strengthening national identity abroad, particularly among the Indonesian diaspora; (2) Enhancing intercultural understanding, enabling the exchange of cultural values with local communities; and (3) Promoting Indonesian culture globally through art, music, and literature activities. In the context of the Indonesian School in Yangon, this program can serve as part of Indonesia's cultural diplomacy in Myanmar, where art performances and cultural exhibitions can showcase Indonesia's rich cultural heritage to the international community.

Thus, the *Gelar Karya* Program is expected to run optimally and serve as an effective platform for preserving and introducing Indonesian culture to the younger generation at the Indonesian School in Yangon. Therefore, the objectives of the *Training and Mentoring Program for the Gelar Karya Initiative* are to:

1. Improve teacher competence in integrating local culture into the learning process to create more innovative, contextual, and engaging teaching methods.
2. Increase student involvement in culture-based activities through experiential learning that fosters pride in Indonesian culture even while abroad.
3. Encourage parental participation in supporting culture-based education both at school and at home to ensure sustainable cultural preservation.
4. Strengthen Indonesia's cultural diplomacy in Myanmar through educational activities highlighting Indonesia's cultural richness, in line with the government's cultural internationalization efforts.
5. Develop a model of best practices in local cultural preservation at overseas Indonesian schools that can be replicated in other Indonesian schools worldwide.

RESEARCH METHOD

The implementation methods for this community service program include training and mentoring activities using the Participatory Training Model [1]. The participatory training model was chosen because it emphasizes a learning process in which participants are actively involved in all aspects of the activity — from planning, implementation, to evaluation. The main focus of this training is to motivate participants and engage them actively throughout the process. The training methods applied include lectures, discussions, and guided practice, with an approximate division of 30% theory and 70% practice. The lecture, discussion, and Q&A methods are used to transfer knowledge related to teacher competency enhancement and professional development. In addition to delivering material, the activity also involves participants through explanations of training objectives, implementation guidelines, and interactive Q&A sessions to ensure a deeper understanding of the content. The tutorial and practice methods are applied to guide participants in developing milieu-based learning tools such as student worksheets (LKPD) or other relevant materials. During these sessions, facilitators provide direct demonstrations, while participants are encouraged to engage in hands-on collaborative practice.

Partner Participation

The partner institution holds the responsibility to identify its own professional development needs. Second, teachers, students, and parents — as training participants — are expected to actively participate in all training activities. This includes taking part in discussions, asking questions, and engaging in simulations or direct practice aligned with the training topics. Third, the partners are expected to apply the knowledge and skills gained from the training in their daily teaching contexts, ensuring that the program produces a tangible impact.

Evaluation

Program implementation and sustainability in the field after completion are assessed through evaluation and reflection sessions. These are conducted using questionnaires and direct interviews with training participants. The questionnaires and interviews aim to identify participants' perceptions of the program, their satisfaction with the facilitators' performance, and the extent of learning outcomes achieved. In addition, evaluation is conducted to measure participants' knowledge of the training materials and to assess the quality of the products developed during the program. This evaluation is intended to determine the level of knowledge and skills acquired by participants after the training intervention.

Program evaluation is carried out after the entire series of activities is completed. The success criteria of the program are defined as follows At least 80% of participants provide positive feedback on the program implementation, and Participants demonstrate proficiency in developing learning milieus, such as LKPD or other equivalent instructional materials.

RESULTS AND DISCUSSION

Training Participants

The Training and Mentoring Program of Gelar Karya for Strengthening Local Culture at Sekolah Indonesia Yangon (SIY) involves three main groups: students, teachers, and parents. The total number of participants includes 29 students, 6 teachers, and representatives of parents. The involvement of these three parties is considered strategic, as they collectively form an educational ecosystem that supports the preservation of Indonesian local culture abroad.

Students

A total of 29 students participated in the training, representing various grade levels at SIY. The distribution includes 5 students from the junior school group, 13 from primary school, 7 from junior high school, and 4 from senior high school. The distribution of student participants is presented in Table 2 below.

Table 2. Distribution of SIY Students by Grade Level

No.	Student Level	Number of Students
1	Playgroup and Kindergarten	5
2	Primary School	13
3	Junior High School	7
4	Senior High School	4
	Total	**29**

Based on the initial observations, students showed a relatively high interest in learning about Indonesian culture; however, limited access and exposure to local traditions, combined with the strong influence of foreign

culture in Myanmar, have led to a superficial understanding of their own cultural roots. This training provided opportunities for students to express creativity through art, craft, and cultural performance activities. This approach aligns with the concept of Culturally Responsive Teaching [1], which emphasizes the importance of hands-on experiences and active student participation in culture-based learning.

Experiential learning has proven to be particularly effective in this context. Activities such as creating simple batik crafts or practicing traditional Indonesian dances encouraged students to internalize cultural values. This finding is consistent with Vygotsky's sociocultural learning theory, which emphasizes that social interaction plays a key role in constructing knowledge and shaping cultural identity [2], [3], [4].

Moreover, students demonstrated an increased sense of pride and belonging toward Indonesian culture despite living in a foreign social environment. This finding supports previous studies suggesting that engaging children in cultural activities strengthens national identity and helps prevent excessive cultural assimilation [5].

Teachers

The six teachers participating in the training played a crucial role as facilitators and role models in implementing culture-based education. Interviews revealed that some teachers still faced challenges in developing learning materials that integrate local cultural content. Through the training, teachers were equipped with contextual pedagogical strategies and collaborative learning approaches to connect instructional materials with Indonesian cultural values. This approach aligns with the principles of multicultural education, which emphasize the importance of cultural integration in the curriculum to reinforce students' identities [6]. Teachers also developed an awareness of their role as cultural brokers, serving as mediators between their home culture (Indonesia) and the host culture (Myanmar). This concept aligns with multicultural education theories highlighting the teacher's responsibility to create inclusive and culturally responsive learning environments [6]. Another positive outcome observed was the increase in inter-teacher collaboration in designing cross-disciplinary lessons — for example, connecting Indonesian language classes with art and cultural studies. This aligns with findings that collaborative pedagogical innovation among teachers enhances the quality of learning and supports the sustainability of school programs [7].

Parents

Parental involvement in the training program demonstrated a significant contribution to cultural preservation within the family environment. Group discussions revealed that many parents experienced challenges in maintaining Indonesian cultural practices at home, particularly amid the daily realities of living in Myanmar. Through the mentoring sessions, parents were provided with practical guidance and cultural awareness, emphasizing their vital role as cultural agents. Simple yet meaningful strategies were introduced — such as encouraging children to use the Indonesian language at home and preserving traditional Indonesian cuisine and customs. This initiative aligns with UNESCO's recommendation that the family serves as the primary and most essential space for transmitting cultural values across generations [8].

Implementation

The community service program was conducted over a three-month period (May–August 2025) using a hybrid approach (online and on-site sessions). However, extensive communication with partner institutions — the Indonesian Embassy in Yangon (KBRI Yangon) and Sekolah Indonesia Yangon (SIY) — had been established since March 2025, culminating in a formal collaboration agreement. The schedule and structure of the training program are presented in Table 3 below.

Table 3. Training Program Milestones

Meeting	Activity Description	Date	Format
1	Initial Coordination with the Indonesian Embassy (KBRI) and SIY	March 17, 2025	Online
2	Focus Group Discussion (FGD) on Program and Technical Planning	April 21, 2025	Online
3	*Gelar Karya* (Program Implementation Showcase)	May 24, 2025	On-site
4	Workshop with SIY Teachers	May 25, 2025	On-site
5	Evaluation of the Training Program	June 16, 2025	Online

The program implementation began with the launch of a training pocketbook prepared by the service team. The pocketbook includes a foreword written by Mr. M. Arif Hidayatullah, Acting Principal of the Indonesian School Yangon (SIY) and Chargé d'Affaires ad interim of the Indonesian Embassy in Yangon. The pocketbook also contains the objectives of the training program along with detailed technical guidelines for its implementation. The cover page of the pocketbook is shown in Figure 1 below.

.

Figure 1. Training Pocketbook

Gelar Karya (Creative Showcase) Activity

One of the most notable activities in the Gelar Karya program at the Indonesian School Yangon was the organization of an Indonesian traditional food exhibition. This activity was designed to engage students, teachers, and parents in a collaborative, contextual, and enjoyable learning experience.

In this event, students and their parents prepared various traditional Indonesian dishes such as lenting, bakpia, klepon, and many others. The preparation involved not only cooking but also table arrangement, booth decoration, and composing short narratives about the origins of each food. Teachers acted as facilitators, guiding participants to convey the cultural values embedded in each dish. The festive atmosphere of the event is illustrated in Figure 2 below.

Figure 2. Participants (Student–Parent Teams) Tasting Traditional Indonesian Food

The activity took place in a lively and joyful atmosphere, as students not only learned to recognize and introduce traditional Indonesian foods but also practiced communication skills by explaining them to visitors—including fellow students, teachers, and members of the local community. In addition, parents who participated expressed pride in sharing the culinary traditions of their homeland, creating a positive interaction between the school, families, and the surrounding community.

The success of this event was reflected in the high enthusiasm of students, the active involvement of parents, and the positive responses from invited guests. Direct participation in culture-based activities helped strengthen students' cultural identity and build their self-confidence [1]. This aligns with the concept of culturally responsive teaching [2], which emphasizes the importance of integrating cultural elements into the learning process to make it more meaningful.

Thus, the Indonesian traditional food exhibition served not only as a platform to introduce the richness of Indonesian cuisine but also as an effective means to foster students' emotional connection with their ancestral culture, even while living abroad.

Workshop Activities with Teachers

In addition to the participation of students and parents in the Gelar Karya event, teachers at the Indonesian School Yangon (SIY) also took part in training sessions and a Focus Group Discussion (FGD). These activities were designed as capacity-building platforms as well as collective reflection forums on culturally based teaching practices.

The training focused on two main aspects: (1) Integration of Indonesian Local Culture across Subjects. Teachers were trained to utilize cultural resources—such as traditional food, dance, and folklore—as engaging and meaningful learning contexts. (2) Strengthening Pedagogical and Technological Competence. Teachers were guided to design creative learning activities using simple technologies, ensuring relevance to the needs of Indonesian diaspora students.

Following the training, an FGD session was conducted, facilitated by the community service team. In this forum, teachers exchanged experiences, discussed challenges, and formulated joint strategies to sustain cultural reinforcement practices at school. Some of the ideas that emerged included integrating traditional cuisine into mathematics lessons (e.g., calculating recipes), using folklore in language learning, and establishing cultural exhibitions as a regular school agenda.The implementation of this activity is illustrated in Figure 3 below.

Figure 3. Implementation of the FGD with SIY Teachers

The teachers' responses reflected a high level of enthusiasm. They felt that the training opened new perspectives on how to preserve students' cultural identity while still achieving curriculum goals. This indicates that practice-oriented and context-based training can enhance teachers' classroom effectiveness [1], [2]. Furthermore, the FGD model that positioned teachers as a learning community aligns with the Professional Learning Community (PLC) approach, in which teacher collaboration plays a crucial role in strengthening the quality of teaching and learning [3].

Thus, the training and FGD for teachers not only served as a platform for improving professional competence but also as a space for strengthening professional solidarity-ultimately contributing to the creation of a school ecosystem that is more responsive to the needs of diaspora students.

Signing of the Cooperation Agreement

As the culmination of the Gelar Karya and Cultural Reinforcement Training Program, a signing ceremony was held between the program implementation team and the Indonesian School Yangon (SIY). This event carried strategic significance-not merely ceremonial, but representing a shared commitment to ensuring the sustainability of Indonesian cultural preservation efforts within the school environment.

The cooperation document outlined several key points: (1) Program Sustainability Commitment. Both the school and the facilitation team agreed to establish the Gelar Karya as an annual event involving students, teachers, and parents. (2) Teacher Capacity Building. The agreement included follow-up actions such as advanced training, the development of context-based cultural curricula, and the formation of a teacher learning community. (3) Parent Involvement. Parents are to be engaged as partners in fostering pride in Indonesian cultural identity among their children through home activities, community involvement, and participation in cultural exhibitions. (4) Support for Cultural Diplomacy. The document also serves as an instrument of Indonesia's cultural diplomacy in Myanmar, affirming SIY's role as part of the network of Indonesian schools abroad that not only teach academic subjects but also strengthen national cultural roots.

The signing ceremony took place in a solemn yet warm atmosphere. Attendees included teacher representatives, members of the school committee representing parents, and students who had previously participated in the Indonesian culinary exhibition. The event reflected a strong sense of belonging among all members of the school community. This cross-stakeholder collaboration (teachers, parents, and the school community) exemplifies the school-community partnership concept, which has been shown to enhance educational quality while preserving the cultural identity of diaspora students [4]. The signing moment is illustrated in Figure 4 below.

Figure 4. Signing of the Cooperation Agreement Document

Thus, the signing of the cooperation document was not merely the conclusion of the activity, but rather a starting milestone for developing follow-up programs that are more sustainable, well-directed, and have a broader impact on the preservation of Indonesian culture at the Indonesian School Yangon (SIY).

CONCLUSION

The implementation of the Training and Mentoring Program for the Cultural Reinforcement Exhibition at the Indonesian School Yangon (SIY) demonstrated that this activity successfully became an enjoyable, participatory, and meaningful learning platform for the entire school community. The involvement of 29 students, 6 teachers, and parents proved that strengthening local culture can be effectively integrated into the educational environment abroad. The results of the program showed several significant achievements:

1. For students, the program enhanced their understanding, skills, and pride in Indonesian cultural identity through hands-on experiences such as art exhibitions and traditional Indonesian food stands.
2. For teachers, the training and Focus Group Discussion (FGD) sessions strengthened their pedagogical capacity to integrate cultural values into learning, while also fostering the formation of a *teacher learning community*.
3. For parents, their participation fostered active roles in supporting cultural preservation and strengthened the school–family relationship.
4. For the school institution, the signing of the cooperation document became a strategic commitment to ensure the sustainability and direction of similar activities, while reinforcing Indonesia's role in cultural diplomacy in Myanmar.

Overall, this program demonstrated that collaboration among students, teachers, and parents is the key to successfully preserving Indonesian culture abroad. With this success, it is expected that similar programs can continue to be expanded and replicated—both in other Indonesian Schools abroad and in domestic schools—so that the reinforcement of local culture can be sustained in the face of globalization challenges.

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BRAND EXPERIENCE, GREEN SATISFACTION, AND GREEN BRAND LOYALTY: EVIDENCE FROM ECO-FRIENDLY COSMETICS CONSUMERS

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Abstract. This study aims to examine the effect of brand experience on green satisfaction and green brand loyalty, as well as the influence of green satisfaction on green brand loyalty. In addition, it investigates the mediating role of green satisfaction in the relationship between brand experience and green brand loyalty. Employing a quantitative approach, this research adopts a cross-sectional design with individual consumers as the unit of analysis. Data were collected through a survey method using purposive sampling, targeting consumers of The Body Shop products. The sample consisted of 120 respondents, comprising male and female consumers aged 17 years and above who had purchased The Body Shop products at least twice. The sample size was determined by multiplying the number of indicators by ten. The data were analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS). The empirical findings indicate that brand experience significantly influences green satisfaction. Moreover, both brand experience and green satisfaction exert a positive and significant effect on green brand loyalty. Mediation analysis further reveals that green satisfaction partially mediates the relationship between brand experience and green brand loyalty. These findings provide both theoretical and managerial implications by enriching the literature on green consumer behavior and offering practical insights for companies seeking to enhance customer loyalty toward environmentally friendly brands.

Keywords: green satisfaction, green brand loyalty, brand experience, green cosmetics

INTRODUCTION

The increasing awareness of sustainability has driven consumers to be more environmentally conscious. At the individual level, consumers may alter their consumption behaviors to preserve environment as well as protecting their health [1]. At the enterprise level, companies have started to implement green marketing, a concept that is now becoming more popular as green practices and eco-friendly attitude among consumers have become a common practice [1]. The popularity of green practices also becomes more common in cosmetics industry, affecting consumers' environmental and health concern [2] and brought the term of "green cosmetics".

The cosmetics industry is one of the fastest growing industries [3], and it has evolved into a trend and necessary need [4]. This phenomenon is predicted to keep growing rapidly in the future as there are more small and medium enterprises participate in the competition. Moreover, consumers are now more conscious about cosmetics usage to enhance their daily appearance. This trend also reinforced by the increasing use of online promotion in social media in which allows consumers to obtain more information of cosmetics products [5], and the raising demand for innovation [6]. The phenomenon of doom spending also contributes in the increasing behavior of impulsive buying, a condition in which consumers tend to purchase unneeded products or to spend more money [7].

Despite of its purpose of beautifying one's appearance and enhancing visual appeal, cosmetics products often contain a mix of chemical compounds. The composition, such as mineral pigments, stabilizers, shine enhancers, and dyes, are used to boost the effectiveness and quality [2]. The application of these chemical compounds on the skin can pose negative impacts for consumers [2]. Therefore, consumers are worried of the health impacts, such as irritations, allergies, or even more dangerous health risk [8]. In addition, consumers are

highly concerned about the negative effects of these chemical compounds on the environment [9], although there are regulations in cosmetics industry regarding the utilization of these ingredients.

Driven by the awareness and the risk of chemical compounds, there is an increase of interest on eco-friendly cosmetics [10]. The concept of eco-friendly cosmetics, or often mentioned as green cosmetics, is cosmetics made with natural or organic ingredients and is produced with environmental sustainability consideration. Nevertheless, the concept of green cosmetics is more than the composition in the cosmetics; it is a comprehensive effort to support for animal welfare and biodiversity conservation [3], [9]. Hence, green cosmetics concept has a wider understanding, including utilizing green packaging, recyclable compositions, and refusing trials on animals [11], [12].

As one of the most populous countries in Asia, Indonesia is a crucial market for cosmetics industry [6], [12]. By 2023, 79 percent of Indonesian consumers indicate a willingness to purchase sustainable products, including green cosmetics. By 2025, the natural cosmetics market was projected to generate the revenue of US$270.22m, and is anticipated to have annual growth rate of 5.62 percent (CAGR 2025-2030) [13]. These numbers show the potential for green cosmetics market in Indonesia, including to a well-known eco-friendly cosmetics brand, The Body Shop.

Nevertheless, the topic of customer loyalty toward eco-friendly cosmetics is still underexplored. The current study aims to analyze the factors that enhance green consumer loyalty, with green satisfaction as mediating variable. Prior studies in the green cosmetics highlighted that consumer's commitment to sustainable practices has become a key factor in building consumer loyalty. Consumers are increasingly prioritizing products that utilize ethically sourced materials and environmentally friendly packaging. However, [2] found inconsistent findings, in which green brand experience was found to have no significant influence on green brand loyalty. Conversely, other studies indicated that green brand experience significantly affects green brand loyalty [14], [15]. [16] found the positive effect of green satisfaction on green customer loyalty, indicating there is a mediation role of green satisfaction. The different findings form the basis for this study to re-examine the effect of both green brand experience and green satisfaction on green consumer loyalty, and the role of green satisfaction as a mediator.

The structure of this paper is as follows: the next section is the literature review explaining the theories and hypotheses development. It is followed by research method and the discussion of the results. The paper then concludes the findings and its implications with conclusion section.

LITERATURE REVIEW

Green Brand Loyalty

Brand loyalty is defined as a customer's enduring intention to maintain a valuable relationship with a particular brand [17]. Generally, the concept of loyalty has been defined as repeat purchasing, showing that loyal customers are those who repurchase and consider only a brand. It signifies that loyal customers have a commitment to brand. This concept also reflects the depth of customer's attachment and emotional commitment to a brand [18]. In the context of eco-friendly products, this commitment is demonstrated through repeated purchase of environmentally friendly products, that is driven by environmental concern and a positive attitude toward sustainability. It is referred to as green brand loyalty [19].

Furthermore, Chen (2013) also defined green brand loyalty as the degree of repurchase intention that is influenced by strong environmental attitudes and sustained commitment toward a brand. Synthesizing various definitions, green brand loyalty can be understood as the level of customer attachment toward a brand, driven from consistent positive environmental attitude and long-term commitment. Prior studies have identified that green brand loyalty can be enhanced through brand experience [20] and green satisfaction [16].

Brand Experience

Brand experience refers to the sensations, feelings, cognitions, and behavioral responses elicited by brand-related stimuli, which are embedded in the design, identity, packaging, communication, and environment of the brand [21]. This experience unfolds as consumers interact with the brand, such as through usage, discussions, information-seeking, event participation, and promotional activities [22]. In other words, brand experience encompasses the interactions created by the brand for its consumers [23]. Furthermore, it emerges as consumers engage with the brand throughout their purchasing journey [24].

Brand experience has been shown to influence green satisfaction through emotional, cognitive, and behavioral dimensions [25]. However, emotional experience does not exhibit a significant impact, whereas cognitive and behavioral experiences do. Another study highlights that sensory brand experiences, which includes visual, auditory, olfactory, tactile, and taste cues, significantly enhance consumer satisfaction [26]. Overall, brand experiences across sensory, emotional, behavioral, and intellectual dimensions contribute positively to brand satisfaction [27].

In addition to its significant role in enhancing green satisfaction, numerous studies have identified brand experience as a key factor in enhancing green brand loyalty [20]. Consistent with this view, brand experience—which encompasses sensory, affective, behavioral, and intellectual dimensions—can contribute to strengthening brand loyalty [27]. This is further supported by findings indicating that brand experience has a significant impact on improving brand loyalty [28], [29]. These findings collectively suggest that brand experience serves as a critical determinant in the development of brand loyalty. Hence, the following hypotheses are proposed.

H1: Brand experience positively and significantly affects green satisfaction.

H2: Brand experience positively and significantly affects green brand loyalty.

Green Satisfaction

Green satisfaction is defined as the level of pleasure fulfillment derived from consumption that aligns with customers' environmentally friendly desires, sustainable expectations, and green needs [30]. As a complex construct, green satisfaction has emerged as a central theme in studies of sustainable consumption. It is articulated as a customer's emotional response to experiences related to sustainable consumption and ecological integrity [30]. Another perspective views green satisfaction as the enjoyment derived from consciously using or consuming environmentally responsible products [30]. Moreover, green satisfaction arises when consumers' positive perceptions and expectations align with a brand's commitment to sustainability principles [31].

This study emphasizes green satisfaction as a critical element in customer evaluations, influenced by brand experience. Thus, green satisfaction can be understood as the pleasure or enjoyment that customer derive from experiencing, whether using or consuming, environmentally friendly products. [17] stated that the concept of satisfaction not always directly affected loyalty, meaning that it can lead to loyalty but can also independent. Nevertheless, prior research has shown that green satisfaction significantly impacts green consumer loyalty [16], with findings consistently supporting its positive influence [32]. Based on this insight, the hypothesis is proposed as follows.

H3: Green satisfaction positively and significantly affects green brand loyalty.

The Mediating Role of Green Satisfaction

Prior studies have identified brand experience as a key predictor in enhancing green brand loyalty [29]. Additionally, green satisfaction has been found to significantly enhance brand loyalty [16]. These findings suggest that brand experience have direct and indirect effects on green brand loyalty, with the indirect effect is emerged through green satisfaction as a mediating variable. Based on this conceptual framework, this study proposes the following hypothesis.

H4: Green satisfaction mediates the relationship between brand experience and green brand loyalty.

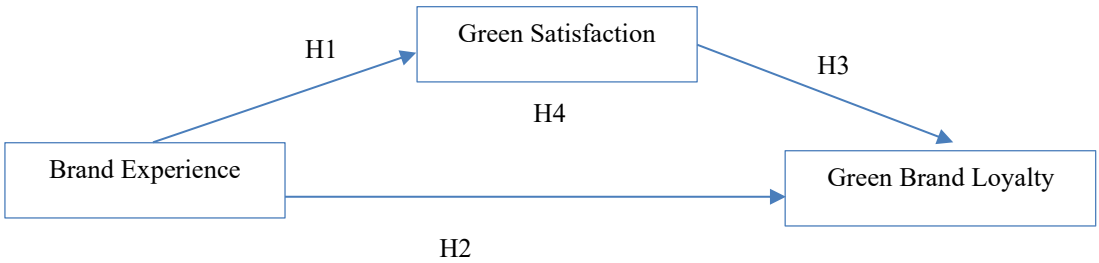

Figure 1. Research model

Graphic 1 shows the research model, emphasizing the effect of brand experience on green satisfaction (H1) and green brand loyalty (H2), the effect of green satisfaction on green brand loyalty (H3), and the mediating role of green satisfaction on the relationship between brand experience and green brand loyalty (H4).

RESEARCH METHOD

This study employs a quantitative research design that utilizes empirical approach to collect, analyze, and present numerical data [33]. The quantitative design is adopted with the aim of hypotheses testing. It is also intended to explain the variance in dependent variables or predict research outcomes [34]. Based on the research timeframe, a cross-sectional approach was applied, as the study was conducted within a single period. The unit of

analysis in this study is the consumer who have previously purchased eco-friendly products. Data were collected through a survey, which serves as a method for obtaining primary data from individual respondents [35].

Population and Sampling Technique

Population refers to a group of individuals or a particular phenomenon of interest being investigated in a study [36]. In this study, the population consists of consumers of The Body Shop brand. A purposive sampling technique was used to collect respondents with the following criteria: (1) male and female participants aged 17 years old or above, and (2) individuals who have purchased The Body Shop products at least twice. Determining an appropriate sample size is crucial for a study, because an excessively large sample may complicate the development of a research model. Taking this into consideration, this study utilized a sample of 120 respondents.

Data Collection and Data Analysis Technique

This study used primary data obtained through online survey. Primary data refers to data that is generated by researchers for a specific purpose of addressing research problem [34]. The data analysis technique in this study was conducted using Structural Equation Modeling – Partial Least Square (SEM-PLS). Furthermore, the measurement of the instruments in this study employed a five-point likert scale, ranging from strongly disagree (1) to strongly agree (5). The variables in this study consist of one independent variable, which is brand experience; one dependent variable, which is green brand loyalty; and one mediating variable, which is green satisfaction. The measurement items for brand experience were adapted from [15]. The measurement items for green satisfaction were derived from [16] and [37]. Lastly, the measurement items for green brand loyalty were adapted from [37].

Measurement of the Outer Model

The measurement of outer model was performed with validity and reliability testing. The convergent validity was assesed using outer loading and Average Variance Extracted (AVE). Based on [38], outer loading ≥ 0.7 and AVE ≥ 0.5 indicating a good convergent validity. Table 1 shows the outer loadings of the measurement items for each variable. It shown in that the outer loadings are ≥ 0.7. in addition, the AVE values as shown in Table 1 are all exceed the 0.5 threshold. Therefore, the measurement items in this study satisfy the convergent validity requirements.

Table 1. Outer loadings

Items	Brand Experience	Green Brand Loyalty	Green Satisfaction	AVE
BE_1	0.856			0.692
BE_2	0.821			
BE_3	0.811			
BE_4	0.798			
BE_5	0.846			
BE_6	0.841			
BE_7	0.851			
BE_8	0.828			
BE_9	0.832			
GBL_1		0.826		0.707
GBL_2		0.795		
GBL_3		0.896		
GBL_4		0.843		
GS_1			0.895	0.765
GS_2			0.858	
GS_3			0.854	
GS_4			0.899	
GS_5			0.866	

The instrument reliability was assesed through Cronbach's Alpha and Composite Reliability (CR), with the threshold of 0.7 [38]. Table 2 shows that all constructs exceeding the threshold of 0.70, confirming the reliability of the measurement items.

Table 2. Construct Reliability

Variables	Cronbach's Alpha	Composite Reliability (CR)
Brand Experience	0.944	0.953
Green Satisfaction	0.923	0.942
Green Brand Loyalty	0.861	0.906

RESULT AND DISCUSSION

This study investigates the influence of brand experience on both green satisfaction and green brand loyalty; the influence of green satisfaction on green brand loyalty; and the mediating effect of green satisfaction with the evidence from eco-friendly product. Using Structural Equation Modeling - Partial Least Squares (SEM-PLS) approach, the findings revealed that all hypothesis were supported.

Respondent Profile

The survey conducted in this study collected 120 valid responses. Table 3 presents the respondents profile of the respondents. The majority of participants were in the 23–28 age group (25.8%), followed by those aged 29–34 (22.5%), 17–22 (20.0%), 35–40 (17.5%), and over 40 years old (14.2%). In terms of occupation, most respondents were private sector employees (26.7%), government employees (20.8%), and students (20.8%). The majority reported monthly expenses ranging from Rp2,000,001 to Rp3,000,000. Respondents were distributed across several provinces, including Bali, Banten, the Special Region of Yogyakarta, Jakarta, West Java, Central Java, and East Java. Regarding purchase frequency, 35.8% of respondents had purchased The Body Shop products at least twice, followed by those who had purchased five times or more (34.2%), and those who had purchased 3–4 times (30.0%). The most commonly purchased product categories were body care (25.0%) and fragrance (17.5%).

Table 3. Respondent Profiles

Category	Frequency	Percentage
Age		
17 - 22	24	20.0%
23 - 28	31	25.8%
29 - 34	27	22.5%
35 - 40	21	17.5%
Above 40	17	14.2%
Occupation		
Housewives	17	14.2%
Private Sector Employees	32	26.7%
Government Sector Employees	25	20.8%
Freelancer	21	17.5%
Students/Colleger	25	20.8%
Monthly expenses (excluding taxes, bills, and installments)		
Di atas Rp3.000.000	23	19.2%
Di bawah Rp1.000.000	12	10.0%
Rp1.000.000 - Rp2.000.000	38	31.7%
Rp2.000.001 - Rp3.000.000	47	39.2%
Domicile		
Bali	9	7.5%
Banten	20	16.7%
Special District of Yogyakarta	11	9.2%

Jakarta	26	21.7%
West Java	23	19.2%
Central Java	17	14.2%
East Java	14	11.7%
Purchase frequency of The Body Shop products		
≥ 5 times	41	34.2%
2 times	43	35.8%
3 - 4 times	36	30.0%
The Body Shop products that have been purchased		
Make up	22	18.3%
Body care	30	25.0%
Haircare	22	18.3%
Skincare	25	20.8%
Fragrance	21	17.5%

Measurement of the Inner Model

The initial stage of the inner model evaluation involved assessing model fit using the Standardized Root Mean Square Residual (SRMR), as recommended by [NO_PRINTED_FORM] [38] and [NO_PRINTED_FORM] [39]. A model is considered to have a good fit if the SRMR value is below the threshold of 0.08 [38], [39]. The SRMR value obtained in this study was 0.044, indicating a good model fit. Additionally, the Adjusted R-square (R^2) values were examined to evaluate the model's explanatory power. The results show that 44.2% of the variance in green satisfaction was explained by brand experience, while 62.4% of the variance in green brand loyalty was explained by both brand experience and green satisfaction. Table 4 presents the detailed R^2 results.

Table 4. R-Square Test

	R^2	Adjusted R^2
Green Satisfaction	0.446	0.442
Green Brand Loyalty	0.631	0.624

Hypothesis testing was conducted by testing the path coefficient of the inner model with Bootstrapping method. Table 5 presents the result of the hypothesis testing. Path coefficient results show that brand experience positively and significantly influence green satisfaction ($\beta = 0.668$, $t = 9.544$, $p = 0.000$) and green brand loyalty ($\beta = 0.338$, $t = 4.598$, $p = 0.000$). Green satisfaction positively and significantly affects green brand loyalty ($\beta = 0.527$, $t = 7.868$, $p = 0.000$). Subsequently, total indirect effect is present between brand experience and green brand loyalty with $\beta = 0.352$, $t = 5.678$, and $p = 0.000$, whereas the specific indirect effect revealed the partial mediation of green satisfaction in the relationship between brand experience and green brand loyalty. Hence, all the hypotheses are supported.

Table 5. Hypothesis testing results

	β coefficient	Sample mean	Standard deviation	*t statistics*	*P value*
Brand Experience → Green Satisfaction	0.668	0.664	0.070	9.544	0.000
Brand Experience → Green Brand Loyalty	0.338	0.334	0.074	4.598	0.000
Green Satisfaction → Green Brand Loyalty	0.527	0.528	0.067	7.868	0.000
Brand Experience → Green Satisfaction → Green Brand Loyalty	0.352	0.351	0.062	5.678	0.000

Discussion

This study aims to examine the effect of brand experience on green satisfaction and green brand loyalty, as well as the influence of green satisfaction on green brand loyalty. In addition, it investigates the mediating role of green satisfaction in the relationship between brand experience and green brand loyalty. This study provides both theoretical and managerial implications by enriching the literature on green consumer behavior and offering practical insights for companies seeking to enhance customer loyalty toward environmentally friendly brands.

The findings indicate that brand experience significantly influence green satisfaction. It is in line with previous studies by [NO_PRINTED_FORM] [25] and [NO_PRINTED_FORM] [26] that stated that brand experience can be a crucial factor in influencing green satisfaction with regard to maintaining customer relationship. Additionally, [NO_PRINTED_FORM] [25] elaborated that the direct effect between brand experience and green satisfaction may emerged because experience is associated with memory, which its attributes are more vivid and required customers' internal elaboration. The familiarity with the brand's eco-friendly mission then can improve customers' ability to assess their overall satisfaction [21]. Thus, a positive experience with eco-friendly products can enhance green satisfaction toward the eco-friendly products.

Both brand experience and green satisfaction exert a positive and significant effect on green brand loyalty. This finding is consistent with previous findings that brand experience is an important factor in fostering green brand loyalty [20], [28], [29]. It indicates that customer's sensory, affective, behavioral, and cognitive experiences are essential in building a long-term relationship with an eco-friendly brand. When they perceive the eco-friendly brand can enhance their real experiences in persevering environment and drive them to be more environmentally conscious, their loyalty most likely will be increased. In addition, when customers are satisfied with an eco-friendly brand, they are more likely to be loyal toward that brand. Moreover, this study found that the effect of green satisfaction on green brand loyalty is greater than the influence of brand experience on green brand loyalty. This finding is supported by Cavusoglu and Putri. Green satisfaction may result from the positive perception and customers' expectation that is in line with the brand's mission [31]. Customers often engage in green marketing activities to investigate environmental awareness and protection (Cavusoglu). Successfully integrating green practices in business, such as commitment to environment and animal protection, tend to satisfy the green consumers' values and attitudes.

The mediation analysis revealed that green satisfaction partially mediates the relationship between brand experience and green brand loyalty. This finding aligns with previous studies [16]. In fostering green brand loyalty, an eco-friendly brand needs to provide a positive brand experience to its customers as well as maintaining a good relationship in order to satisfy their needs. This may be done by aligning its mission to show that the brand does the business without harming the environment or animals. Through the brand's commitment in green marketing activities customers can develop a positive perception that leads to enhanced satisfaction and loyalty.

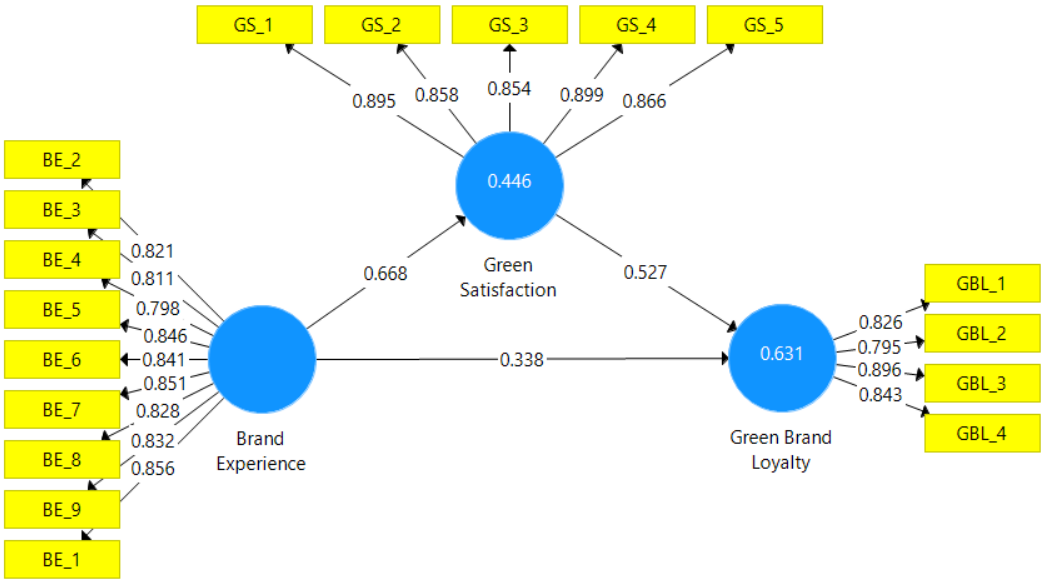

Figure 2. Model testing results

CONCLUSION

This study investigates brand experience, green satisfaction, and green brand loyalty. The findings confirms that brand experience has positive and significant effect on green satisfaction and green brand loyalty. Green

satisfaction is positively and significantly influencing green brand loyalty. In addition to these results, green satisfaction is revealed to have a partial mediation effect on the relationship between brand experience and green brand loyalty. For a business to able to foster customer green brand loyalty, it needs to build a positive brand experience. It can be done by performing business ethically that committed to protect the environment. The similarity of values in green marketing actions may improve customer green satisfaction and leads to loyalty to the brand.

This study was conducted based on the data from 120 consumers who have purchased The Body Shop. Future study can elaborate in another green product categories to investigate the generalizability. Future study may also compare between industries or between markets to make the findings more valuable and reflect the differences in the green market. Additionally, it is expected to provide a different perspective for the literature and practitioners in different markets.

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AN EVALUATION OF WORKFORCE DEMANDS FOR MASTER'S GRADUATES IN EARLY CHILDHOOD EDUCATION

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Abstract. This study aims to evaluate the labor market needs for graduates of the Master's Program in Early Childhood Education (ECE) at Universitas Negeri Yogyakarta (UNY). A mixed-methods approach was employed, combining a quantitative descriptive survey with qualitative expert focus group discussions (FGDs). The participants comprised employers of ECE graduates and experts affiliated with the Indonesian Early Childhood Education Association (APG). Data were collected through interviews, documentation, and questionnaires, and analyzed using both qualitative and quantitative techniques. The findings resulted in the identification and ratification of the program's learning outcomes (LOs) and graduate learning achievements (Capaian Pembelajaran Lulusan, CPL). Two primary LOs were established: (1) graduates as lecturers who possess theoretical mastery to advance knowledge and technology through research and the creation of innovative works with significant impact in early childhood education; and (2) graduates as managers capable of developing and applying service management concepts. Quantitative results revealed that 80% of graduates secured employment within less than six months, with an average monthly salary of IDR 2,172,647. Alumni evaluations indicated that academic services (56%), learning facilities (49%), and teaching and learning processes (53%) were predominantly rated as "very good," with lectures and project participation identified as the most frequently applied instructional methods. However, employers emphasized the need for improvement in foreign language proficiency, particularly English, which received the lowest evaluation score. These findings provide valuable insights for strengthening curriculum development, enhancing graduate competencies, and ensuring alignment between academic outcomes and labor market expectations in early childhood education.

INTRODUCTION

Early Childhood Education (ECE) represents a critical period for the development of children's cognitive, moral, social, emotional, and physical capacities, which profoundly influence human productivity in later life[1]. ECE is increasingly recognized globally as a fundamental foundation for cultivating high-quality human resources[2]. International organizations, such as UNESCO, emphasize that investment in early childhood education generates long-term impacts on the acquisition of 21st-century skills required in the labor market[3,4]. In Indonesia, the urgency of strengthening early childhood education has been underscored in various national policies, including the National Medium-Term Development Plan (RPJMN) and the Merdeka Belajar (Freedom to Learn) policy, which designates ECE as one of its key priorities[5]. Consequently, the demand for professional ECE practitioners who are competent, adaptive, and innovative has become increasingly critical.

Nevertheless, a significant gap persists between the profiles of ECE graduates produced by higher education institutions and the competencies expected by the labor market, including those required in ECE centers, managing institutions, consultancy services, and managerial roles. Various reports indicate that, despite the integration of innovative learning methodologies into ECE master's curricula, graduates continue to face challenges in mastering evaluation strategies, managing educational services, and implementing effective classroom participation. This condition raises critical questions regarding the extent to which universities are able to prepare graduates who are genuinely aligned with field requirements, particularly within the context of ECE, which demands both pedagogical and managerial competencies.

These challenges are closely linked to the increasingly competitive dynamics of the labor market. The professional field requires ECE master's graduates not only to serve as educators but also as researchers, innovators, educational managers, and curriculum developers capable of responding to the complex needs of early childhood development. UNESCO (2018), through the *ECCE Teacher Competency Framework for Southeast Asia*, underscores the importance of multidimensional competencies encompassing knowledge,

skills, and dispositions to holistically support early childhood development[6]. However, in practice, ECE master's graduates in Indonesia continue to face difficulties in meeting these international competency standards, particularly in the areas of leadership, innovation, and community collaboration. If the gap between graduate learning outcomes and labor market demands is not adequately addressed, it may lead to reduced productivity, less effective ECE service delivery, and limited contributions of graduates to improving the quality of early childhood education in Indonesia.

Furthermore, the ECE workforce is currently evolving in a highly dynamic manner. The demands extend beyond pedagogical expertise to include the ability to design responsive curricula, integrate educational technologies, manage institutions effectively, and conduct research-based evaluations to enhance service quality. Higher education institutions often lag in adapting to these rapid changes, both in terms of curriculum design and in providing students with relevant practical experiences. Consequently, ECE master's graduates are frequently not fully prepared to meet the expectations of key stakeholders, including government bodies, ECE institutions, and the wider community.

Therefore, evaluating the labor market needs for ECE master's graduates constitutes a strategic step to reassess the relevance of curricula, graduate learning outcomes (CLOs), and the competency profiles produced. Such evaluation is not merely intended to identify weaknesses but also to provide evidence-based recommendations regarding aspects that should be maintained, enhanced, improved, or even discontinued. Accordingly, the findings of this study are expected to serve as a reference for formulating curriculum development policies for ECE master's programs, while simultaneously addressing the needs of graduate users at both national and international levels.

METHOD

This study employed a mixed-methods approach by integrating both quantitative descriptive and qualitative methods. Such an approach was selected to obtain a comprehensive understanding of labor market demands regarding graduates of the Master's Program in Early Childhood Education (ECE). The quantitative component was conducted through a survey method, while the qualitative component was carried out through focus group discussions (FGDs) with experts.

In the quantitative phase, the study was carried out by distributing questionnaires to users of graduates from the Master's Program in Early Childhood Education (ECE) at Yogyakarta State University (Universitas Negeri Yogyakarta/UNY). The respondents consisted of institutional leaders of ECE centers, foundation managers, and other key stakeholders who were directly involved in recruiting or collaborating with graduates of the program. The survey instrument was specifically designed to measure stakeholders' perceptions of the extent to which graduates' competencies aligned with the requirements of the labor market.

The questionnaire items were structured based on the Context, Input, Process, and Product (CIPP) evaluation model, covering four major dimensions: (1) *Context*, which addressed the demand for a qualified workforce in the field of early childhood education; (2) *Input*, which examined graduates' readiness in terms of qualifications and competencies; (3) *Process*, which assessed the relevance of the learning experiences provided in the program to professional practices in the field; and (4) *Product*, which evaluated graduates' learning outcomes and their contributions to the overall improvement of institutional quality in early childhood education.

Meanwhile, in the qualitative phase, the study was conducted through focus group discussions (FGDs) with early childhood education (ECE) experts affiliated with the Indonesian Association for Early Childhood Education (*Asosiasi PAUD Indonesia*/APG). The primary objective of the FGDs was to deepen and contextualize the survey findings, while also capturing critical perspectives from experts on the profile of an ideal graduate of the Master's Program in Early Childhood Education.

The discussions were guided by a set of open-ended questions designed to elicit comprehensive insights regarding the strengths, weaknesses, opportunities, and challenges of graduates in addressing labor market demands. Qualitative data were collected through detailed discussion notes, interview recordings, and relevant documentation. Subsequently, the data were analyzed thematically to identify recurring patterns and extract meaningful interpretations that could enrich the overall understanding of graduate competencies and their alignment with professional expectations.

RESULT And DISCUSSION

This chapter presents the findings of the study on labor market needs in relation to graduates of the Master's Program in Early Childhood Education (ECE), followed by a discussion based on the data obtained through a combination of quantitative and qualitative approaches. The results are systematically organized in accordance

with the Context, Input, Process, and Product (CIPP) evaluation model, which served as the analytical framework for this research.

Data were collected through surveys and questionnaires administered to alumni and graduate users, which were further enriched by in-depth interviews with experts, program administrators, and relevant stakeholders. The quantitative data were analyzed statistically to provide a general overview of the alignment between graduates' competencies and labor market demands, while the qualitative data were employed to further interpret the underlying factors influencing competency gaps, opportunities for development, and challenges faced by graduates in professional contexts.

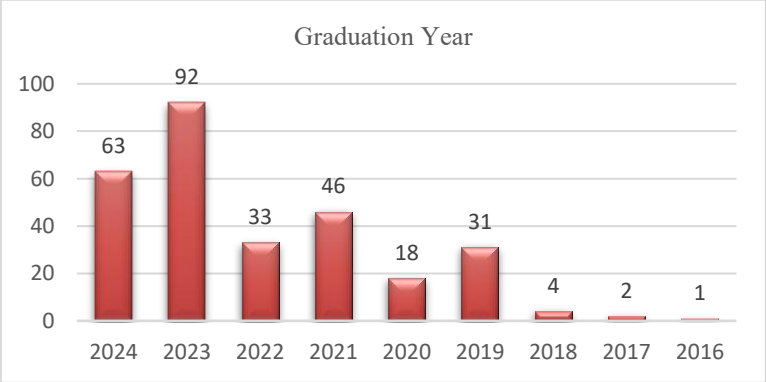
Subsequently, a gap analysis approach was applied to identify the extent to which the competencies taught in the Master's Program in Early Childhood Education (ECE) corresponded to those required in the field. Through this approach, the findings not only highlighted the degree of relevance between academic competencies and labor market needs but also generated targeted recommendations concerning curriculum content, teaching methodologies, and professional development.

In this section, the research findings are presented progressively, beginning with the context of labor market needs, the availability of resources, the implementation of the learning process, and finally, the outcomes or products reflected in the graduate profiles of the Master's Program in ECE. The subsequent discussion integrates these findings with existing theories, previous studies, and practical implications for the advancement of study programs as well as policy development in early childhood education in Indonesia.

Data Responden

The respondents consisted of alumni of the Master's Program in Early Childhood Education (ECE), Faculty of Education, Yogyakarta State University (FIP UNY), who graduated between 2016 and 2024. Table 1 presents the distribution of respondents based on their year of graduation.

Table 1. Distribution of Alumni Respondents by Graduation Year

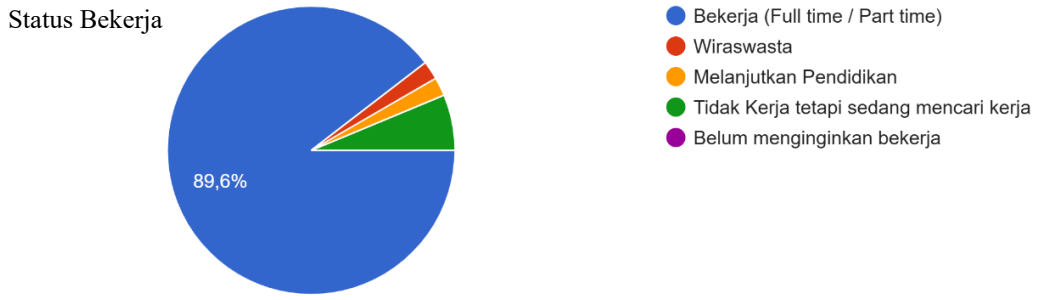


Based on the distribution of respondents across different cohorts, the analysis of the research findings was organized using the Context, Input, Process, and Product (CIPP) evaluation model. This framework provided a systematic approach to examining the relevance of the Master's Program in Early Childhood Education (ECE) to labor market demands. The presentation begins with the Context analysis, which highlights the need for qualified professionals in the field of ECE as reflected in the graduates' waiting period before employment. The subsequent section addresses the Input dimension, focusing on alumni satisfaction with academic services and learning facilities that support the development of graduate competencies. The next section discusses the Process, emphasizing the extent to which the learning experiences provided by the program are aligned with professional practice, particularly the implementation of teaching and the instructional methods employed. Finally, the Product dimension evaluates graduates' learning outcomes and their contributions to improving the quality of ECE institutions, as reflected in user satisfaction with the application of graduates' competencies in the workplace.

Context

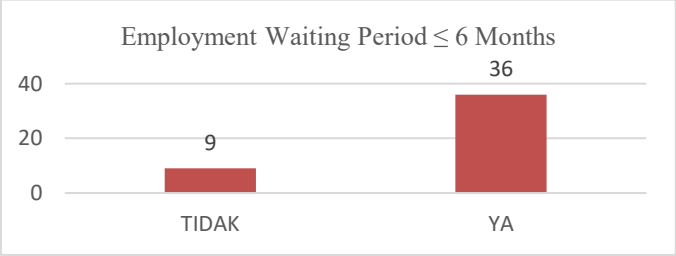
Labor Market Demands for Graduates of the Master's Program in Early Childhood Education (ECE)

The labor market demand for graduates of the Master's Program in Early Childhood Education (ECE) can be categorized as high or very significant at present. This is evidenced by the employment status of graduates from the Master's Program in ECE, Faculty of Education, Yogyakarta State University (FIP UNY), in which 89.6% of respondents reported being employed full-time. Meanwhile, 6.3% of respondents indicated that they were either unemployed or actively seeking employment, and 2.1% reported pursuing further studies or engaging in entrepreneurial activities, as illustrated in the following diagram.

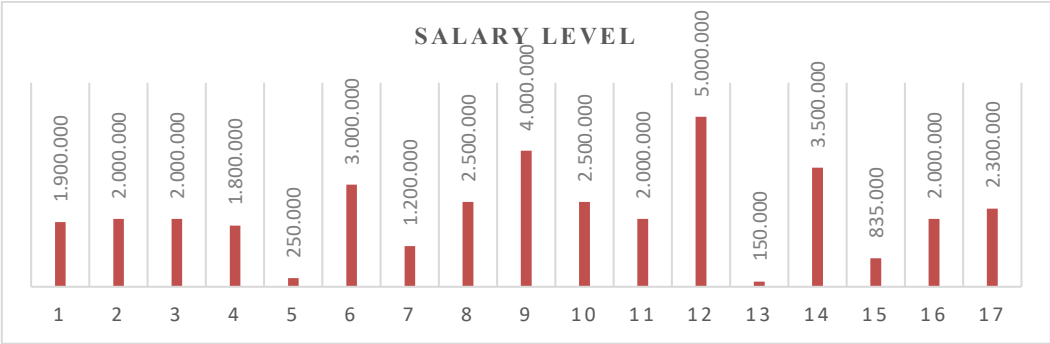


The high rate of full-time employment among graduates indicates that the competencies acquired in the Master's Program in Early Childhood Education are largely relevant to current labor market needs. The relatively small proportion of graduates who are unemployed, seeking employment, or pursuing further studies suggests that the program has been effective in preparing its graduates for professional engagement. This finding also reflects the increasing demand for highly qualified professionals in the field of early childhood education, particularly in managerial, academic, and institutional development roles.

These findings are further supported by data on the employment waiting period of the alumni, which shows that the majority were able to secure employment within six months after graduation, as illustrated in the following diagram.



From the diagram, it can be observed that graduates of the Master's Program in Early Childhood Education (ECE), Faculty of Education, Yogyakarta State University (FIP UNY), were able to secure employment within six months or less, with 36 out of 45 respondents (80%) reporting such a waiting period. Only 9 out of 45 respondents (20%) indicated a waiting period of more than six months. The relatively short waiting period demonstrates the strong absorption capacity of the labor market for graduates of the Master's Program in Early Childhood Education. This suggests that the competencies acquired through the program are not only aligned with professional requirements but also considered valuable and competitive. Such findings reinforce the view that the demand for highly qualified professionals in the early childhood education sector remains substantial, with graduates being able to integrate into the workforce in a relatively short time span. This employment absorption is proportional to the level of income or salary received, as presented in the following diagram.



From the salary distribution diagram, it is shown that 17 respondents reported their income. Based on this data, the average salary of graduates from the Master's Program in Early Childhood Education (ECE), Faculty of Education, Yogyakarta State University (FIP UNY), is IDR 2,172,647. This average income level reflects the relative positioning of Master's graduates in Early Childhood Education within the regional labor market. Although the reported salary may vary depending on institutional type, geographic location, and professional role, the data suggest that graduates are able to achieve a level of income that is generally consistent with

prevailing standards for the education sector in Indonesia. Furthermore, the combination of a relatively short employment waiting period and a competitive average salary underscores the continuing demand for highly qualified professionals in early childhood education.

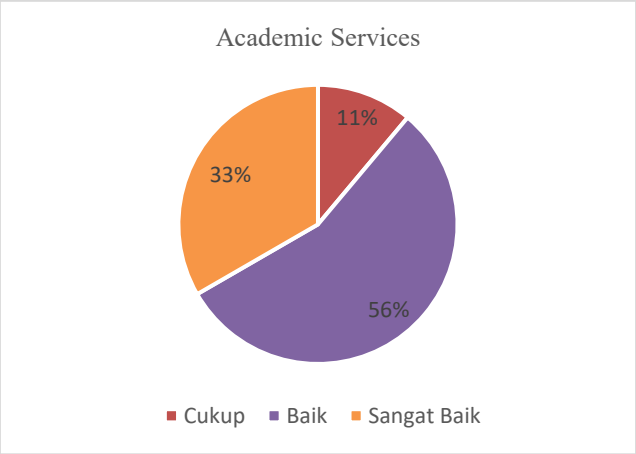
The quantitative findings described above are further supported by qualitative data obtained from in-depth interviews with experts, alumni, and employers. The results highlight two key points: (1) the curriculum of the Master's Program in Early Childhood Education (ECE) demonstrates a considerable degree of relevance to labor market demands, enabling graduates to secure appropriate positions within a relatively short period of time; and (2) graduates possess strong competitiveness and a high level of adaptability, allowing them to meet the needs of educational institutions as well as related sectors effectively.

Input

In the input dimension, alumni perceptions were assessed regarding the quality of educational services and the availability of supporting learning facilities provided by the Master's Program in Early Childhood Education (ECE). The findings indicate that alumni generally expressed a high level of satisfaction with academic services, including lecturer support, administrative assistance, and guidance throughout the learning process. In addition, learning facilities such as libraries, digital resources, and classroom infrastructure were considered adequate in supporting the development of competencies required for professional practice.

Academic Services

Academic services in this context include teaching and supervision provided by faculty members, as well as academic support services delivered by administrative staff and program managers in facilitating students' studies. The corresponding data are presented in the following diagram.

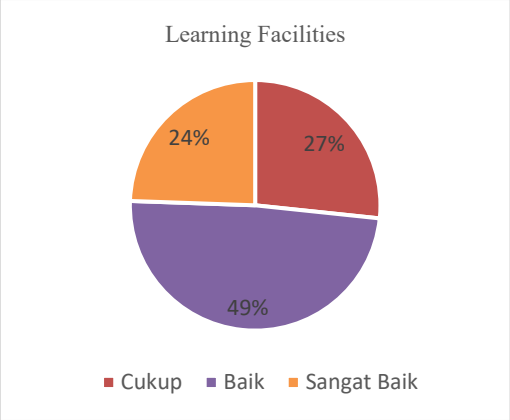


The alumni assessment revealed that the majority of respondents rated the academic services provided by faculty members, administrative staff, and program managers as good (56%), while 33% rated them as very good. This indicates that more than two-thirds of alumni were satisfied with the academic services they received during their studies in the Master's Program in Early Childhood Education (ECE). These findings suggest that the program has been able to deliver academic services at an optimal level, adequately meeting the needs of its students.

Nevertheless, 11% of alumni rated the academic services as merely adequate. This finding indicates that certain aspects of academic services have not fully met student expectations, particularly in areas such as response time, administrative support, or other forms of academic facilitation. Accordingly, these data suggest that while the overall quality of academic services is generally satisfactory, continuous improvement remains necessary. Efforts for enhancement should be directed toward the areas that received only an adequate rating, thereby ensuring that service standards are raised uniformly to the good and very good categories.

Learning Facilities

Learning facilities were assessed in terms of the availability of classrooms, library resources, digital or information technology-based media, and other supporting resources. The results of alumni evaluations regarding learning facilities are presented as follows.



Alumni assessments of learning facilities revealed that the majority of respondents rated them as good (49%), while 27% rated them as adequate, and 24% rated them as very good. This distribution shows that nearly three-quarters of alumni perceived the available facilities as sufficient, both in terms of quantity and quality, thereby supporting the learning process.

However, the 27% who rated the facilities as merely adequate indicate that certain limitations were still experienced by some students. These limitations may relate to the completeness of learning resources, accessibility, or the utilization of supporting technologies. Thus, the findings suggest that although the overall quality of learning facilities in the Master's Program in Early Childhood Education (ECE) can be categorized as relatively good, further improvements and more equitable access are required to ensure that all students can benefit optimally from the facilities provided.

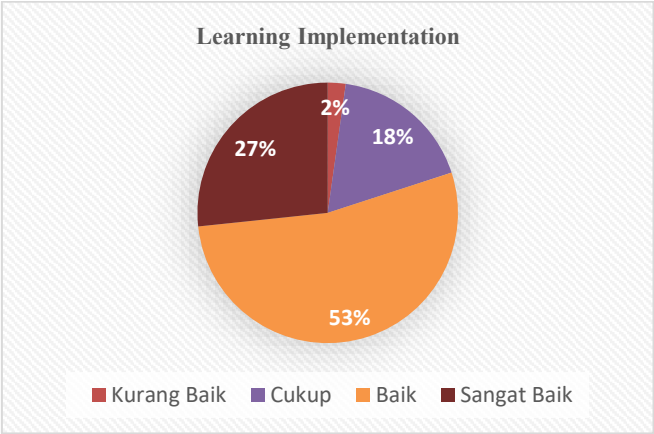
Qualitative feedback regarding learning facilities further emphasized that classroom units were not always proportional to the number of students. This mismatch often resulted in students not having access to representative classroom spaces.

Process

In the process dimension, the focus is placed on examining the implementation of learning activities and the teaching methods applied within the Master's Program in Early Childhood Education (ECE). This aspect is critical, as the extent to which instructional practices align with professional demands directly influences the readiness of graduates to enter the workforce. The evaluation considers not only the organization and delivery of courses but also the pedagogical strategies employed by faculty members to ensure that students acquire both theoretical knowledge and practical competencies relevant to the field of early childhood education.

Learning Implementation

The implementation of learning was assessed based on the learning processes experienced by alumni during their period of study. The detailed results are presented as follows.



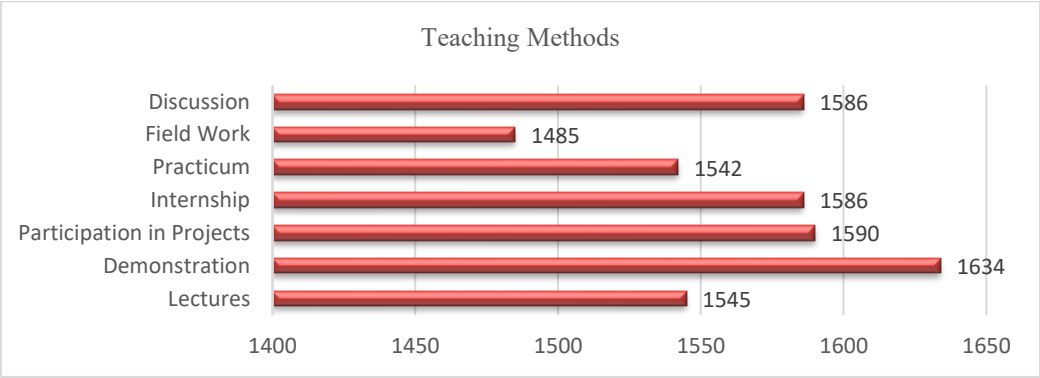
Alumni evaluations of the learning implementation indicate that the majority of respondents rated it as *good* (53%) and *very good* (27%). This means that approximately 80% of alumni were satisfied with the learning process conducted in the Master's Program in Early Childhood Education (ECE), suggesting that the instructional activities were generally effective, well-structured, and aligned with students' needs.

Nevertheless, 18% of alumni rated the learning implementation as *adequate*, and 2% as *poor*. These findings point to certain weaknesses in the execution of learning, such as teaching methods, diversity of instructional strategies, utilization of technology, or the provision of practical field experiences. Therefore, while the overall implementation of learning can be considered satisfactory, improvements are still needed in specific areas that received *adequate* or *poor* ratings. Continuous enhancement efforts—such as increasing faculty competence, innovating teaching methods, and optimizing supporting facilities—are expected to strengthen the quality of learning, potentially shifting the majority of alumni evaluations toward the *very good* category in the future.

Qualitative data further revealed that perceptions of academic regulations should be consistent across all components. Variations in how individual faculty members interpret and implement these regulations have led to differences in teaching standards and assessment practices. Faculty policies are thus influenced by their understanding of academic regulations, highlighting the need for clearer and more uniform guidance to ensure consistency in learning implementation.

Teaching Methods

The courses within the curriculum of the Master's Program in Early Childhood Education (ECE) at FIP UNY are conducted using the following instructional methods. In the Master's Program in Early Childhood Education (ECE), the selection and implementation of teaching methods are designed to enhance both theoretical understanding and practical competencies. The instructional approaches aim to facilitate active learning, critical thinking, and professional skill development, ensuring that graduates are well-prepared to meet the demands of the labor market. These methods are aligned with the program's learning outcomes and are tailored to accommodate diverse learning styles, promote student engagement, and integrate relevant field experiences that reflect real-world professional contexts.



The research findings regarding the various forms of learning experienced by students indicate a relatively balanced distribution across different instructional methods. Learning activities conducted through demonstrations recorded the highest score of 821 (14.90%), followed by participation in projects with a score of 800 (14.52%) and internships at 798 (14.49%). This suggests that students acquire substantial experiential learning through direct practical activities and active involvement in real-world projects and professional contexts.

In addition, discussions scored 796 (14.45%), lectures 775 (14.07%), and practicums 774 (14.05%). These three forms of learning contributed nearly equally, indicating that theoretical instruction and academic interaction in the classroom remain a fundamental component in supporting the achievement of student competencies. Field work, meanwhile, received the lowest score at 745 (13.52%), although the difference compared to other methods was not substantial.

Overall, the data demonstrate that all forms of learning, whether classroom theory, discussions, or field practice, contributed significantly, with a range of approximately 13–15%. This relatively even distribution reflects that the Master's Program curriculum in Early Childhood Education (ECE) is designed to balance theoretical and practical aspects. Furthermore, the greater emphasis on practice-based methods such as demonstrations, projects, and internships underscores the importance of direct experience in preparing students to meet real-world labor market demands.

The finding that teamwork skills ranked highest aligns with the nature of learning, which heavily incorporates field work. From a theoretical perspective, this can be explained through social constructivist approaches (Vygotsky) and experiential learning theory (Kolb). Vygotsky emphasizes that social interaction is a critical medium for knowledge construction; structured field work promotes collaboration and the development of shared professional practices[7], thereby facilitating the internalization of collaborative competencies. Similarly, according to Kolb, concrete experiences such as field work provide the foundation

for a learning cycle encompassing experiencing, reflecting, conceptualizing, and applying[8]. However, for this cycle to be complete and to ensure strong transfer of theoretical knowledge, adequate stages of reflection and discussion are required. Unfortunately, the data indicate that discussions are underutilized in lectures (discussion score = 114), suggesting a potential weakness in reflective and conceptualization processes following experiential activities.

Product

The product dimension in this study refers to the outcomes of the evaluation, specifically focusing on user satisfaction with graduates as reflected in their competencies. In the product dimension, the evaluation emphasizes the outcomes of the Master's Program in Early Childhood Education (ECE), particularly in terms of graduate competencies as perceived by employers, alumni, and other stakeholders. This assessment aims to determine how well the program prepares graduates to meet professional expectations, contribute effectively to educational institutions, and fulfill the requirements of the labor market. By examining user satisfaction with graduates' performance and the application of their competencies, the product evaluation provides critical insights into the effectiveness of the curriculum, teaching methods, and practical learning experiences in producing qualified and competent professionals.

Alumni and Employer Satisfaction

Respondents provided feedback on alumni and employer satisfaction, revealing the strengths and weaknesses of graduates from the Master's Program in Early Childhood Education (ECE), Faculty of Education, Yogyakarta State University (FIP UNY), as outlined below.

The histogram data indicate that the highest-rated competency perceived by employers was the graduates' self-development ability, specifically their willingness to engage in lifelong learning, with a score of 1,108. However, graduates were found to have weaker competencies in foreign language proficiency, particularly in English, and in the ability to work under pressure.

The deficiency in English language skills among graduates carries dual implications. Practically, this limitation restricts graduates' access to international literature, opportunities for publication in reputable journals, and the ability to communicate effectively in cross-national collaborations or professional frameworks requiring academic English literacy. Pedagogically, low foreign language proficiency may be associated with limited practice in English discussions, a scarcity of assignments requiring reading and synthesizing international texts, and insufficient integration of language training across courses. In other words, the learning process (Process) within the CIPP model appears to inadequately support the development of language competencies as part of the expected outcomes (Product).

Overall, the research data can be summarized in the following table.

Component	Indicators	Quantitative Data	Qualitative Data
Context	Labor market demand for Master's graduates in Early Childhood Education (ECE)	- 89.6% of alumni employed full-time- 80% obtained employment within ≤ 6 months. - Average salary: IDR 2,172,647	- The curriculum of the Master's Program in ECE demonstrates considerable relevance to labor market needs, enabling graduates to secure appropriate positions within a relatively short period. - Graduates exhibit strong competitiveness and good adaptability to the needs of

Component	Indicators	Quantitative Data	Qualitative Data
			educational institutions and related sectors.
Input	Academic Services	Majority of students rated academic services provided by faculty, administrative staff, and program managers as good (56%), very good (33%), and adequate (11%)	-
	Learning Facilities	Students rated learning facilities as good (49%), adequate (27%), and very good (24%)	Classroom units are not always proportional to student numbers.
Process	Learning Implementation	Learning implementation was rated good (53%), very good (27%), adequate (18%), and poor (2%)	Perceptions suggest that academic regulations across components should be standardized.
	Teaching Methods	Teaching methods frequently employed by faculty included demonstrations (score 821, 15%) and project participation (score 800), whereas field work was less applied (score 745)	- Student involvement in practical ECE or higher education field activities - Training students to conduct mini research projects leading to scientific articles
Product	Alumni & Employer Satisfaction	Most graduates demonstrated strong lifelong learning/self-development ability (score 1,108). The weakest competency was foreign language proficiency (English), scoring 882	- Limited English proficiency, particularly in basic communication with children in international-standard schools - Graduates show weaknesses in personal branding and professionally representing institutions - Insufficient emotional and social maturity in fulfilling professional educator roles - Limited creativity in creating employment opportunities in ECE, indicating underdeveloped entrepreneurial and innovative skills

The survey results were further corroborated by in-depth interviews with early childhood education (ECE) experts from five major universities offering Master's programs in ECE. These interviews were conducted within the framework of the Indonesian ECE Association (APG). The in-depth interviews resulted in the formulation of Learning Outcomes (LO) and Graduate Learning Achievements (CPL) for the Master's Program in ECE at a national level, which were subsequently ratified through official approval documents. The LOs were defined around two primary roles: as a lecturer/researcher, encompassing graduates who master theoretical knowledge and are capable of advancing science and technology through research or the creation of innovative works in early childhood education; and as a manager, referring to graduates who are capable of developing and implementing service management concepts. These LO formulations constitute the product output of the evaluation, reflecting decisions regarding whether graduate profiles should be maintained, enhanced, improved, or discontinued. UNY's Master's Program in ECE subsequently established a third LO, namely the role of researcher.

The LO framework highlighting the dual roles of researcher/lecturer and manager demonstrates the intention for Master's graduates to possess a dual profile: academic-scientific capacity as well as managerial capability. Theoretically, this dual orientation aligns with the competency-based education (CBE) paradigm, which

emphasizes the linkage between clearly defined outcomes (LO/CPL) and the design of curriculum and measurable assessment strategies. However, the gap between the expected LOs and the observed learning practices indicates disharmony among input (curriculum, resources), process (teaching methods), and product (LO/CPL) within the CIPP framework. In other words, although the labor market context requiring researchers and managers has been identified, some elements of input and process do not fully support the achievement of optimal product outcomes.

From an andragogical perspective (Knowles) and adult learning practice, Master's students as adult learners require problem-centered approaches that are relevant to professional practice and allow autonomy in learning. Therefore, a curriculum that emphasizes field experience alone without strengthening critical discussion, academic reflection, and international literacy risks producing graduates who are proficient in practical skills but deficient in research, publication, and academic communication capabilities—skills essential for knowledge advancement through research and innovation. Overall, the findings underscore the need to reconcile the currently dominant learning practices (field work) with the enhancement of academic discussion, international literacy, and managerial competencies to ensure that the established LOs, both as lecturers/researchers and as service managers, are fully achieved and remain relevant to labor market demands.

CONCLUSION

This study indicates that graduates of the Master's Program in Early Childhood Education (ECE) demonstrate a primary strength in self-development and lifelong learning, yet exhibit weaknesses in English language proficiency and the ability to work under pressure. The graduate profile, formulated through nationally established Learning Outcomes (LO) and Graduate Learning Achievements (CPL), emphasizes two key roles: lecturer/researcher and service manager. At UNY's Master's Program in ECE, an additional LO as researcher is included. However, the achievement of these outcomes is not yet fully supported by the existing curriculum and teaching methods. Therefore, curriculum adjustments that strengthen international literacy, critical discussion, and managerial competencies are essential to ensure that graduates can meet labor market demands while remaining globally competitive.

ACKNOWLEDGMENTS

The author expresses gratitude to the early childhood education (ECE) experts from various universities, the employers of Master's graduates from diverse institutions, and the alumni of UNY's Master's Program in ECE. Appreciation is also extended to Yogyakarta State University (UNY) for funding this research. It is hoped that the findings of this study will contribute to the improvement of the curriculum for the Master's Program in ECE at FIP UNY in the future.

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INNOVATIVE DEEP LEARNING-BASED TEACHER TRAINING: A STRATEGY FOR ENHANCING PEDAGOGICAL COMPETENCE AT LP MA'ARIF NU PWNU D.I. YOGYAKARTA

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Abstract: This community service program (PkM) addressed the persistently low pedagogical competence of teachers, as identified by Indonesia's National Teacher Competency Test (UKG), at LP Ma'arif NU D.I. Yogyakarta. In response to the limitations of conventional training, this study implemented an innovative professional development model grounded in the deep learning approach, utilizing a Participatory Action Research (PAR) framework with 30 teachers. The intervention, delivered in a blended format, integrated interactive workshops, focused group discussions, reflective practice simulations, and online community mentoring. Results demonstrated a significant quantitative improvement in pedagogical competence, with mean scores rising from 68 to 85 ($p < 0.001$). Qualitatively, the program cultivated teachers as reflective practitioners, strengthened collaborative learning communities, and enhanced their ability to design adaptive, student-centered instruction. The findings confirm that the deep learning-based training model is an effective and transformative strategy for sustainable pedagogical enhancement. Consequently, this study recommends the continuous development and institutionalization of this model within LP Ma'arif NU and other educational institutions to strengthen teacher professionalism and foster meaningful learning practices.
Keywords: *Pedagogical Competence, Deep Learning, Teacher Professional Development, Participatory Action Research, Reflective Practice.*

INTRODUCTION

Teachers are a key element in efforts to improve the quality of education. The quality of learning in schools is highly dependent on the teacher's ability to understand learner characteristics, manage the learning process, and create a meaningful learning environment. Law Number 14 of 2005 of the Republic of Indonesia affirms that teachers are professional educators who must possess four core competencies: pedagogical, professional, social, and personal. Among these, pedagogical competence holds a strategic position as it is directly related to the teacher's ability to design, implement, and evaluate an effective learning process (Rahmawati et al., 2022; Yuliana & Lee, 2023).

Although various teacher competency improvement programs have been implemented across Indonesia, recent empirical evidence indicates that teachers' pedagogical competence remains uneven and often fails to reach an optimal standard. For instance, a meta-analysis on teacher quality in the digital era found that determining factors such as technology access, teachers' digital readiness, and school support significantly influence overall teacher competency (Prihono, Retnawati, Lapele, & Waluyo, 2024). On the other hand, a study in elementary schools in Blora reported that teacher learning communities have a positive and significant correlation with the improvement of pedagogical competence, although this factor contributes only approximately 36.4% of the measurable variance; the remainder is influenced by other contextual factors such as facilities, school culture, and teacher workload (Wuryandoko, Maryanto, & Abdullah, 2024).

Furthermore, a study in the context of Madrasah Ibtidaiyah (Islamic elementary schools) in the digital era also found that although teachers possess a basic understanding of technology and instructional design, there is a deficiency in the application of active and innovative pedagogical principles. This is particularly evident in the use of digital media and learning strategies that differentiate according to individual student needs (Nikmah, Dinata, Mujmal, & Yanti, 2023). In the Yogyakarta region, research on improving professionalism through Classroom Action Research (CAR) also indicated that teachers face obstacles in internalizing routine reflective

practice and learning evaluation, resulting in minimal changes to teaching practices despite having received training (Agustinova, Wulansari, & Fitriana, 2024).

These findings confirm that improving the average attainment of pedagogical competence is not merely about conducting training activities. It is also intrinsically linked to aspects of training quality, sustained support, contextual relevance, and opportunities for teachers to practice, evaluate, and collaborate professionally. This situation creates an opportunity for a new approach that is not only informative but also transformational; one that not only enhances teachers' knowledge but also tangibly and sustainably transforms their teaching practices.

One of the causes of low pedagogical competence is the dominance of a content-delivery oriented learning paradigm (surface learning), which is heavily influenced by assessment pressures and curriculum policies. When assessment becomes the central focus, both teachers and students tend to adopt "safe" learning strategies, such as memorization and repetitive drills. Consequently, curriculum coverage is prioritized over deep, reflective, and contextual understanding. A study by Fischer (2024) indicates that dominant summative assessment systems trigger more surface-level student learning activities, as students focus on final scores rather than genuine learning processes. This aligns with findings that curriculum design and the learning environment—particularly when they are assessment-driven—significantly influence the adoption of deep learning approaches by both learners and educators (Fawzia et al., 2024).

Practical barriers further confirm that teachers often struggle to translate the concept of deep learning into tangible instructional designs. Constraints such as limited time for lesson preparation, administrative burdens, a lack of pedagogical resources, and technological readiness frequently pose significant obstacles. Furthermore, sustained support systems like coaching, post-training mentoring, and a collaborative school culture are often inadequate, leading to a slow transition in teaching practices from surface to deep learning. A meta-analysis on online teacher professional development revealed that while online interventions have a moderate effect on teacher outcomes and classroom practices, the effect on students is lower when ongoing support is minimal (Zhang et al., 2025). Similarly, a recent study on teachers' digital learning design states that digital training that is modular, decontextualized, or lacks follow-up coaching tends to have a minimal impact on changing teaching practices (Lindvall, Kirsten, Ryve, & Gustafsson, 2025).

International research affirms the importance of strengthening pedagogical competence through reflective and experience-based learning. This approach has been proven to enhance teachers' professional awareness, strengthen their metacognitive abilities, and foster pedagogical creativity in designing meaningful learning experiences (Marton & Säljö, 2021; Phan et al., 2022). Reflective learning also forms the foundation for teachers to develop higher-order thinking skills and adapt to learners' needs (Rahayu et al., 2023; Wu et al., 2024). In particular, recent studies highlight that the success of pedagogical transformation depends on the teacher's capacity to internalize deep learning practices, which require a balanced engagement of emotional, social, and cognitive dimensions (Fawzia et al., 2024; Fischer, 2024). Therefore, strengthening pedagogical competence cannot be achieved through technical training alone; it must be contextualized within the dynamics of professional reflection and peer collaboration in the teacher's work environment.

This context underscores the urgency of the present study, which focuses on developing teacher pedagogical competence through a deep and reflective learning approach, contextually designed within the Indonesian educational ecosystem. This study offers novelty by integrating deep learning principles into an experience-based professional learning design for teacher training. This model aims not only to enhance pedagogical knowledge but also to foster sustainable changes in teachers' mindsets and professional practices. This approach is expected to yield a dual impact: (1) the enhancement of teachers' reflective capacity in managing student-centered learning processes, and (2) the strengthening of a collaborative learning culture in elementary schools as a manifestation of the transformation towards more humanistic and meaningful learning-oriented practices. Consequently, the findings of this study are expected to provide a theoretical contribution to the development of a teacher training model based on deep reflective learning, as well as practical implications for policies on enhancing teacher professionalism in Indonesia (Zhang et al., 2025; Lindvall et al., 2025; Rahmawati & Hasanah, 2024).

RESEARCH METHOD

This study employed a Participatory Action Research (PAR) approach that emphasizes collaboration among researchers, lecturers, and elementary school teachers in identifying problems, designing interventions, conducting training, and reflecting on outcomes collectively. This approach was chosen because it aligns with the study's objective of enhancing teachers' pedagogical competence through contextual and sustainable engagement in the learning process (Kemmis, McTaggart, & Nixon, 2014; Stringer, 2021). The research was conducted within the Ma'arif NU Educational Institution, Yogyakarta Province, involving 30 senior high school teachers as participants. The training was implemented in a blended learning format, combining face-to-face sessions and interactions. Each session focused on deepening teachers' understanding of deep learning principles and their practical applications in classroom pedagogy.

Research Phases

The research process consisted of several key phases:

1. Preliminary Diagnosis, to identify the current state of teachers' pedagogical competence and contextual challenges in teaching practice.
2. Action Planning, to design an adaptive training program on deep learning aligned with participants' needs.
3. Action Implementation, involving workshops, focus group discussions (FGDs), lesson plan design, teaching simulations, and reflection activities.
4. Evaluation and Reflection, to assess the extent to which the training contributed to improvements in teachers' understanding, skills, and professional attitudes.
5. Data Analysis and Verification, following the qualitative analysis model of Miles, Huberman, and Saldaña (2018), which includes data reduction, data display, and conclusion drawing, validated through triangulation and member checking

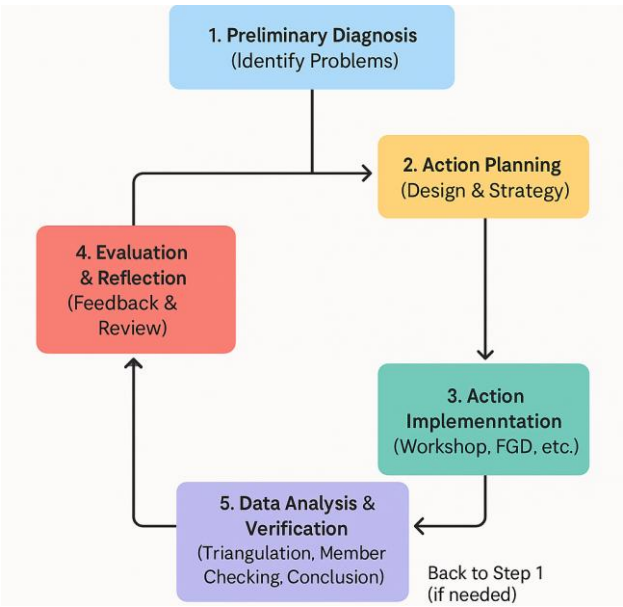

Fig 1. Research phases in participatory action research

A detailed overview of the research process, main activities, data types, and data sources is presented in Table 1

Table 1. Research Phases, Activities, Data Types, and Data Sources

Research Phase	Main Activities	Data Collected	Data Sources
1. Preliminary Diagnosis	- Classroom observations of teaching practices.- Interviews with teachers and principals to identify pedagogical challenges and learning constraints.	Qualitative descriptions of teachers' pedagogical competence and teaching patterns.	Teachers, principals, lesson plans, school documents.
2. Action Planning	- Development of *deep learning*-based training modules.- Preparation of observation sheets, reflection guides, and evaluation instruments.	Training module drafts and evaluation instruments.	Research team, pedagogical experts.
3. Action Implementation	- Conducting interactive training sessions on pedagogical competence.- FGDs on problem analysis.- Lesson planning and teaching practice.- Individual and group reflection.- Establishment of an online learning community.	Observation notes, discussion transcripts, lesson plan outputs, teachers' reflection logs, online forum interactions.	Teachers, facilitators, research team.
4. Evaluation and Reflection	- Formative and summative evaluations.- Follow-up interviews assessing changes in perception and practice.	Evaluation data, post-training interviews, teachers' reflection reports.	Teachers, principals, research team.
5. Data Analysis and Verification	- Qualitative analysis (Miles, Huberman & Saldaña, 2018).- Source and method triangulation.- *Member checking* for data validation.	Verified data displays and summaries.	Field data, interviews, teachers' reflections.

This research process, therefore, yielded both empirical evidence on the improvement of teachers' pedagogical competence and the reflective participant engagement central to participatory action research.

Instruments and Data Collection Techniques

Data were collected through classroom observations, in-depth interviews, documentation analysis, and participants' reflective journals. The primary instruments included observation checklists, interview guides, and reflection templates. In addition, learning analytics from Google Classroom were utilized to monitor teachers' engagement in online learning activities (Garrison, 2020; Siemens, 2021).

Data Analysis and Validation

Data were analyzed qualitatively through three interconnected steps: data reduction, data display, and conclusion drawing (Miles, Huberman, & Saldaña, 2018). Triangulation was performed across data sources (teachers, principals, facilitators) and data collection methods (observation, interview, reflection). Validation was further strengthened through member checking and collaborative reflection sessions with participants to ensure interpretive accuracy (Lincoln & Guba, 2020; Creswell & Poth, 2023).

Student Involvement and Credit Recognition

University students participated as training assistants, learning community facilitators, and field data collectors. Their active engagement was formally recognized through academic credit equivalence (credit transfer) in the following ways:

1. Fulfillment of requirements for Community Service Program (KKN) or Field Practice;
2. Recognition of academic contribution by the study program;
3. Issuance of Community Service Certificates by the university.

This integration of students into the research not only enriched the implementation process but also strengthened the Tri Dharma of Higher Education — the synergy of education, research, and community engagement.

Conclusion of the Research Method

Through its collaborative nature, this study did not merely enhance teachers' pedagogical competence empirically but also fostered reflective awareness and a deep-learning culture among educators. The integration of deep learning within teacher professional development offers an innovative, replicable model that can be applied across educational institutions in Indonesia to promote more meaningful, contextual, and sustainable learning practices.

FINDING AND RESULT

Quantitative Findings: Enhancing Teachers' Pedagogical Competence

The training program involving 30 secondary school teachers (SMA/SMK) under LP Ma'arif NU D.I. Yogyakarta demonstrated a substantial improvement in pedagogical competence. Using a pretest–posttest design, the average score of teachers' pedagogical competence increased from 68 (SD = 6.3) before the training to 85 (SD = 4.8) afterward. A paired-samples t-test revealed a significant improvement ($t = 9.41$, $p < 0.001$), indicating that the training based on a deep learning approach effectively enhanced teachers' conceptual and practical understanding of pedagogical principles. Approximately 90% of participants (27 out of 30) showed individual score increases of more than 10 points.

The quantitative data also indicated notable improvements in three sub-domains of pedagogical competence: (1) lesson design and planning (mean gain = 17.5 points), (2) classroom engagement and management (mean gain = 15.2 points), and (3) evaluation and reflective practice (mean gain = 13.6 points). These findings align with previous international studies showing that structured professional development emphasizing deep learning strategies significantly improves teachers' cognitive engagement and adaptive expertise (Biggs & Tang, 2020; Phan et al., 2022; Wu et al., 2024).

The effect size (Cohen's d = 1.72) indicated a large educational impact, meaning that the change was not only statistically significant but also practically meaningful. Teachers reported being more capable of connecting pedagogical theory with classroom practice, using student-centered strategies, and fostering critical and creative thinking among students. Similar patterns were found in studies by Lee & Kim (2023) and Marton & Säljö (2021), which emphasized that deep learning-oriented training strengthens teachers' metacognitive awareness and reflective capacity in curriculum enactment.

Qualitative Findings: Insights from Teachers' Reflections and Observations

The qualitative findings were derived from reflective journals, focus group discussions (FGD), and classroom observations conducted throughout and after the training. Four key themes emerged from thematic analysis. Teachers reported that the deep learning approach encouraged them to become more reflective practitioners. They learned to critically evaluate their teaching methods, assess student engagement, and modify their instructional design based on evidence from classroom interactions. This mirrors findings from Trigwell

(2021) and Rahayu et al. (2023), which indicate that reflective cycles strengthen teachers' pedagogical reasoning and professional growth. Participants also expressed that reflection helped them shift from a teacher-centered mindset toward a student-centered paradigm, aligning with 21st-century education goals.

The creation of peer-learning communities was another major outcome. Teachers formed online groups via WhatsApp and Google Classroom to share lesson plans, videos, and reflective notes. This network sustained post-training collaboration and fostered a culture of continuous learning, as suggested by Kim & Choi (2021) and Wu et al. (2024). Teachers also developed joint classroom projects, which led to cross-school collaboration—an innovation rarely seen in traditional professional development programs. Participants demonstrated increased adaptability in responding to diverse student needs. They began applying differentiated instruction and formative assessments aligned with the deep learning model. This adaptability echoes findings by O'Connor & Day (2022), who emphasized that adaptive pedagogy enables teachers to manage complex classroom dynamics and improve learner engagement. Teachers also expressed greater confidence in modifying learning activities to emphasize inquiry, problem-solving, and reflective questioning.

Another key theme was the integration of digital technology to support deep learning. Teachers utilized online platforms, such as Google Classroom and Padlet, to facilitate reflection and student discussion. They produced micro-learning videos and podcasts that encouraged students to learn collaboratively beyond classroom boundaries. This demonstrates the synergy between digital pedagogy and deep learning principles (Setiawan et al., 2022; Li & Wang, 2023). Moreover, teachers acknowledged that digital tools improved classroom inclusivity by enabling more personalized feedback and learning pathways.

The findings demonstrate that applying a deep learning approach in teacher training leads to a transformative shift in teachers' pedagogical orientation—from procedural teaching toward reflective, inquiry-based, and adaptive pedagogy. This transformation supports the theoretical foundation of Biggs and Tang's (2020) Constructive Alignment Model, which emphasizes coherence between intended learning outcomes, teaching activities, and assessment strategies.

In this study, teachers not only enhanced their understanding of pedagogical theories but also internalized them into classroom practice through cycles of reflection, collaboration, and experimentation. This finding resonates with Marton & Säljö's (2021) conception of deep versus surface approaches to learning, wherein learning is not mere knowledge acquisition but a process of meaning-making and conceptual change. Moreover, the observed improvement in teachers' pedagogical competence supports Phan et al.'s (2022) argument that deep learning-based professional development nurtures cognitive engagement, intrinsic motivation, and reflective judgment among teachers. Teachers' engagement in reflective dialogues during FGD mirrored what Darling-Hammond et al. (2023) describe as transformative professional learning, which emphasizes contextual, collaborative, and inquiry-driven development.

The digital integration theme reinforces the ongoing relevance of technological pedagogical content knowledge (TPACK) frameworks (Mishra & Koehler, 2020; Li & Wang, 2023). Teachers became capable of using digital tools not as content delivery media but as instruments for cultivating critical thinking and collaboration—hallmarks of deep learning. Importantly, the collaborative communities established during the training illustrate social constructivist learning in action. Teachers co-constructed pedagogical knowledge through dialogue and shared experiences, consistent with Vygotskian perspectives and recent empirical work by Rahayu et al. (2023) on Indonesian teacher learning networks.

This study underscores several implications for teacher education policy and practice. Embedding deep learning cycles—reflection, collaboration, experimentation—into professional development can promote long-term growth. Rather than one-off workshops, training should be iterative and contextually grounded (Phan et al., 2022; Lee & Kim, 2023). The use of online platforms for reflection and collaboration proved effective in extending learning beyond the training period. This supports the concept of blended professional learning environments (Wu et al., 2024), enabling teachers to continuously engage in peer feedback and content co-creation.

Schools under LP Ma'arif NU are encouraged to institutionalize reflective practices through learning communities, mentoring systems, and innovation-driven performance evaluations. Such institutional structures are essential for sustaining pedagogical transformation (Rahayu et al., 2023). Although this study focused on teacher competence, future research should examine how these pedagogical improvements affect student learning outcomes. International evidence suggests that teacher deep learning correlates with higher-order student thinking and achievement (Biggs & Tang, 2020; Darling-Hammond et al., 2023). The Ma'arif NU context highlights how local values—collaboration, humility, and continuous reflection—can be synergized with global deep learning frameworks, creating culturally responsive professional development models (Setiawan et al., 2022).

CONCLUSION AND RECOMMENDATION

The results of this study demonstrate that the implementation of a professional development program grounded in the deep learning approach effectively enhanced the pedagogical competence of secondary and vocational school teachers. Through a cyclic process of orientation, reflection, practice, and evaluation, teachers

not only increased their understanding of pedagogical principles but also transformed their instructional practices into more reflective, student-centered, and inquiry-based forms.

The improvement in the Pedagogical Competence Index (PCI)—rising from 65.8 in the baseline phase to 82.4 in the final reflection—suggests a significant cognitive and behavioral shift. This shift was further supported by qualitative data drawn from teachers' reflective journals and focus group discussions, which highlighted key areas of professional growth. Teachers reported higher confidence in designing differentiated instruction, better understanding of learner diversity, and greater motivation to integrate reflective practices into their daily teaching.

Furthermore, the inclusion of both online and offline mentoring sessions created a flexible learning environment that accommodated teachers' schedules and technological readiness. The blended format, combined with the use of digital platforms such as Google Classroom and Zoom, fostered sustained interaction between participants and facilitators, leading to deeper professional engagement. The findings underscore that technology-mediated reflection can function as a sustainable model for continuing professional development in the post-pandemic educational context.

Another significant finding is the formation of teacher learning communities as a follow-up initiative. These online communities served as collaborative spaces for teachers to share teaching materials, discuss classroom challenges, and co-create digital learning content. Such initiatives strengthened the long-term impact of the training and established a peer-based support system that encouraged continuous learning beyond the formal program.

From an institutional perspective, the study also revealed that school leaders play a critical role in sustaining pedagogical improvement. Schools that provided administrative support and policy recognition—such as allocating time for professional reflection and recognizing innovative teaching practices—exhibited greater continuity in applying deep learning principles. Hence, leadership involvement is vital for embedding the outcomes of this training into the broader culture of instructional practice.

Recommendations

Based on the findings, several recommendations can be proposed. First, professional development programs should adopt a cyclic reflective model that continuously integrates observation, feedback, and reflection rather than being a one-time intervention. This model ensures that teachers internalize pedagogical principles through iterative practice. Second, teacher training institutions and educational policymakers should promote the use of blended learning formats that combine face-to-face mentoring with digital platforms. This hybrid approach can expand accessibility while maintaining the quality of guidance and interaction.

Third, the establishment of professional learning communities (PLCs) should be encouraged at the school and regional levels. These communities can serve as sustainable ecosystems for pedagogical innovation and knowledge exchange among teachers. Fourth, future research should explore longitudinal impacts of the deep learning approach on students' outcomes, particularly in terms of critical thinking, creativity, and problem-solving. Lastly, universities should continue involving students and pre-service teachers in community engagement programs such as this, not only as observers but as co-facilitators, to bridge theoretical knowledge with real educational practice. This integration strengthens both academic and social contributions, aligning higher education with national goals for teacher quality improvement.

In summary, the deep learning-based training model has proven to be both pedagogically transformative and contextually adaptable. It reinforces the idea that teacher learning, when supported by reflection, collaboration, and technology, becomes a lifelong and self-sustaining process—one that is essential for nurturing high-quality, future-ready education.

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ANALYSIS LEARNING INTERACTIVE SIGASER (SIMAK, GAMBARKAN, AND GESER) FOR ABILITY SIMPLE DRAWING OF A KINDERGARTEN TEACHER

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Abstract. The purpose of this study was to determine the analysis of the use of SIGASER Interactive learning (Simak, Gambarkan, dan Geser). The study was based on the problem where kindergarten teachers still have difficulty drawing simple drawings. The subjects of this study were kindergarten teachers in the Yogyakarta City area. The number of subjects involved was 28 kindergarten teachers. The research method used was a quasi-experimental, to measure the success of the use of SIGASER Interactive learning. The data collection technique was through direct observation of how kindergarten teachers draw and are shown the results of their drawings. The assessment aspects of this drawing work are the shape of the drawing object and the composition of the drawing object created. Data analysis was carried out using a t-test to see the pretest and posttest scores. The results of this study showed that the pre-test results showed that 7 kindergarten teachers had already drawn simple drawings, while 93% still had difficulty drawing simple drawings. The post-test results showed a significant increase in the simple drawing skills of kindergarten teachers after the implementation of SIGASER interactive learning. Most teachers, namely 94% of teachers, were able to draw simple drawings. These results indicate that SIGASER (Simak, Gambarkan, dan Geser) learning can improve simple drawing skills for kindergarten teachers. This study has limitations in that it was only tested on kindergarten teachers in Yogyakarta, so it does not represent the simple drawing skills of kindergarten teachers as a whole.

Keyword: SIGASER, drawing, early childhood teachers, kindergarten

INTRODUCTION

Skills draw simple for garden teachers Kindergarten is one of them competence professionals who should be mastered . This is also in line with with Teachers and Lecturers Law , that every teacher must own competencies including pedagogy [1], [2] , professional , social , and personality . Kindergarten teachers who have skills draw with okay then will affect the quality classroom learning [3], [4] . Activities drawing in kindergarten no aim For produce artist small , will but For understand object through visual [5], [6], [7], [8] . That is , drawing as one of the media or means learning . Concept This called with *education through art* , which was introduced by Herbert Read [9] . Skills draw simple good kindergarten teacher , has benefits on quality learning and practicing learning draw [10]. This is make child more easy understand , so that child can easy be creative work image . In addition , it has impact to aspect development child his students [11]–[13]. When learning draw implemented in class , the teacher stimulates child visual [14]–[16], helps development cognitive [17]–[19], fine motor skills [20], creativity [21], [22], and means expression child [23]–[25]. Competence good professional owned by kindergarten teachers, has an impact stimulated aspect development child .

However , there are kindergarten teachers who have limitations ability draw simple . Observation results regarding kindergarten teachers in DI Yogyakarta, there were 35 out of 52 kindergarten teachers who experienced difficulty draw simple . Indicator problem the seen 18 kindergarten teachers more choose imitate (copy). Object the image created is still not clear there are 17 kindergarten teachers, because minimal detail of the objects created . Kindergarten teachers who have Can form A object picture totaling 17. Causes problem This that is Lots PG-PAUD graduates who do not get portion Enough in learning art appearance children. Implementation learning draw only drawing and coloring, not yet existence modification like shifted. Limitations This impact on less optimally visual stimulation for children in class.

Solution to the above limitations that is development learning interactive SIGASER (Listen, Draw and Slide) based digital animation for increase skills drawing on kindergarten teachers. The resulting drawings from SIGASER later can be slid the object use thread , so that cause impression move . Suppose object frog , later object the when shifted cause effect jumping . This digital animation , functions help understand skills and knowledge base draw [26]–[28].

Kindergarten teachers do not must produce realistic images like graduate of bachelor art appearance , but at least produce work picture simple . Simple image the covering aspect object visible image its shape , and the details of the object the image that becomes characteristics object The solution to the limitations this , based on studies literature related [29]–[31]and analysis needs that are carried out with kindergarten teachers. Most kindergarten teachers expect work the image created modified 2D shape , can be moved or moved .

Study This aim For analyze learning interactive SIGASER (Listen, Draw and Slide) based digital animation against skills drawing on kindergarten teachers. The hope is that teachers can be creative together child his students , played together good indoors or outdoor [32] , means education character [33], as well as can made into as a learning medium interactive . Research results This support achievement of Asta Cita, as well as prepare generation towards Golden Indonesia 2045.

RESEARCH METHOD

Development in research learning interactive SIGASER (Listen, Draw , and Slide) based this digital animation use quasi- experimental design with pretest and posttest. Subject study shared become group experiments , which get learning with the SIGASER model, and groups control (learning conventional). Data analysis was carried out with t-test for see pretest and posttest scores , as well compare results between group experiments and controls . If the results show significant difference ($p < 0.05$) and more of 80% of children reach category Good or very good , then the learning model based on AGAR stated effective in increase visual intelligence of kindergarten children .

Subject study This is a kindergarten teacher in the Yogyakarta area, with involving 28 kindergarten teachers in Yogyakarta City. Subject study This spread , things This For guard objectivity results research . Research This carried out from September to October 2025. This data collection technique aim obtain appropriate data with objective research, researchers do technique data collection including questionnaires and observations or evaluation work picture .

Effectiveness test learning interactive SIGASER based digital animation is done with use design *pretest–posttest* on one group without control [34] . Data obtained from results evaluation skills drawing of kindergarten teacher before and after treatment , then analyzed using sample t-test paired (*Paired Sample t-test*) for see significant difference in a way statistics . The model is stated effective if there is difference significant score ($p< 0.05$) between results *pretest* and *posttest* , accompanied average yield increase skills draw simple for kindergarten teachers more from 80% of the criteria Good .

Instrument study development learning interactive SIGASER (Simak, Gambarkan, dan Geser) based digital animation that has been described above. Validation results analyzed use formula index validity grains Aiken , with index agreement the rater is 0.80 [35]. Item instruments that get values below 0.80 are declared invalid, whereas grains instrument with mark more from 0.80 is declared valid and ready used .

Reliability test to instrument questionnaire in study development learning interactive SIGASER (Simak, Gambarkan, dan Geser) based digital animation is done For know internal consistency of items statement use Cronbach's Alpha formula . Instrument tested to 28 kindergarten teachers and analyzed use Cronbach's Alpha assistance, with criteria reliability that is Cronbach's Alpha value ≥ 0.70. Instruments that meet the requirements criteria the stated reliable and worthy used in research data collection.

RESULTS AND DISCUSSION

Result

Based on results of the trials conducted against 28 garden teachers children in the Yogyakarta area, obtained improvement score skills draw simple after using a learning model interactive SIGASER (Simak, Gambarkan, dan Geser).

Based on category evaluation skills drawing, before treatment part most teachers are in the category enough and less, whereas after done treatment the results of the teacher trial reached category good and

very good. Trial results show existence significant difference ($p < 0.05$) between pretest and posttest results, so that the learning model interactive SIGASER stated effective increase skills draw simple to kindergarten teachers.

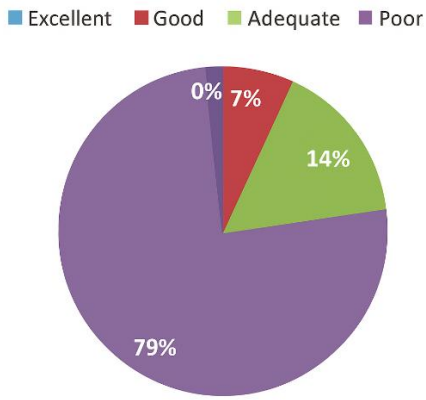

Figure 1. Test Results

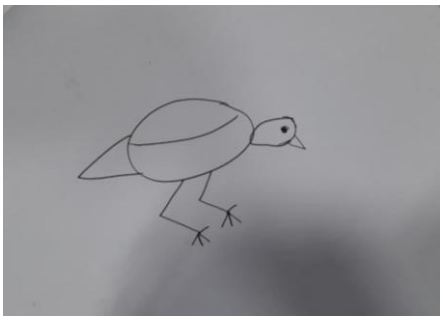

Figure 2. Test Work

Based on results *pretest* above, it can be seen that ability draw simple garden teacher children are still classified as low before given *learning* treatment interactive SIGASER (Listen, Draw and Slide). Most teachers, namely by 79%, is in the category less, which shows that majority participant Not yet capable produce picture with clear shape and details of the object. While that, 14% of teachers are included in category enough, which means they Already can draw with form visible base but still limited in matter proportion and creativity. Only 7% of teachers entered category good, and not There is none (0%) achieved very good category. This data show that skills draw simple kindergarten teacher before done treatment *(treatment)* is still not optimal. Condition the strengthen need will innovation learning, where the SIGASER model is expected capable become solution For increase ability drawing teachers through approach interactive.

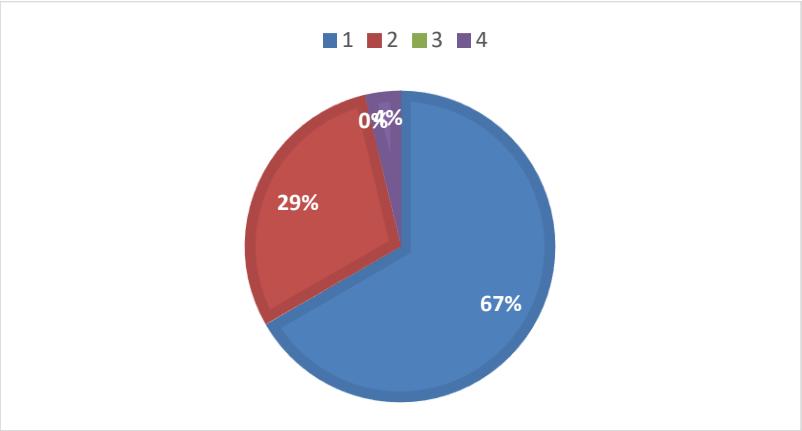

Figure 3. Post-Test Results

Based on results *post-test* above, it can be seen existence improvement significant in skills draw simple garden teacher children after its implementation learning interactive SIGASER (Simak, Gambarkan, dan Geser). Most teachers, namely 67%, are in the very good category, indicating that majority participant Already capable draw with proportion , detail, and clear visual expression. As many as 29% of teachers are in the category good , signifies that they has control basics draw simple with Enough good and capable develop creativity in work they. Meanwhile that, only 4% of teachers are in the category enough , and not there are teachers who are included in category not enough.

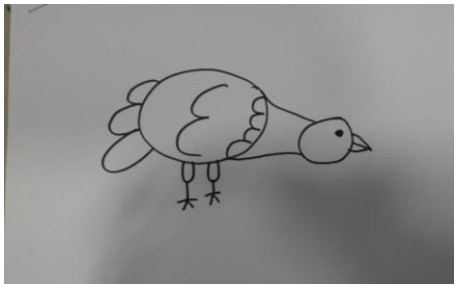

Figure 4. Post- Test Work

This result show that after follow SIGASER learning (Simak, Gambarkan, dan Geser), ability drawing of a kindergarten teacher experiencing real improvement compared to with condition beginning *(pre-test).* Implementation of the SIGASER model which emphasizes activities listening, describing, and moving object picture proven effective in help teachers understand structure shape, proportion, and stimulate visual creativity. Thus, it can concluded that learning interactive SIGASER influential positive and significant to improvement skills draw simple to the garden teacher children.

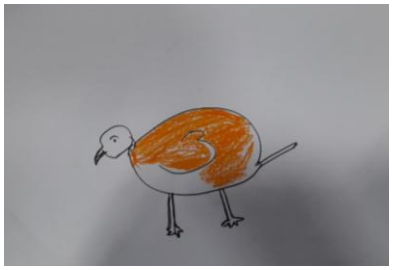

Figure 5. Pre-Test Work

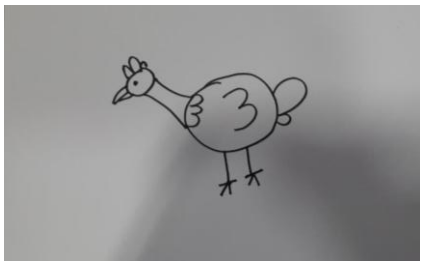

Figure 6. Post-Test Work

Although results study stated increase study this still has necessary limitations noticed that is amount subject study This only limited to 28 garden teachers children in the Yogyakarta area. Therefore, That researchers furthermore expected can expand coverage study with involving garden teachers children from various areas throughout Indonesia.

Discussion

The results of the study showed that the interactive learning model SIGASER (Simak, Gambarkan, dan Geser) significantly improved the simple drawing skills of kindergarten teachers in Yogyakarta. Before the treatment was given, most teachers were in the poor (79%) and sufficient (14%) categories, while after the treatment the majority improved to the good (29%) and very good (67%) categories. This improvement indicates that the SIGASER model is effective in helping teachers understand shape, proportion, and visual expression in a more focused manner. This finding is in line with the opinion of [6]who emphasized that learning to draw is effective in developing children's visual intelligence, and thus, also influences the improvement of teachers' visual competence as the main facilitators of art activities.

The implementation of SIGASER, which emphasizes listening, drawing, and moving objects, can create an active and reflective learning experience for teachers. Through this process, teachers not only imitate visual forms but also develop an understanding of the structure and meaning of the resulting images.

This aligns with the theory of [7], which states that drawing activities can be a means of conceptual learning and self-exploration, as well as the findings of [4], which emphasize that drawing activities encourage both children and teachers to construct scientific knowledge through visual representations. Thus, SIGASER serves as a model that integrates cognitive, motor, and creative aspects in one integrated learning experience.

Improving teachers' drawing skills also reflects the importance of arts-based learning approaches and interactive technology in early childhood education. The SIGASER model, which uses animation media and digital object shifting, has been shown to stimulate creativity and enhance teachers' visual skills. This aligns with [2] theory that integrating digital technology into art activities can enrich teachers' pedagogical strategies and support visual storytelling. Furthermore, [36] emphasized through their Animation-Based Drawing in Kindergarten project that animation technology can foster children's understanding of form and visual imagination, making this approach relevant for teacher training.

Theoretically, the results of this study reinforce the view that arts education for kindergarten teachers has a significant contribution to the quality of creative learning in early childhood. According to [16], teachers who possess visual arts competencies are better able to create expressive, imaginative, and meaningful learning environments. In this context, SIGASER not only improves drawing skills but also shapes teachers' visual and reflective thinking towards the learning process. However, this study has limitations in the number of subjects (28 teachers in the Yogyakarta area), so further research is recommended to involve more participants from various regions so that the results can be generalized more widely.

This study has several limitations, including the fact that it was only conducted with kindergarten teachers in the Yogyakarta region, with a limited number of participants of 28. This condition means that the results of the study cannot represent the simple drawing skills of kindergarten teachers as a whole in Indonesia. Furthermore, this study did not explore in depth other factors that may influence the effectiveness of the SIGASER model, such as teachers' art education background, teaching experience, and the availability of technological facilities. Therefore, the recommended follow-up plan (RTL) is to conduct research with a wider sample coverage from various regions, and to develop a digital version of SIGASER based on an online platform for greater national accessibility. Future researchers can also examine the long-term impact of SIGASER implementation on children's creativity and teachers' pedagogical competence, so that this model can be continuously refined as a sustainable art learning innovation.

CONCLUSION

Based on the results of research conducted on 28 kindergarten teachers in the Yogyakarta region, it can be concluded that the interactive learning model SIGASER (Listen, Draw, and Slide) has proven effective in improving simple drawing skills of kindergarten teachers. Before the treatment was given, most teachers still had difficulty in drawing objects proportionally and in detail. However, after the implementation of SIGASER, the teachers' abilities improved significantly, with most participants achieving good and very good categories. This improvement shows that SIGASER is able to help teachers understand the structure of form, composition, and foster visual creativity through an interactive approach based on listening, drawing, and sliding drawing objects.

This learning provides an important contribution to the development of the arts competencies of kindergarten teachers as the primary facilitators of creative learning in early childhood. However, this study has limitations because it was only conducted on a limited scope, namely kindergarten teachers in the Yogyakarta region. Therefore, further research is needed, involving more participants from various regions and developing a digital version of SIGASER for wider application. Thus, SIGASER has the potential to become an adaptive, interactive, and sustainable arts learning innovation in improving the visual and pedagogical skills of early childhood teachers in Indonesia.

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Training and Revitalization of Trellis Product Manufacturing Tools at Karang Taruna in Serut Kulon Progo Hamlet for Entrepreneurship Initiation

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Abstract. Economic growth in Indonesia has increased the needs of the community, including the need for employment. One way to meet these needs is through economic activities based on local business potential and opportunities through the Serut Hamlet youth organization, as the UNY Golden Village, which has business potential based on the workshop industry, particularly the manufacture of trellises. However, the development of this business faces several obstacles, such as a lack of technical skills, minimal understanding of production, limited tools, and a lack of entrepreneurial insight. To overcome these problems, training and revitalization of production tools are needed to increase the capacity of the Karang Taruna youth.

The training and revitalization stage for trellis manufacturing tools includes: a) Theory for understanding entrepreneurship, materials, and work safety, b) Practical demonstrations of trellis manufacturing and hands-on training, c) Production – independent trellis manufacturing with guidance and marketing strategies, and d) Evaluation – assessment of results, certification, and business assistance.

The results of the community service program show that the training has comprehensively achieved its expected objectives. Participants not only acquired technical skills (hard skills) in trellis fabrication, but also a basic understanding of entrepreneurship (soft skills). With the handover of welding machines and supporting equipment, it is hoped that this will spark a new spirit of entrepreneurship among young people and make Karang Taruna Dusun Serut an independent and sustainable trellis production center, thereby contributing to the village economy.

Keywords: Training, equipment revitalization, railings, entrepreneurship, youth organization

INTRODUCTION

Economic growth in Indonesia has led to an increase in the needs of the community. These needs can be met by providing employment opportunities that are able to absorb the entire workforce. Efforts to improve the standard of living of the community can be carried out through economic activities [1]. Economic activities are carried out in order to meet the needs of the community so that they can prosper. In carrying out economic activities, the community must have the ability to be observant in seeing their potential and be able to identify the environment, be able to find opportunities and open opportunities for business for the community. With these business opportunities, it is hoped that they can help boost the community's economic growth to become better so that it can reduce the high level of urbanization. Additionally, with the existence of businesses that focus on the opportunities available in the surrounding area, it is hoped that they can become an icon or characteristic of the region.

Karang Taruna is a youth organization that plays a strategic role in social and economic development, particularly in improving the skills and independence of young people in the field of entrepreneurship (Indonesian Ministry of Social Affairs, 2021). In various regions, Karang Taruna has proven to be a driving force in developing local economic potential by developing various types of community-based businesses. The Acting Regent of Kulon Progo (2023) said that Karang Taruna's involvement in supporting the completion of government programs in various fields, such as reducing stunting, alleviating poverty, and others, is considered very important by the Regional Development Planning Agency ( ). Moreover, Karang Taruna was formed from a vision and mission that broadly aims to assist the government in overcoming social problems in the community. Serut Village is a UNY Gold Village that has been inaugurated by the Rector of UNY (Figure 1). With the inauguration of this Gold

Village, it is hoped that Padukuhan Terbah and Serut can become models of community empowerment based on integrated local potential, as well as a living laboratory to support the three pillars of Yogyakarta State University.

Figure 1. Inauguration of UNY's gold village: Terbah and Serut hamlets, Kulon Progo

In Serut Hamlet, Kulon Progo, the potential for industry-based businesses, particularly in the manufacture of trellis products, is quite significant. This is due to the increasing demand for trellis products as both a safety and decorative element in homes and buildings. However, there are several obstacles faced by the Karang Taruna youth in developing this business, including:

1. Lack of technical skills in the manufacture and design of innovative trellis products.
2. Lack of understanding of efficient production techniques and product quality standards.
3. Suboptimal production equipment conditions, which hinder the production process.
4. Low level of entrepreneurial knowledge and product marketing.

In a study conducted by Prasetyo et al. (2020), it was mentioned that revitalizing production tools and technical skills training can improve the efficiency and quality of products produced by micro-business groups. Therefore, strategic efforts are needed to increase the capacity of Karang Taruna youth through training activities and revitalization of production tools to support sustainable entrepreneurship development. The training and revitalization program for Karang Taruna in Serut Hamlet is a strategic step in improving skills, opening up business opportunities, and encouraging economic independence among young people. With this program, it is hoped that the younger generation can develop their potential, create jobs, and contribute to village development. Therefore, continuity and support for this program are crucial to realizing a more productive, innovative, and competitive Karang Taruna.

The objectives of this activity are:

1. To provide technical training in the manufacture of trellis products to make them more innovative and of
   higher quality.
2. To repair and revitalize production tools in order to improve work efficiency.
3. Enhancing the understanding of Karang Taruna youth regarding business strategies and product marketing.

LITERATURE REVIEW

1. Making trellises

Trellises are one of the construction elements used to improve the security and aesthetics of a building. According to Supriyadi (2018), trellises are generally made of metal materials such as iron, steel, and aluminum, which are formed into various designs according to requirements. The main function of trellises is to provide additional protection for windows, doors, or fences to prevent unauthorized access to the building. In addition, trellises also have aesthetic value that can beautify the exterior and interior appearance of a house. In the manufacturing process, several techniques are used, including cutting, welding, design shaping, and finishing. Figure 2 shows the trellis manufacturing process during the cutting and welding stages. According to Rachmat

(2020), the welding technique used in the manufacture of trellises must pay attention to the quality of the joints in order to produce a strong and durable product. In addition, the selection of raw materials also plays an important role in determining the trellis's resistance to corrosion and extreme weather. Mild steel and hollow iron are often used because they have good durability and are easy to shape according to the desired design.

Figure 2. The process of making trellises through cutting and welding.

The manufacture of trellises also requires special skills, especially in terms of design and installation. A study conducted by Handoko (2019) shows that good trellis design not only considers safety factors but also aesthetic values that are in line with the architecture of the building. The use of technologies such as laser cutting or plasma cutting is also growing in this industry, enabling the creation of more complex and high-precision patterns. In terms of marketing, trellises have considerable business opportunities, especially in urban areas with high security needs. According to a report from the Indonesian Metal Craftsmen Association (2021), the trellis industry is growing rapidly with increasing demand from the residential and commercial sectors.

2. Youth entrepreneurship

Entrepreneurship is an activity related to the creation, management, and development of a business to achieve profits and added value. According to Schumpeter (1934), entrepreneurship is a process of innovation carried out by individuals or groups in creating new business opportunities. In the context of entrepreneurship theory, Drucker (1985) states that the success of an entrepreneur depends on their ability to identify opportunities and manage risks. Successful entrepreneurs must have visionary thinking, a proactive attitude, and good managerial skills. In addition, the aspect of courage in taking risks is also a key factor in running a business.

Education and training also play an important role in building an entrepreneurial spirit. According to Zimmerer & Scarborough (2008), entrepreneurship training programs can help individuals develop managerial skills, business planning, and effective marketing strategies. Practical entrepreneurship education provides direct experience in facing business challenges, so that prospective entrepreneurs can be better prepared to run their businesses. In addition to individual factors, the social environment and government policies also influence the development of entrepreneurship. According to research by Hisrich, Peters, & Shepherd (2017), a conducive entrepreneurial ecosystem includes access to capital, supportive regulations, and extensive business networks.

With the development of technology and digitalization, entrepreneurship has become increasingly widespread in various sectors. Digital-based business models, such as e-commerce and technology startups, have become major trends in the modern business world. According to Kotler & Keller (2016), the use of digital technology in entrepreneurship can increase operational efficiency and expand market reach.

3. Training and revitalization of tools

Training is a systematic process to improve an individual's skills, knowledge, and competence in a particular field. According to Noe (2017), training aims to develop participants' abilities so that they are better prepared to face challenges in the world of work or business. Training methods vary, ranging from lectures, demonstrations, simulations, to hands-on practice. Knowles (1980) emphasizes that the andragogical approach in adult training is more effective because it emphasizes active participation and practical experience. In addition, technical skills-based training is more optimal when supported by adequate tools and facilities (Dessler, 2020).

In the context of community empowerment, training plays an important role in increasing economic independence and productivity. A study by Prasetyo et al. (2020) shows that technical training combined with tool revitalization can increase the efficiency and quality of micro-business groups' production. Tool revitalization is an effort to renew, repair, and optimize equipment to increase efficiency and quality in a production or training process. According to Heizer & Render (2019), the performance of a production system is highly dependent on the condition of the tools used, where suboptimal equipment can reduce productivity and quality of work. Therefore, tool revitalization is a strategic step in improving the competitiveness of a business or training program.

Revitalizing tools involves several aspects, such as inventorying and evaluating the condition of tools, repairing or replacing worn-out equipment, and providing training on the use and maintenance of tools so that they continue to function properly in the long term (Gaspersz, 2020). In addition, according to Prasetyo et al. (2020), revitalizing tools in technical training programs can increase the effectiveness of learning and help participants master skills better. In the context of trellis making training for the Serut Hamlet Youth Organization, revitalizing tools plays an important role in supporting the production process and ensuring that participants can use the equipment optimally.

METHOD

1. Stages of Tool Revitalization Implementation

The revitalization of tools in trellis-making training aims to improve production efficiency and quality by providing and updating the equipment used. This process is carried out using an evaluative and needs-based approach to ensure that the tools used in training are in optimal condition. In addition, tool revitalization also includes training in the use and maintenance of equipment so that participants can make the most of it in the long term.

a. Tool Identification and Evaluation Stage
b. Tool Procurement and Repair Stage
c. Tool Testing and Usage Training Stage

2. Training Implementation Stages

The method of implementing the trellis-making training for Karang Taruna in Serut Hamlet was designed systematically and practice-based so that participants could understand and master the skills optimally. This training combines lectures, demonstrations, hands-on practice, and technical assistance to ensure that each participant gains comprehensive experience in trellis making. In addition, a participatory approach is applied so that participants are active in each training session, from the planning stage to the evaluation of work results.

a. Introduction and Theory Presentation Stage
b. Demonstration and Practice Stage
c. Production and Mentoring Stage
d. Evaluation and Follow-Up Stage

RESULTS

The community service in the form of trellis making training for Karang Taruna members in Serut Hamlet was successfully carried out. This activity was enthusiastically attended by 20 participants who are active young men and women of Karang Taruna. The training was designed systematically with a hands-on approach to ensure that participants not only understand the theory but also truly master the technical skills. The community service began with an introduction and presentation of material related to the basic concepts of welding and welded joints. Participants were provided with a basic understanding of entrepreneurship, types of materials (such as hollow iron), and strict work safety procedures when using production equipment. This presentation was delivered by Dr. Ir. Heri Wibowo, S.T., M.T and Ir. Prihatno Kusdiyarto, M.Eng., Ph.D. This material presentation activity is illustrated in Figure 3.

Figure 3. Material delivery and technical skills introduction activities

The next stage is Demonstration and Practice, accompanied by Arif Marwanto, M.Pd. and Ardani Ahsanul Fakhri, M.Pd as shown in Figure 4. In the demonstration session, the instructor began by clearly and systematically demonstrating the fundamental techniques. Each step, from cutting hollow iron with precision using a grinder, shaping it according to the design, performing strong and neat welding, to the finishing process of grinding the weld and painting, was carefully demonstrated. The instructors did not just demonstrate, but also included explanations of the functions of each tool, parameters to pay attention to (such as cutting angle and welding temperature), as well as tips and tricks to avoid common mistakes often made by beginners. After the demonstration, the participants were immediately invited to practice each technique that had been shown. Divided into small groups, each participant had the opportunity to take turns holding the tools and trying each manufacturing process. Under the intensive guidance of instructors who moved from one participant to another, they began to learn how to control the grinding machine, weld iron, and produce strong joints. This guidance was personalized, with instructors providing immediate corrections, answering questions, and ensuring that everyone understood the essence of each skill.

Figure 4. Demonstration and Practice Stage

Practice is not just done once, but repeated in several cycles to build muscle memory and confidence. This repetition aims to make technical movements, such as welding in the correct position or cutting steadily, more natural and mastered by participants. Through this repeated and continuous practice, their skills are continuously honed, evolving from initially awkward and hesitant to smoother, more precise, and capable of producing work of increasingly higher quality. This process is the key to their transformation from beginners to skilled artisans.

Entering the production stage, participants began applying all the theoretical knowledge and practical skills they had learned previously to create a real product as shown in Figure 5. With a strong spirit of mutual cooperation, they worked together in a compact team; some were tasked with cutting hollow iron materials to size, some shaped them, while others focused on the welding and finishing processes. The entire process took place under the intensive supervision of instructors, who were ready to provide solutions to any technical obstacles that arose, ensuring that quality and safety standards were maintained. From this collaboration, a high-quality

trellis unit was finally created, serving as tangible proof and a source of pride for the competencies mastered by all participants.

Figure 5. Trellis Construction Stage

Not only stopping at production skills, participants are also equipped with basic entrepreneurial knowledge to ensure their products have economic value. Through special sessions, they are introduced to various product marketing strategies, ranging from competitive pricing, direct marketing (word of mouth) to neighbors and surrounding communities, to the use of simple digital platforms such as social media (WhatsApp, Facebook, Instagram) to expand their market reach. 's training aims to complement their competencies, so that they not only become skilled craftsmen, but also potential entrepreneurs who can see business opportunities from their new skills.

During the evaluation stage, the participants' work, in the form of completed trellis units, was thoroughly inspected by the instructors. The assessment process focused not only on the final result, but also considered criteria such as the strength of the welded joints, the precision of the cutting and shaping, the neatness of the finishing, and the conformity with the original design. The assessment was carried out by the instructors after the trellis products had been completed by the four groups of participants. The results of the evaluation of the suitability of the trellis products made can be seen in Table 1.

Table 1. Assessment results of the trellis products made by the training participants

Assessment aspects	Group 1	Group 2	Group 3
Weld joint strength	3.4	3.5	3
Cutting precision	3.2	3.6	3.2
Forming precision	3	3.3	3
Finishing neatness	3.2	3.4	3
Design compatibility	3.2	3.6	3.3

*) Assessment scores range from 1 to 4 (4 being the best)

After undergoing a rigorous assessment, the product was declared suitable and met the established quality standards as shown in Figure 6a. This recognition is objective proof that the participants not only understood the theory but were also able to apply their technical skills to create a product with market value.

As a tangible commitment to ensuring the sustainability of the post-training program, a symbolic handover of vital supporting equipment was carried out, as shown in Figure 6b. The assistance consisted of:

1. one 1200 W RHINO welding machine
2. one unit of a grinding machine, brand BOSCH
3. One unit of a hand drill machine, brand BOSCH
4. One welding mask
5. One set of drill bits
6. One set of grinding bits
7. Two magnetic brackets

The equipment was handed over to representatives of Karang Taruna. The handover of this equipment was not merely symbolic, but rather an investment in building an independent workshop, so that participants could continue to practice, innovate, and even begin to receive orders for trellis work from the community without being constrained by a lack of equipment.

Figure 6. Product Evaluation Stage for Railings and Provision of Welding Equipment Assistance

This stage does not mark the end, but rather the beginning of independence. The follow-up program also includes plans for regular business assistance from instructors to monitor progress and help overcome any challenges that may be encountered in running the business. In addition, Karang Taruna will also be connected to a network of material suppliers and other artisan communities to broaden their knowledge and marketing networks. Thus, the entire series of activities is expected to be a catalyst for the growth of productive and sustainable businesses managed by the youth of Karang Taruna Dusun Serut.

CONCLUSION

This training has comprehensively achieved its objectives. Participants not only acquired technical skills (hard skills) in trellis fabrication, but also a basic understanding of entrepreneurship (soft skills). With the handover of welding machines and supporting equipment, it is hoped that this will spark a new entrepreneurial spirit among young people and make Karang Taruna Dusun Serut an independent and sustainable trellis production center, thereby contributing to the village economy.

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UTILIZATION OF AI IN LEARNING AT SMA NEGERI 1 MINGGIR SLEMAN, YOGYAKARTA

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Abstract. The development of Artificial Intelligence (AI) provides significant opportunities for the education sector to deliver more engaging and adaptive learning experiences. However, most secondary school teachers in Indonesia still face challenges in utilizing this technology, including those at SMA Negeri 1 Minggir Sleman. This study aims to describe the implementation of teacher training and mentoring in the use of AI, the AI-based learning products produced, and teachers' reflections after participating in the program. The training involved teachers from various subject areas. The program was carried out over one semester through six face-to-face sessions, which included an assessment of school conditions, an introduction to basic AI concepts, discussions on implementation plans, media creation, product refinement, as well as presentation and evaluation. Data were collected through observation, product documentation, and reflection questionnaires, and then analyzed descriptively. The findings reveal that teachers successfully produced various AI-based media, including MathGPT, LearningApps, and Kahoot. Teachers' reflections indicate that the program was beneficial in supporting more engaging learning and fostering interest in participating in similar initiatives in the future. The study concludes that AI training can enhance teachers' digital competence while strengthening cross-disciplinary learning innovations, making it feasible to replicate in other schools with similar conditions.

INTRODUCTION

The rapid advancement of digital technology in the era of the Fourth Industrial Revolution has encouraged the education sector to adapt quickly in order to improve the quality of learning. One of the most rapidly growing innovations is Artificial Intelligence (AI). AI technology has been applied in various fields, including education, with great potential to support teachers in designing more effective, interactive, and student-centered learning. The use of AI in education can foster adaptive learning strategies, promote personalized learning, and enhance students' learning motivation[1,2].

However, the adoption of AI in secondary schools in Indonesia still faces various challenges. Many teachers are not yet accustomed to using this technology due to limited knowledge, skills, and experience in integrating it into classroom practices[3,4]. Meanwhile, the advancement of educational technology requires teachers to prepare engaging digital learning materials while also providing students with opportunities for independent learning supported by AI tools.

SMA Negeri 1 Minggir Sleman is one of the schools experiencing similar conditions. Communication with teachers and alumni who had participated in *KKN* (Community Service Program) and *PK* (Teaching Practice) indicated that teachers at this school were not yet accustomed to using AI in teaching and had never received specific training in this field. This highlights an urgent need to provide training and mentoring so that teachers can develop the ability to integrate AI into learning activities.

This need is crucial not only for teachers but also for students and the school as a whole. Teachers require skills to integrate AI technology into daily instructional practices, students need more interactive and effective learning innovations, while schools are expected to enhance the quality of education in line with digital-era developments[5–7]. Therefore, strengthening teacher capacity through AI training and mentoring becomes an important strategy to address the challenges of 21st-century education.

Based on this background, the present study aims to describe the implementation of teacher training and mentoring in the use of AI, the AI-based learning products developed by teachers, and teachers' reflections after participating in the program. The findings are expected to serve as a model for teacher competency development in other schools with similar contexts, while also contributing to improving the quality of technology-based education in Indonesia.

LITERATUR REVIEW

Educational innovation refers to the effort to introduce something new and distinct from conventional learning patterns routinely practiced by teachers. Innovative learning is designed to optimize the achievement of learning objectives through comprehensive, creative, and learner-oriented approaches. This innovation is closely related to the development of modern learning theories that emphasize active student participation (student-centered learning) and the integration of technology to support the learning process[8,9].

One rapidly growing form of innovation is the use of digital technologies in education. Since the Industrial Revolution 4.0, various online learning platforms such as Learning Management Systems (LMS), Virtual Learning Environments (VLE), and Personal Learning Environments (PLE) have been widely adopted by teachers and learners to expand access to education[10,11]. The use of these technologies allows flexible learning, both offline and online, supported by a variety of interactive media[12,13].

Furthermore, the advancement of digital technologies has introduced Artificial Intelligence (AI) as a groundbreaking innovation in education. AI can be utilized to support adaptive learning strategies, provide personalized learning experiences, and enhance learner motivation[1,2]. AI in Education (AIED) offers diverse applications, including content recommendation systems, learning chatbots, learning analytics, and automated assessment. Thus, AI has the potential to assist teachers in designing more effective and learner-centered instruction[14,15].

Nevertheless, the integration of AI in education is not without challenges. Several studies indicate that teachers still encounter barriers related to digital literacy, technical skills, and pedagogical readiness to incorporate AI into their teaching practices[4,16,17]. Limited training opportunities and lack of direct experience also contribute to teachers' lack of confidence in using AI effectively. Some even perceive AI as a threat to the teaching profession[4]. Previous research also highlights issues such as teachers' limited technological knowledge, insufficient infrastructure, and the suboptimal validity of AI tools, all of which reduce AI's potential to support adaptive learning and automated assessment[18]. These findings emphasize the importance of providing adequate training and mentoring to enable teachers to master the effective use of AI in classroom contexts.

In the Indonesian context, the Ministry of Education, Culture, Research, and Technology has developed various digital initiatives, such as the Rumah Belajar portal, which provides web-based learning resources and supports the Merdeka Belajar program. However, the adoption of AI in schools remains very limited. Teachers require continuous training and capacity building to integrate AI technologies into their teaching practices. Therefore, implementing teacher training and mentoring programs on the use of AI is a relevant strategy to address these challenges. Such initiatives not only equip teachers with technical skills but also help them reflect on their instructional practices. This aligns with the purpose of the present study, which is to describe the process of training and mentoring, the AI-based instructional products developed by teachers, and their reflections after participating in the program.

RESEARCH METHOD

This study employed a qualitative descriptive approach aimed at providing an in-depth account of the implementation process of the mentoring program, the instructional products developed by teachers, and their perceptions of the activities in which they participated. This approach was chosen because the research emphasizes understanding processes and experiences rather than numerical measurement or hypothesis testing. The research subjects were teachers at SMA Negeri 1 Minggir, Sleman, who actively engaged in the mentoring program, without restriction to any specific subject area. Consequently, the findings reflect a diversity of perspectives and teaching practices in the field.

The study was conducted over one semester, from April to October 2025, across six systematically structured face-to-face sessions. The initial stage involved orientation and needs assessment, where the researchers introduced the program while identifying the school's conditions to design appropriate mentoring strategies. The subsequent sessions covered the following topics: Session 1 introduced the fundamental concepts of Artificial Intelligence (AI) and its potential applications in teaching; Session 2 focused on planning AI integration in classrooms tailored to each teacher's needs; Session 3 facilitated teachers in developing AI-based learning media relevant to their subject areas; and Session 4 emphasized refinement and technical mentoring to ensure effective implementation of the developed products. The final stage included presentations, evaluation, and program closure, during which teachers showcased their products, reflected on their learning experiences, and provided feedback on the strengths and limitations of the program.

Multiple instruments were employed to collect comprehensive data. Observations were conducted to record teachers' engagement during training activities. Documentation focused on collecting the AI-based instructional products developed by teachers, such as applications, interactive quizzes, and other digital media. Reflective questionnaires were administered to capture teachers' perceptions regarding the benefits of the program, challenges encountered, and its overall usefulness. The data were analyzed using a qualitative descriptive

technique, which included data reduction, data display, and conclusion drawing. In addition, questionnaire responses were analyzed quantitatively through percentage calculations, which were then interpreted to identify trends in teachers' perceptions of the program. This procedure enabled the study not only to describe processes and products but also to provide a comprehensive picture of the impact of the mentoring program on teachers.

RESULT AND DISCUSSION

The first objective of the mentoring program was to provide training for teachers to develop skills in utilizing Artificial Intelligence (AI) in teaching and learning. The training results showed that teachers from various subject areas successfully developed and applied AI-based applications as well as interactive digital media. The products included MathGPT for Islamic Religious Education (PAI), Exponent Multiple Choice Quiz for Mathematics, LearningApps for English, and Kahoot for Informatics. The diversity of these products demonstrates that teachers were able to adapt the use of technology to the needs of their respective subject areas.

The second objective was to provide intensive mentoring to ensure that AI could be applied across all subjects. Based on documentation, all participating teachers succeeded in integrating the mentoring outcomes into their teaching practices, although the complexity of the media varied. This proves that the mentoring program was able to reach multiple subject areas and was not limited to a single discipline. A summary of the teachers' products is presented in Table 1.

TABLE 1. AI-Based Learning Products Developed by Teachers.

No.	Teacher's Name	Subject	AI-Based Product	Link
1	Ulinatun Nadhifah	Islamic Religious Ed.	MathGPT	https://math-gpt.org/
2	Ajrina Fauhan Salsabila	Mathematics	LearningApps.org	https://learningapps.org/watch?v=pidu66ppt25
3	Yanita Prajati Yuswaningrum	English	LearningApps.org	https://learningapps.org/display?v=pz92bd53a25
4	Agus Budiyono	Informatics	Kahoot	https://play.kahoot.it/v2/lobby?quizId=1b9c2ec9-3e93-48f9-b2d5-4162de95fc47

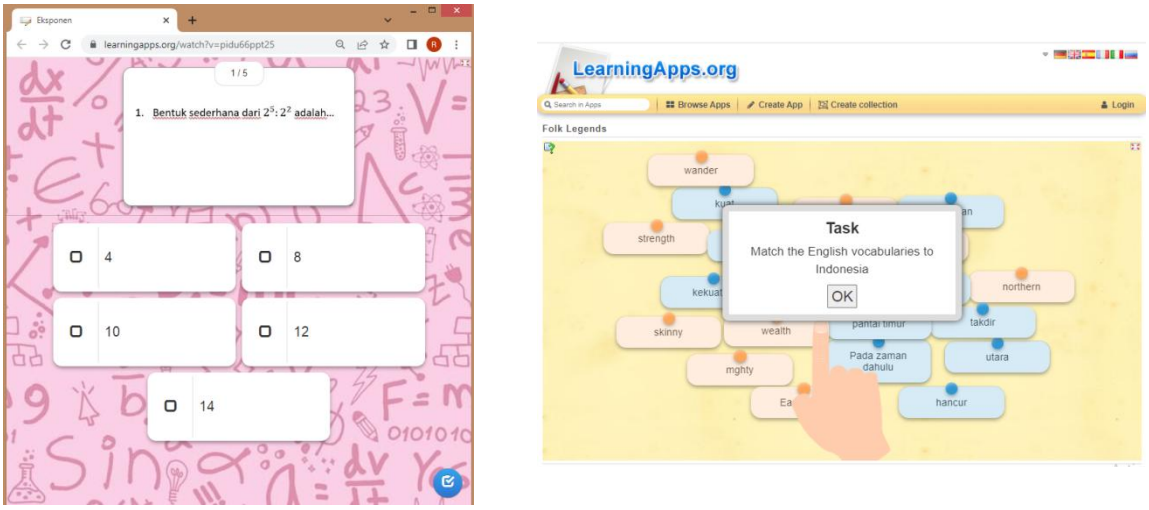


FIGURE 2. AI-Based Learning Products Developed by Teachers.

In general, the results indicate that teachers were not only able to master the basic use of applications but also modify them according to pedagogical needs. Teachers stated that the materials provided were highly useful for enriching learning variations, broadening their understanding of differentiated instruction, and motivating them to continue exploring digital technologies.

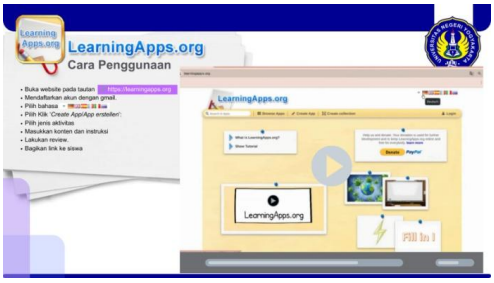
An analysis of the results reveals diverse strategies in application use. Four teachers from different subject areas produced varied products and experiences, reflecting the unique needs and characteristics of each subject.

Teachers' reflections were gathered through an online questionnaire (Google Form) consisting of three main questions: (1) Was the material useful in supporting more engaging learning? (2) Did the material enhance your understanding of differentiated instruction? (3) Are you interested in participating in similar programs in the future?

The reflections show that all teachers found the materials beneficial for supporting engaging learning and for expanding their knowledge of differentiated instruction. The PAI teacher reported that MathGPT enriched the variation of materials; the Mathematics teacher highlighted the new insights gained; the English teacher found

that digital applications increased student enthusiasm; and the Informatics teacher acknowledged gaining additional knowledge for managing varied learning strategies.

Furthermore, all teachers expressed interest in participating in similar activities in the future. This indicates that the mentoring program succeeded not only in improving technical skills but also in fostering sustained motivation to develop digital competencies. Thus, both objectives of the program, (1) training in AI application skills and (2) intensive cross-subject mentoring, were achieved optimally.



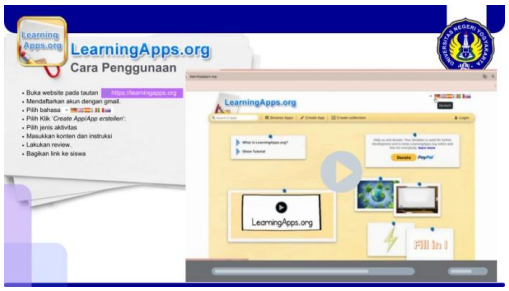


FIGURE 2. Mentoring Materials on the Use of AI Tools.

The PAI teacher developed the use of MathGPT (https://math-gpt.org/), a platform generally focused on mathematics. However, in the context of PAI, the teacher adapted this text-based AI to help students answer analytical and problem-based questions related to religious teachings. For example, students could input questions about applying moral or fiqh values in daily life and then critically discuss AI-generated responses in class. This illustrates the teacher's flexibility in applying technology across disciplines, even though the platform was not originally designed for PAI. The teacher stated that the training materials were highly beneficial for making learning more engaging, enriching differentiated instruction, and she expressed strong enthusiasm for joining similar programs in the future.

The Mathematics teacher developed an interactive multiple-choice quiz on exponents using LearningApps (https://learningapps.org/watch?v=pidu66ppt25). The quiz presented exponent problems in multiple-choice format, enabling students to respond directly via digital devices. With this format, mathematics learning, often perceived as abstract, became more concrete and enjoyable. In reflection, the teacher emphasized that the application was very useful because it not only diversified teaching methods but also supported differentiated instruction. Through adaptive features, problem difficulty could be adjusted to student proficiency levels. The reflection shows that digital innovation motivated the teacher personally to keep exploring creative learning strategies.

The English teacher employed LearningApps in the form of interactive matching and ordering exercises (https://learningapps.org/display?v=pz92bd53a25). These exercises were designed to practice vocabulary and sentence structure in everyday communication. The teacher reported that learning became more enjoyable as students could directly interact with the material through language games. Furthermore, the teacher reflected that using interactive digital applications enriched teaching methods and broadened pedagogical perspectives, especially in meeting the diverse needs of learners at different proficiency levels. According to her, students were much more enthusiastic when learning through interactive, game-based applications, and she expressed a strong interest in continuing with such training.

The Informatics teacher opted to use Kahoot! (https://play.kahoot.it/v2/lobby?quizId=1b9c2ec9-3e93-48f9-b2d5-4162de95fc47), a popular online quiz platform. Through Kahoot, the teacher designed questions on basic informatics concepts presented in a competitive quiz format. The platform proved effective in increasing student engagement due to its gamification and healthy competition features. The teacher reflected that the training provided valuable insights into utilizing digital platforms to create differentiated learning and expressed his interest in participating in future programs.

Based on the findings above, it can be concluded that the training successfully encouraged teachers from various disciplines to integrate digital applications into their teaching practices. Despite differences in subject characteristics, all teachers demonstrated high enthusiasm, perceived the program as beneficial, and showed interest in continuing to explore educational technologies. The diversity of applications,from text-based AI, interactive tools, to quiz platforms, highlights the broad opportunities for integrating technology in education.

The mentoring results revealed that teachers from various subject areas successfully integrated Artificial Intelligence (AI) into their teaching practices in diverse ways, depending on the disciplinary context. Each teacher demonstrated unique creativity in employing AI-based applications to produce learning products that were not only relevant to their subjects but also had the potential to enhance student engagement. This integration provides concrete evidence that AI is not confined to numerically oriented subjects but can be flexibly applied in religious studies, languages, and other applied sciences.

For example, the Islamic Religious Education (PAI) teacher used MathGPT to design calculation-based exercises in the context of religious teachings. This innovation demonstrates an attempt to repurpose a technology typically applied in mathematics and adapt it for religious education. Such an approach supports the idea that AI can transcend disciplinary boundaries and, if managed effectively, enrich interdisciplinary teaching strategies. Previous literature emphasizes that AI possesses the flexibility to be implemented in various learning contexts due to its adaptive and data-driven nature[1,2]. Thus, the PAI teacher's approach aligns with earlier studies suggesting that AI can expand the range of instructional methods traditionally perceived as rigid and conventional.

In Mathematics, the teacher utilized the LearningApps platform to develop a multiple-choice quiz on the topic of exponents. This product illustrates the integration of abstract mathematical content with interactive digital media that facilitates student comprehension. The use of quiz-based applications indicates that AI and digital technologies can be employed not only to assess understanding but also to support active learning through educational games. Prior studies have noted that the use of digital platforms in mathematics education can both increase student participation and reduce anxiety toward a subject often considered difficult[12,13]. Therefore, these mentoring results are consistent with previous findings regarding the importance of interactive media in promoting innovative learning.

The English teacher developed LearningApps-based materials focusing on vocabulary and text comprehension exercises. According to the teacher, students responded very positively, as the application added variety to learning activities and introduced a game-like atmosphere. These findings are in line with innovative learning theories emphasizing student-centered learning, where the teacher's role extends beyond delivering information to facilitating active student engagement[8,9]. By introducing AI through digital exercises, the teacher succeeded in creating enjoyable learning experiences while fostering students' intrinsic motivation to learn a foreign language.

Meanwhile, the Informatics teacher employed Kahoot! to design interactive quizzes that could be played live in the classroom. The use of Kahoot! functioned not only as an assessment tool but also as a means of cultivating a competitive yet collaborative learning atmosphere. The teacher reported that students were more enthusiastic when Kahoot!-based quizzes were integrated into the lessons. This demonstrates that AI and digital technologies can foster enjoyable learning conditions and enhance student motivation. Previous research also shows that integrating educational games into teaching can improve student engagement and strengthen retention of material[5,7]. Thus, the Informatics teacher's innovation aligns with theoretical perspectives highlighting the pivotal role of digital technologies in encouraging creative learning.

Overall, the teacher-specific analysis shows that AI integration in teaching broadens the scope of educational innovation. These mentoring outcomes reinforce prior claims that AI can create learning experiences that are more adaptive, personalized, and enjoyable[14,15]. The fact that teachers from various disciplines successfully developed AI-based products illustrates the flexibility and cross-disciplinary relevance of AI. Therefore, the integration of AI should not be viewed merely as a technological trend but as a concrete strategy for realizing innovative teaching practices in the classroom.

FIGURE 3. Documentation of Program Implementation.

The training provided in the mentoring program has been proven to contribute significantly to the improvement of teachers' competence. Survey results indicate that all teachers found the training materials beneficial in supporting more engaging learning, providing additional insights for implementing differentiated instruction, and

fostering an interest in participating in similar activities in the future. This finding demonstrates that the training not only enhanced technical skills but also built teachers' motivation to continuously learn and innovate.

The newly acquired skills were reflected in teachers' ability to independently download, install, and utilize AI applications. Although some teachers initially required technical assistance, the majority successfully mastered the applications and even integrated them into their lesson plans. This illustrates a significant increase in digital literacy, which had previously been one of the main obstacles to the integration of educational technology[3,16,17]. With proper mentoring, teachers were able to overcome these barriers and gain confidence in using new technologies.

These findings align with the theory of innovative learning, which emphasizes the importance of teachers as lifelong learners. Teachers are not only expected to teach but also to continuously update their skills to remain relevant in a changing world. AI training provided teachers with opportunities to broaden their perspectives on adaptive, student-centered teaching strategies while simultaneously introducing them to practical applications that could be directly implemented in the classroom. This is consistent with the literature stating that the use of AI can strengthen teachers' roles as facilitators in creative and personalized learning[1,2].

Furthermore, the training strengthened teachers' pedagogical dimension. The integration of AI was not only about technical aspects but also about how teachers designed instruction that met students' needs. The results revealed that teachers successfully adapted the AI products they created to align with the characteristics of their respective subjects. This finding is consistent with previous studies emphasizing that teachers' pedagogical readiness is a crucial factor in the successful integration of AI in classrooms[4]. Thus, the impact of training was not limited to technical competence but also reinforced teachers' pedagogical capacity to deliver innovative learning.

Despite these significant achievements, the implementation of AI in learning still faces several challenges. One of the main obstacles is limited digital literacy among teachers. Teachers with an Informatics background were relatively quicker in mastering applications, while teachers from other disciplines required more time to adapt. This reflects a digital competence gap among teachers which, if not addressed, may hinder the equitable integration of AI in schools. Previous studies also confirm that low digital literacy remains a major barrier to the adoption of educational technology[16,17].

In addition, technical barriers such as limited devices and infrastructure remain challenging. Not all teachers had access to devices with adequate specifications to run AI-based applications. This is consistent with earlier research showing that infrastructural limitations often act as significant barriers to technology adoption in schools[18]. Therefore, the successful integration of AI requires support not only at the individual teacher level but also within the broader educational system.

Resistance to change also emerged as another challenge. Although all teachers in this study expressed interest in participating in further training, some still expressed concerns about the long-term impact of AI on their profession. Such concerns are reflected in the literature, which notes that some teachers perceive AI as a threat to the existence of human educators[3]. Therefore, continuous mentoring programs should be designed not only to enhance technical skills but also to build a broader understanding of AI's role as a partner, rather than a replacement, in the teaching and learning process.

The findings of this study carry important implications for educational innovation in Indonesia. First, the mentoring results demonstrate that AI can be applied across disciplines, ranging from religion, mathematics, and language to informatics. This flexibility indicates that AI has the potential to serve as a catalyst for strengthening a culture of innovation in schools. If teachers from various subjects are able to utilize AI, opportunities will emerge to create a collaborative and interdisciplinary learning ecosystem.

Second, the findings support the government's initiatives through the Merdeka Belajar program, which emphasizes adaptive, flexible, and student-centered learning. The integration of AI can accelerate the achievement of this program's objectives by providing teachers with tools to design differentiated instruction tailored to students' needs. Thus, AI training and mentoring can serve as concrete strategies to support the implementation of national education policies.

Third, the long-term implication of this study is the establishment of a culture of innovation in schools. As teachers become accustomed to using AI in their teaching, they will be more open to adopting new technologies in the future. This aligns with the concept that educational innovation does not solely depend on the adoption of technology but also on attitudes and cultures that support sustainable innovation[8,9]. Therefore, AI training programs not only generate short-term impacts but also hold the potential to shape a sustainable culture of innovation within schools.

Finally, this study underscores that the integration of AI into teaching cannot be separated from the local context. Although AI offers great potential, its successful implementation depends heavily on teachers' readiness, the availability of infrastructure, and policy support. Therefore, in order to make AI an integral part of educational innovation in Indonesia, a comprehensive strategy is required, one that includes continuous training, teacher capacity building, and the provision of adequate infrastructure.

CONCLUSION

Based on the outcomes of the training and mentoring program on the use of Artificial Intelligence (AI) in teaching at SMA Negeri 1 Minggir, it can be concluded that the program not only achieved its initial objectives but also generated broader impacts on enhancing teachers' competencies and fostering a culture of innovation within the school. The implementation demonstrated that when teachers are given the opportunity to explore, experiment with, and reflect upon the use of new technologies, they are able to display openness, creativity, and strong motivation to innovate in their teaching practices.

In addition to these successes, the program also revealed the need for continuity in teachers' use of AI. The skills acquired through training will only be sustained if consistently practiced in daily instruction. Repeated practice not only sharpens technical proficiency but also nurtures creativity in discovering new ways to apply AI in addressing students' learning challenges. Therefore, teachers should be provided with space and institutional support to continue experimenting, whether through internal school forums or cross-disciplinary collaborations that enable the exchange of experiences. Schools as institutions also play a pivotal role in ensuring the sustainability of such programs. AI-based training needs to be institutionalized as part of structured and continuous teacher professional development. By adopting this training as a model, schools can cultivate an innovative learning culture that is not only curriculum-oriented but also encourages teachers to embrace lifelong learning. In the long run, such a culture will nurture a community of teachers accustomed to collaborative work, critical engagement with technological change, and responsiveness to the increasingly diverse needs of learners.

Furthermore, this study underscores the importance of further research focusing on the impact of AI use on student learning outcomes. The AI-based learning products developed by teachers during the mentoring sessions hold strong potential to enhance learners' motivation, engagement, and academic achievement. However, this potential must be substantiated through systematic empirical evaluation so that its effectiveness can be scientifically validated. Such evaluation would not only enrich our understanding of the educational benefits of AI but also provide evidence-based foundations for decision-making at both the school and national policy levels regarding the direction of technology integration in education.

In conclusion, the AI training and mentoring program at SMA Negeri 1 Minggir is not merely a technical skills initiative for teachers but serves as a catalyst for transforming school culture toward a more adaptive, creative, and future-oriented learning environment. The program demonstrates that with appropriate support, teachers can harness AI not as a threat but as a strategic partner in creating more meaningful learning experiences. If implemented sustainably and scaled to other schools, this initiative has the potential to accelerate the emergence of an innovative educational ecosystem that is well-prepared to address the challenges of the digital era.

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The Influence of the Capacity of Tourism Awareness Groups (POKDARWIS) in Organizing Recreational Sports Activities as an Effort to Improve Tourism Management in Kulonprogo Regency

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Abstract. This study aims to increase community capacity and awareness in sustainable tourism management through the empowerment of Tourism Awareness Groups (POKDARWIS) in Kulonprogo Regency. The study focused on socializing the concept of sustainable tourism, strengthening the role of Tourism Awareness Groups (POKDARWIS) as a driving force for tourist villages, and mentoring local potential-based management strategies. The study was attended by the Head of the Kulonprogo Regency Tourism Office, the Head of the Creative Economy and Tourism Resources Division, the Head of Pengasih Village, the Kulonprogo Tourism Awareness Group (POKDARWIS), and students of the Recreational Business Management Study Program, Faculty of Vocational Studies, Yogyakarta State University. The sample of this study was 100 people. This research method is a comparative study with a quantitative approach. The implementation of the study included counseling, participatory discussions, field practice, and evaluation of community involvement in tourism destination management. The results showed that the value of 84.9% was categorized as very good. This means that the capacity of POKDARWIS in planning and organizing recreational sports has a very positive influence on improving tourism management in Kulonprogo Regency. Respondents assessed that the strongest aspects were: (1) Integration of local wisdom in the concept of recreation, Creation of equal participation opportunities for the entire community, (3) Cooperation between institutions. Meanwhile, aspects that need to be improved are: (1) Consideration of financial factors & facilities, (2) Adjustment of national standards to local conditions. There was an increase in understanding of members (POKDARWIS) and the community about the principles of sustainability, the formation of a shared commitment to protecting the environment and local culture, and the emergence of a community action plan to support the sustainability of tourist destinations in the Kulonprogo region. Thus, this research contributes to strengthening institutional capacity (POKDARWIS), fostering collective community awareness, and encouraging the creation of more sustainable and competitive tourism management.

Keywords: Pokdarwis, Community Empowerment, Sustainable Tourism.

INTRODUCTION

Tourism is a crucial pillar of regional economic development, particularly in creating jobs, increasing community income, and encouraging cultural and environmental preservation. Law of the Republic of Indonesia No. 10 of 2009 stipulates that Kulonprogo Regency, as part of the tourism buffer zone of the Special Region of Yogyakarta, has diverse natural, cultural, and man-made tourism potential that continues to be developed. In managing this potential, local community participation through the Tourism Awareness Group (POKDARWIS) is crucial. POKDARWIS is a community organization that grows from, by, and for the community, which plays a strategic role in supporting sustainable tourism development. Its main functions include educating the public about the seven charms, developing tourist destinations, and organizing activities that can attract tourists (Kemenparekraf, 2020). However, the effectiveness of POKDARWIS's role depends heavily on its capacity in terms of human resources, institutions, collaborative networks, and program innovation. One form of innovation that has a significant impact on increasing the attractiveness of tourist destinations is recreational sports activities. Aditya, R., & Susanti, I. (2021). Recreational sports, such as fun biking, trail running, group gymnastics, and traditional competitions, not only serve as entertainment and destination promotion, but also create interaction between local communities and tourists. Darmawan, D. (2017). These activities can strengthen local identity,

increase the creative economy, and extend the length of stay of tourists. This is where the capacity of POKDARWIS as organizers of recreational sports activities is important. Their ability to design, manage, and evaluate these activities will greatly determine the success of tourism programs in the region. Problems that often arise are limited human resource competency, minimal budget support, and a lack of synergy with other stakeholders, such as local governments, business actors, and sports communities. Given the important role of POKDARWIS in organizing innovative activities such as recreational sports, an in-depth study is needed to determine the influence of POKDARWIS institutional capacity on the implementation of recreational sports activities and its contribution to improving tourism management in Kulonprogo Regency. The results of this study are expected to serve as a basis for local governments and relevant stakeholders in formulating policies for empowering POKDARWIS in a more targeted and sustainable manner. Based on this, the Research Team in collaboration with Partners is interested in conducting research on "The Influence of the Capacity of Tourism Awareness Groups (Pokdarwis) in Organizing Recreational Sports Activities as an Effort to Improve Tourism Management in Kulonprogo Regency".

LITERATURE REVIEW

Sustainable tourism promotes empowerment, making communities key actors in the tourism business and allowing them to enjoy greater tourism benefits by minimizing the negative impacts of tourism development. Community-based organization is a key factor in determining the success of village tourism activities (Asmoro and Da'awi 2020). Village tourism is a potential destination for development in Indonesia. Tourist attractions in village tourism can include both natural and cultural attractions. Developing a village tourism requires community participation as a form of awareness and preservation of its potential. This participation can be expressed in the form of tourism awareness groups, commonly known as Pokdarwis. Pokdarwis act as drivers and facilitators in the development of a village tourism. The success of village tourism development can be seen from the role of Pokdarwis in the area (Salsabila and Puspitasari 2023). POKDARWIS is a community organization that grows from, by, and for the community, which plays a strategic role in supporting sustainable tourism development. Its main functions include educating the public about the seven charms, developing tourist destinations, and organizing activities that can attract tourist visits (Kemenparekraf, 2020). However, the effectiveness of the role of POKDARWIS is highly dependent on its capacity in terms of human resources, institutions, cooperation networks, and program innovation. Based on these problems, through this community service program through the socialization of the empowerment of tourism awareness groups (POKDARWIS) to increase public awareness in sustainable tourism management in Kulonprogo Regency. Pokdarwis as one of the community groups is expected to be able to improve sustainable tourism management in Kulonprogo Regency.

RESEARCH METHOD

This research is a comparative research with an approach that combines quantitative methods. Quantitative Approach (1) Used to measure the contribution of the influence of the capacity of tourism awareness groups (pokdarwis) in organizing recreational sports activities as an effort to improve tourism management in Kulonprogo district (2) Instruments in the form of questionnaires are used to obtain numerical data that can be analyzed statistically. Nature of the Research (1) Descriptive-comparative, because it aims to describe the phenomenon of recreational sports programs in Kulonprogo district, (2) This research examines opportunities for tourism development in Kulonprogo district. The location of the research was carried out at the Pengasih village hall which has a recreational sports program in Kulonprogo district. The research subjects were Tourism Awareness Groups (Pokdarwis) who manage tourism in Kulonprogo district.

Research Instrument

Questionnaire on the Capacity of Tourism Awareness Groups (Pokdarwis) in Organizing Recreational Sports Activities as an Effort to Improve Tourism Management in Kulonprogo Regency

Questionnaire Instructions:

1. Write your identity on the sheet provided.
2. Your answers will be kept confidential.
3. Below are several statements about academic self-concept.
4. Please read them carefully and answer according to your actual situation by placing a checkmark (v) in the column provided, selecting the answer option from the provided.
5. There is only one answer for each question or statement.

6. There are no wrong answers in answering this question/statement.

Therefore, please ensure that no answer is left blank.
Note:
SS = Strongly agree
S = Agree
KS = Disagree
TS = Disagree
STS = Strongly disagree

No	Statement	Answer				
		SS	S	KS	TS	STS
1.	I will offer visitors several recreational sports concepts, such as outdoor activities, camping, tracking, and so on.					
2.	I will consider the expansive tourist area to allow visitors to participate in various recreational sports.					
3.	I will offer creative activities by combining local wisdom, such as farming and fishing, with creative and educational sports concepts.					
4.	I will plan the development of recreational programs that prioritize equipment, space, and recreational activities within the community.					
5.	I will prioritize individual interests, characteristics, needs, and capabilities when planning recreational programs.					
6.	In planning programs, I must consider individual differences in skills and expertise.					
7.	I will prioritize creativity and self-expression when considering program planning.					
8.	I will create opportunities for service to others and personal satisfaction.					
9.	In planning recreational sports programs, I must provide a variety of activities.					
10.	I will consider financial resources and facilities in program planning.					
11.	I will increase physical and human resources within the community to mobilize recreational programs.					
12.	I will create recreational programs that provide equal opportunities for participation for everyone in the community.					
13.	I will be flexible enough to change activities as people's interests change, which must be considered in a recreation program.					
14.	I will consider the health and safety of participants.					
15.	I will create a recreation program that strives to help everyone demonstrate standards of human behavior that are characteristic of human beings.					
16.	I will define interests based on the cultural, economic, religious, and social phenomena that characterize them.					
17.	I will create cooperatively planned recreational sports.					
18.	I will plan programs that adapt national standards to local conditions.					
19.	I will prioritize the type of community, location, economic conditions, and so on.					
20.	I will build collaborations between agencies, organizations, and institutions within the community (government and private).					

Formula
Result = (total score obtained) / (maximum score) x 100%
(Arikunto, 2019)
Assessment Score Criteria

SS = Strongly agree = 5
S = Agree = 4
KS = Somewhat disagree = 3

TS = Disagree = 2
STS = Strongly disagree = 1

Table 1. Research Categories

No	Score in percent (%) Category	Category
1	< 21 %	Very Low
2	21 – 40 %	Low
3	41 – 60 %	Currently
4	61 – 80 %	Tall
5	81 – 100 %	Very high

Data Collection Techniques

This study used several data collection techniques to obtain comprehensive information, namely: (1) Questionnaires/Surveys were used to collect quantitative data related to the level of Pokdarwis participation in recreational sports programs, perceptions of the benefits of activities, and contributions to fitness, health, and character building. The instrument, a questionnaire with a Likert scale, was distributed to Pokdarwis that actively organize recreational sports activities. (2) Participatory Observation was used to conduct direct observations of the implementation of recreational sports activities in Kulonprogo Regency. Aspects observed included the type of activity, Pokdarwis participation, facilities used, and character values that emerged in the activity. (3) Documentation Studies were used to (1) Collect secondary data in the form of official documents, activity reports, program guidelines, and statistical data from tourist attractions related to recreational sports programs. (2) This data was used to strengthen the findings from the survey and observation.

RESULTS AND DISCUSSION

Based on the research results, it shows that:

Table 2. Research Data

No	Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Amount
1	AF	3	4	5	4	2	4	4	4	5	5	5	4	2	5	4	4	4	5	4	4	81
2	SY	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	81
3	GN	5	4	4	4	5	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	83
4	EY	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	81
5	MN	5	5	5	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	84
6	LK	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	80
7	MI	4	5	4	4	3	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	82
8	EH	4	4	4	4	4	5	4	4	4	4	4	4	4	4	5	4	4	4	4	5	83
9	BS	5	5	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	83
10	PH	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	100
11	TW	4	4	4	4	4	4	4	4	4	4	4	5	4	5	4	4	4	4	4	4	82
12	NH	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	80
13	AL	4	4	4	4	4	4	4	5	5	4	4	4	4	5	5	4	4	5	5	5	87
14	QY	5	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	82
15	PK	5	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	82
16	CH	4	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	81
17	EF	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	80
18	LA	4	4	4	4	4	5	5	5	5	4	5	4	4	4	4	4	4	4	4	4	85
19	RS	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	100
20	RG	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	100
21	AY	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	98
22	KH	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	81

No	Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Amount
23	KHN	4	5	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	83
24	KAH	4	4	3	3	4	4	4	4	4	3	3	4	4	4	4	3	4	4	4	4	75
25	MFH	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	80
26	AB	5	5	4	5	4	4	5	5	5	5	4	4	5	5	4	4	5	4	5	5	92
27	QB	5	5	4	4	4	4	5	5	4	5	4	4	5	5	4	5	5	5	4	5	91
28	SHB	5	5	5	5	4	4	5	5	4	5	5	5	5	5	5	5	4	4	4	5	94
29	SA	5	4	4	3	4	3	4	3	3	4	4	4	4	4	3	5	5	5	3	4	78
30	WS	5	5	4	5	5	4	5	5	5	4	5	5	5	4	4	4	4	5	5	4	92
31	CHI	4	5	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	83
32	AUL	4	4	3	3	4	4	4	4	4	3	3	4	4	4	4	3	4	4	4	4	75
33	VEL	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	80
34	SUP	5	5	4	5	4	4	5	5	5	5	4	4	5	5	4	4	5	4	5	5	92
35	IN	5	5	4	4	4	4	5	5	4	5	4	4	5	5	4	5	5	5	4	5	91
36	RSO	5	5	5	5	4	4	5	5	4	5	5	5	5	5	5	5	4	4	4	5	94
37	HTP	5	4	4	3	4	3	4	3	3	4	4	4	4	4	3	5	5	5	3	4	78
38	LTG	5	5	4	5	5	4	5	5	5	4	5	5	5	4	4	4	4	5	5	4	92
39	SUM	4	5	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	83
40	SUR	4	4	3	3	4	4	4	4	4	3	3	4	4	4	4	3	4	4	4	4	75
41	KLI	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	80
Total Number																						**3484**

Formula
Result = (total score obtained) / (maximum score) x 100%

Result = 3484 / 4100 x 100%

Result = 84.9%

Interpretation

A score of 84.9% is categorized as very good. This means that the capacity of the Tourism Awareness Group (POKDARWIS) in planning and organizing recreational sports has a very positive impact on improving tourism management in Kulonprogo Regency. Respondents assessed that the strongest aspects were: (1) Integration of local wisdom into recreation concepts, (2) Creation of equal participation opportunities for all members of the community, (3) Cooperation between institutions. Meanwhile, aspects that need improvement are: (1) Consideration of financial factors and facilities, (2) Adaptation of national standards to local conditions. The results showed that the capacity of the Tourism Awareness Group (POKDARWIS) in organizing recreational sports activities scored 84.9%, which is categorized as very good. This indicates that the majority of respondents support POKDARWIS's efforts to develop recreational sports programs as a strategy to improve tourism management in Kulonprogo Regency. Respondents gave high scores to statements about offering recreational sports concepts based on local wisdom, such as outbound activities, camping, tracking, and activities that combine agriculture and fisheries. This aligns with the theory of community-based tourism management, which emphasizes the importance of integrating local potential as a tourist attraction. Thus, POKDARWIS was deemed capable of creating innovative programs that are not only recreational but also educational. The statement regarding providing equal participation opportunities for all levels of society also received a high score. This demonstrates that POKDARWIS strives to provide inclusive tourism, in accordance with the principles of community-based tourism (CBT), namely the involvement of all levels of society in tourism management. This effort is crucial to ensure that the benefits of tourism are felt equally, not just by certain groups. The aspect of cooperation between agencies/organizations (government and private) also received strong support from respondents. This demonstrates that POKDARWIS's capacity extends beyond internal management to building external networks. Cross-sector collaboration is believed to be key to the success of sustainable tourism development.

Although the research results were generally very positive, several aspects need improvement: (1) Financial and facility considerations indicate that the availability of infrastructure and funding remains a challenge in planning recreational sports programs; (2) Adapting national standards to local conditions; respondents assessed the need for flexibility in implementing national policies or standards to align with local social, economic, and cultural realities in Kulonprogo. This study indicates that: (1) POKDARWIS plays an important role as a main actor in developing recreational sports-based tourism, which can increase the length of stay of tourists and increase the local economic impact, (2) The capacity of POKDARWIS is already very good, but needs to be strengthened in terms of funding, infrastructure, and regulatory assistance so that the designed program can run more optimally, (3) The local government together with tourism stakeholders need to provide ongoing support in the form of training, facilitating cooperation networks, and providing supporting facilities for recreational sports activities. Thus, the results of this study confirm that the capacity of POKDARWIS in Kulonprogo is already at a very good level in managing recreational sports activities, but needs to be continuously strengthened to be able to encourage the realization of sustainable, inclusive, and local wisdom-based tourism.

CONCLUSION

Based on the results of the study entitled "The Influence of Tourism Awareness Group (POKDARWIS) Capacity in Organizing Recreational Sports Activities on Improving Tourism Management in Kulonprogo Regency", the percentage result was 84.9% which is in the very good category. This shows that the capacity of POKDARWIS in planning and implementing recreational sports activities has a positive effect on improving tourism management in Kulonprogo Regency. In detail, it can be concluded: (1) The creativity of recreational programs that combine sports with local wisdom is a strong attraction in improving the quality of tourism management, (2) Inclusive community participation is an important factor that makes the POKDARWIS program beneficial to various groups, (3) Cooperation between institutions (government, private sector, and community) has been proven to support the success of developing recreational sports-based tourism, (4) However, there are still obstacles, especially in terms of facilities, financial support, and adapting national standards to local conditions. Based on these conclusions, several suggestions are proposed: For POKDARWIS (1) Continue to increase creativity in designing recreational sports programs that are relevant to local potential, (2) Strengthen managerial capabilities, especially in financial planning and facility maintenance, (3) Develop ongoing training programs so that POKDARWIS members have skills in event management, tourism services, and activity safety. For the Regional Government (1) Provide support for infrastructure and funding to support the development of recreational sports, (2) Create flexible policies so that national tourism standards can be adjusted to the social, cultural, and economic conditions of the Kulonprogo community, (3) Facilitate cross-sector cooperation with the private sector, educational institutions, and local communities. For Academics and Researchers (1) Conduct further research related to more specific recreational sports development models according to regional characteristics, (2) Provide research-based assistance and innovation to improve the quality of POKDARWIS programs. For the Community (1) Be more active in supporting recreational sports activities organized by POKDARWIS, (2) Maintain the sustainability of the program with real participation, both as participants, managers, and providers of supporting services.

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Development of a Fashion Technology Hybrid Learning Model to Improve Sewing Competence in Vocational Education

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Abstract. The industrial transformation in the era of the Fourth Industrial Revolution (Industry 4.0) demands vocational education to produce graduates who not only master conventional sewing skills but are also competent in utilizing digital technology. This study aims to develop a **Fashion Technology Hybrid Learning Model** that integrates the Chamilo Learning Management System (LMS) and instructional video tutorials to enhance students' sewing competence. The research employed a **Research and Development (R&D)** approach based on a modified Borg & Gall model. Data were collected through observation, interviews, questionnaires, pre-tests, and post-tests. Expert validation results indicated that the model achieved a high level of feasibility in terms of content (4.67) and implementation (4.67), with recommendations to improve technological aspects. A limited trial showed a significant increase in students' average scores from the pre-test (65) to the post-test (80), with a t-value of 9.87 ($p < 0.05$). These findings demonstrate that the hybrid learning model effectively improves students' sewing skills, fosters self-directed learning, and aligns with the demands of the modern fashion industry. This model can be widely adopted in vocational education to strengthen graduates' job readiness.

INTRODUCTION

The rapid development of digital technology in the era of the Fourth Industrial Revolution (Industry 4.0) has brought significant changes to almost every aspect of human life, including the creative industry sector such as fashion. The fashion industry is evolving at an increasingly fast pace, demanding continuous innovation and the ability to adapt to emerging technologies such as computer-aided design (CAD) software, automated production systems, and digital marketing through e-commerce and social media. This situation has led to a growing demand in the workforce for professionals who not only master manual sewing skills but also possess sufficient digital literacy to integrate technology into the entire garment production process, from design conceptualization, pattern making, and sewing processes to finishing and product promotion.

Unfortunately, most vocational fashion education programs in Indonesia still rely heavily on conventional teaching methods centered on face-to-face practice in laboratories or workshops. While this approach is effective in providing hands-on experience, it has several limitations. First, the learning time is restricted to scheduled class hours, leaving students with limited opportunities to review or repeat lessons outside the classroom. Second, personalized learning is not optimal because instructors must divide their attention among many students during each session, which often prevents those with different learning paces from receiving adequate guidance. Third, the integration of digital technology in teaching remains minimal, even though it is crucial to prepare students to meet the demands of the modern fashion industry. As a result, there is a gap between the skills possessed by graduates and the competencies expected by the labor market, which negatively impacts the competitiveness of vocational education graduates.

To address these challenges, an innovative learning model is required to bridge the gap between theory and practice, between manual skills and digital technology, and between students' learning needs and industry demands. The hybrid learning model is considered a strategic solution that is relevant for implementation. Hybrid learning combines the advantages of flexible, accessible online learning with face-to-face sessions that allow students to receive direct guidance from instructors. Through this approach, students can access theoretical

materials online, study them at their own pace, and then apply their knowledge during hands-on sewing practice in laboratories or workshops.

Furthermore, the integration of technology in this hybrid model utilizes a Learning Management System (LMS) as the central hub of digital learning. The LMS offers key features such as material uploads, interactive quizzes, discussion forums, assessments, and real-time monitoring of students' learning progress. With the support of video tutorials, students can visually observe sewing techniques and repeat them as many times as needed until they fully master each step. This not only enhances self-directed learning but also improves students' motivation and the overall quality of their acquired skills.

This study focuses on the development and validation of a Fashion Technology Hybrid Learning Model specifically designed to improve the sewing competencies of vocational fashion students. The model not only integrates online and offline components but also incorporates interactive digital media to make learning more engaging and accessible. This approach is expected to overcome the limitations of conventional teaching methods, provide flexible learning schedules, strengthen personalized learning, and prepare students to compete in an increasingly technology-driven and competitive labor market.

In addition, this research contributes significantly to the development of vocational education curricula in Indonesia. The availability of a scientifically validated hybrid learning model can serve as a reference for institutions to implement more innovative, technology-based teaching strategies. This model also has the potential to strengthen collaboration between educational institutions and the fashion industry, as graduates will be equipped with both technical and digital skills that meet modern industry standards. Therefore, this research not only benefits students and instructors but also supports sustainable development goals in providing quality education and developing a highly competitive workforce.

LITERATURE REVIEW

Hybrid learning is a learning concept that combines the strengths of face-to-face instruction with online learning. According to Graham (2006), hybrid learning provides a more flexible, adaptive, and interactive learning experience by integrating the best elements of conventional and technology-based learning. This concept leverages digital technology to provide access to learning materials online, while retaining face-to-face sessions to support direct interaction, in-depth discussion, and hands-on practice that requires instructor guidance.

In the context of vocational education, the implementation of hybrid learning is highly urgent. Vocational education generally emphasizes the mastery of practical skills that can only be acquired through hands-on practice. However, supporting theoretical knowledge remains important so that students understand the principles underlying these practices. The hybrid model bridges the gap between theory and practice by providing theoretical content in a digital format that students can study independently. Consequently, face-to-face time can be devoted more to practical training, personalized guidance, and solving real-world problems that students encounter while developing their skills. Thus, hybrid learning improves the efficiency of the learning process while also enhancing learning outcomes.

One of the key components supporting the success of hybrid learning is the use of a Learning Management System (LMS). The LMS serves as a central hub for digital learning where instructors can upload teaching materials, schedule assignments, administer quizzes, and monitor student progress in real time (Johnson et al., 2020). The LMS also facilitates two-way communication through discussion forums and comment features, enriching interaction between instructors and students outside of classroom hours. Previous research has shown that

using an LMS can improve student autonomy, engagement, and make it easier for instructors to conduct ongoing assessments.

In addition to the LMS, supporting media such as video tutorials have become an important innovation in vocational education, particularly in fields requiring fine motor skills such as sewing. Lee & Moon (2015) emphasized that video tutorials allow students to observe techniques in detail, repeat steps they have not fully understood, and learn at their own pace. This is especially useful to overcome the limited duration of face-to-face learning, which is usually restricted to scheduled class hours. Mayer (2009), in his multimedia learning theory, also pointed out that using visual-auditory media simultaneously enhances conceptual understanding and long-term memory retention, thereby optimizing learning outcomes.

Several relevant studies support the effectiveness of combining LMS and video tutorials. Ramadhani & Putra (2021) found that integrating online learning through an LMS with the use of video tutorials significantly improved vocational students' sewing practice outcomes while also encouraging self-directed learning. Similarly, Hasanah et al. (2022) reported that the use of video media accelerated students' understanding of sewing techniques and helped them achieve better practical results. Wang et al. (2019), through a meta-analysis, also revealed that blended learning increases student engagement compared to either traditional classroom learning or fully online learning.

Despite these benefits, the implementation of hybrid learning is not without challenges. Rovai & Jordan (2004) highlighted the importance of building a sense of community in hybrid learning to ensure that students remain connected with their instructors and peers, preventing feelings of isolation often experienced in fully online learning. Other challenges include the readiness of technological infrastructure, the digital literacy of both students and instructors, and the need for ongoing training to optimize the use of LMS and digital media.

In conclusion, the literature suggests that hybrid learning—when supported by a well-functioning LMS and appropriate learning media such as video tutorials—can enhance the quality of vocational education. This model provides flexibility, boosts learning motivation, and helps students achieve the expected competencies. However, its success greatly depends on good instructional design, technological readiness, and institutional support in providing the necessary facilities and training for all stakeholders.

RESEARCH METHOD

This study employed a Research and Development (R&D) approach with the primary aim of producing a technology-based hybrid learning model that is valid, feasible, and effective for application in vocational fashion education. The R&D model used was adapted from the Borg & Gall framework, which is recognized as one of the most systematic methods for developing educational products through a series of research and testing steps. However, the model was modified to suit the context of vocational learning, which requires a balance between theory and practice, while also considering the limited research timeframe.

The research process began with a needs assessment, conducted through classroom observations, interviews with lecturers and students, and a literature review. This stage aimed to identify the gap between the existing teaching methods and the competencies expected by the fashion industry. The needs assessment included collecting data on learning facilities and infrastructure, availability of technological devices, the digital literacy level of lecturers and students, as well as challenges faced during the sewing learning process. The results of this analysis became the foundation for designing a relevant and contextual learning model.

The next stage was model design. At this stage, the researchers developed a conceptual design for the Fashion Technology Hybrid Learning Model, which combines online learning

via the Chamilo LMS with offline learning in the form of sewing practice in laboratories. The design included the learning structure, the proportion of theoretical and practical materials, the selection of supporting media such as video tutorials, and the strategy for assessing learning outcomes.

Once the conceptual design was completed, the product development stage involved the creation of learning tools such as digital modules, LMS user guides, sewing technique video tutorials, and evaluation instruments. These products were then subjected to expert judgment for feasibility validation. The validation process involved experts in vocational education, instructional technology, and the fashion industry, who evaluated the content accuracy, clarity of the model design, ease of technological use, and feasibility of implementation in real classroom settings.

Following validation, a limited trial was conducted with a group of students from the Fashion Design Study Program as respondents. The trial aimed to determine the effectiveness of the model in improving sewing competence. In this stage, a pre-test was administered to measure students' initial competence prior to using the hybrid model. The model was then implemented over a certain period, followed by a post-test to measure improvement after the learning process. In addition, a student questionnaire was distributed to measure levels of satisfaction, perceptions of the LMS, and learning motivation.

Data collection techniques consisted of:

1. Observation to monitor the implementation of conventional learning as well as the hybrid model.
2. Interviews, conducted with lecturers and students to explore challenges and learning needs.
3. Questionnaires, containing items on learning experience, motivation, and ease of LMS use.
4. Competency Tests, in the form of pre-tests and post-tests to measure improvement in sewing skills.

Data analysis employed both quantitative and qualitative approaches. Quantitative data from the pre-tests and post-tests were analyzed using descriptive statistics to determine the mean, standard deviation, and score distribution. Subsequently, a paired sample t-test was conducted to examine the significance of the difference between pre-test and post-test scores. The paired t-test formula used was:

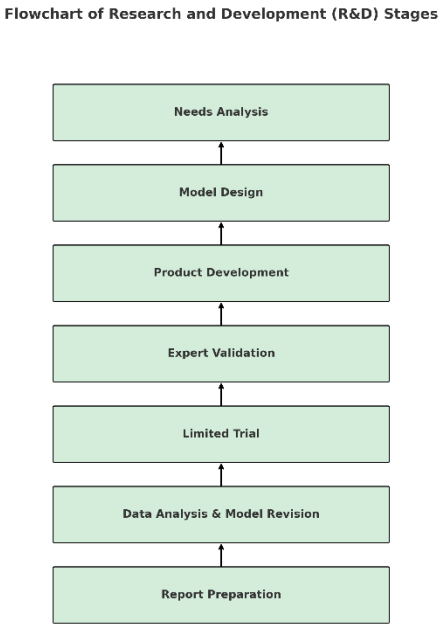
$$t = \frac{\bar{d}}{s_d/\sqrt{n}}$$

Where:

- d = mean of the differences between pre-test and post-test scores
- Sd = standard deviation of the differences
- n = number of participants

If t calculated > t table at a 5% significance level, it indicates a statistically significant difference, suggesting that the hybrid model effectively improved students' sewing competence. Qualitative data from interviews and observations were analyzed using content analysis to identify key themes regarding strengths, weaknesses, and suggestions for improving the model. To ensure research validity, triangulation of techniques was applied by combining observations, interviews, questionnaires, and tests to cross-check findings. The reliability of

the instruments was tested through a preliminary trial with a small group of students and revised based on consistency analysis results. Through these steps, the study aimed to produce a learning model that is not only innovative but also empirically proven to be effective, replicable, and aligned with the needs of the fashion industry.



RESULTS AND DISCUSSION

Result

The initial observations revealed that sewing instruction in the Fashion Design Study Program is still predominantly conducted using conventional methods with a fully face-to-face approach. Students rely heavily on direct instruction from lecturers during laboratory practice sessions, while access to theoretical materials outside of class remains very limited. The lack of technology integration makes it difficult for students to review the material or learn new techniques independently. The observation also found infrastructure constraints, such as a limited number of sewing machines, which forces students to wait their turn to practice and ultimately reduces the effectiveness of learning time.

In response to these findings, the researchers developed the Fashion Technology Hybrid Learning Model, which combines the Chamilo Learning Management System (LMS) with sewing technique video tutorials. The Chamilo LMS is used to upload theoretical materials, learning modules, quizzes, and discussion forums, while the video tutorials allow students to visually observe each sewing step and repeat it as often as needed. This approach provides students with greater flexibility in their learning process and enables them to prepare themselves more effectively before attending face-to-face practice sessions.

TABLE 1. Average expert validation score

Aspect	Average Score	Category
Material	4.67	Highly Appropriate
Design	4.00	Quite Innovative
Technology	3.33	Needs Improvement
Implementation	4.67	Highly Appropriate

This result indicates that the model is feasible for implementation; however, it requires technical improvements to the LMS features to make them more interactive.

Limited Trial Results

The limited trial was conducted with 20 students. Quantitative data were collected through pre-tests and post-tests measuring sewing skills ranging from pattern cutting to finishing. Statistical analysis showed that the students' average pre-test score was 65 with a standard deviation of 7.5. After the implementation of the hybrid model, the average post-test score increased to 80 with a standard deviation of 6.2. The paired sample t-test revealed a calculated t-value of 9.87, which was greater than the critical t-table value of 2.093 at the 5% significance level, indicating that the difference was statistically significant.

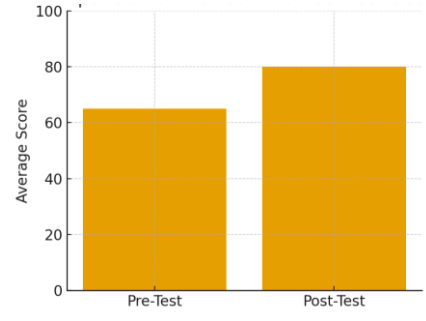


Figure 1. Comparison chart of students' average pre-test and post-test scores:

In addition to the quantitative data, the results of the student questionnaire indicated a high level of satisfaction with the hybrid learning model. The average satisfaction score was 4.16 on a 5-point scale, with the highest ratings on the indicators of ease of reviewing materials (4.9) and support for independent learning (4.9). However, the communication features in the LMS received a lower score (3.9), indicating the need for further improvement to enhance interactivity.

TABLE 2. Mean score of research findings

Indicator	Average Score
Easy-to-Understand Material	4.8
LMS Interface & Layout	4.7
Ease of Repetition	4.9
Support for Self-Learning	4.9
Communication Features (Chat/Forum)	3.9
Device Accessibility	4.5

Qualitative Analysis

The results of the interviews with students revealed that the hybrid model made them feel more confident before participating in laboratory practice. Several students stated that the video tutorials were particularly helpful for understanding complex techniques, such as constructing a Mandarin collar and installing zippers. Students also appreciated the flexibility of the learning schedule, as they could access materials at home or in between other activities.

From the lecturers' perspective, the hybrid model facilitated monitoring of students' learning progress because activity data could be viewed through the LMS. Lecturers also felt

more efficient, as face-to-face sessions could be focused on providing practical guidance rather than solely delivering theoretical material. However, one of the challenges encountered was the need for additional training for students and lecturers who were less familiar with the LMS, as well as the requirement for stable internet infrastructure to support smooth implementation.

Discussion

The findings of this study consistently support the blended learning theory proposed by Graham (2006), which asserts that the combination of online and face-to-face learning can enhance instructional effectiveness. The significant increase in the average post-test score from 65 to 80 serves as empirical evidence that the hybrid learning model, which integrates Chamilo LMS and video tutorials, positively impacts the acquisition of sewing skills. This improvement is not merely numerical but also reflects a higher quality of students' conceptual understanding and mastery of sewing techniques. This result is also aligned with Mayer's (2009) multimedia learning theory, which emphasizes that learning is more effective when learners receive information simultaneously through both visual and auditory channels, as facilitated by the video tutorials in this study.

Beyond its impact on learning outcomes, the model also influenced how students interacted with the learning materials and their instructors. The use of LMS allowed students to repeatedly access materials, independently complete quizzes, and monitor their own progress. This aligns with Johnson et al. (2020), who found that LMS use fosters learner autonomy and engagement. Such independence is evident in the questionnaire results, which showed high scores on the indicator of support for independent learning (4.9). Students reported feeling supported, as they could learn at their own pace without being completely dependent on the lecturer's presence.

From a social perspective, these findings reinforce Rovai & Jordan's (2004) argument about the importance of developing a sense of community in hybrid learning to prevent student isolation. Although part of the learning took place online, students still felt connected through discussion forums and face-to-face sessions. This sense of community was crucial for encouraging participation and engagement. In this study, several students reported that the combination of online and offline sessions made them more comfortable asking questions and engaging in discussions since they could post some questions on the LMS without waiting for the next scheduled class.

Nevertheless, the study also highlighted several important challenges. The communication features in Chamilo LMS were rated as less than optimal, with a score of 3.9 in the student survey. This limitation made online interactions less dynamic. Students suggested improving the chat feature to allow real-time communication and strengthening discussion forums to support group collaboration. Another challenge was the disparity in digital literacy levels among students; some were already familiar with technology, while others required additional assistance in accessing materials and submitting assignments via LMS.

From the lecturers' perspective, the hybrid model was beneficial but also demanded adequate readiness. Lecturers involved in the study reported that face-to-face class time became more effective, as students had already accessed theoretical materials in advance. However, they also faced challenges in managing the hybrid class, such as ensuring consistent student participation in LMS activities and preparing engaging digital content. This indicates the need for targeted training programs for lecturers to design learning content tailored to vocational students' characteristics and to maximize the features available in the LMS.

Overall, the hybrid learning model developed in this study has significant potential to improve the quality of vocational education. It has been proven effective not only quantitatively (through test scores) but also qualitatively, as it increases student motivation, engagement, and

confidence. Implementing similar models in other vocational programs could help address the limited availability of practice time, broaden access to learning materials, and better prepare graduates to meet the increasingly complex demands of Industry 4.0.

Furthermore, this study opens opportunities for future innovation. By strengthening the interactive features of the LMS, adding gamification elements, and integrating project-based assessments, the model could become even more engaging and support the development of students' higher-order thinking skills. Future research with larger samples and longer implementation periods is recommended to enhance the generalizability of the findings.

CONCLUSION

This study successfully developed a Fashion Technology Hybrid Learning Model that has been empirically proven effective in enhancing the sewing competencies of vocational fashion students. The model integrates online learning through the Chamilo Learning Management System (LMS) with face-to-face sessions focusing on hands-on practice in the laboratory, thereby creating a learning experience that is adaptive, flexible, and relevant to the needs of the modern fashion industry. Expert validation results confirmed that this model meets pedagogical, technological, and implementation criteria, with particularly high ratings in the content and implementation aspects. This demonstrates that the developed model aligns with the graduate competency standards expected by the fashion industry.

Quantitatively, this research also demonstrated a significant improvement in student learning outcomes. The average pre-test score of 65 increased to 80 in the post-test after implementing the hybrid model, with paired t-test results showing a statistically significant difference ($t = 9.87$; $p < 0.05$). These findings reinforce the evidence that integrating digital learning with hands-on practice can substantially enhance sewing skills. Qualitatively, students reported a high level of satisfaction with this model, particularly in terms of ease of accessing materials, learning flexibility, and the ability to review video tutorials as needed. Lecturers also noted the benefits of this model, as face-to-face sessions could be utilized more effectively for individualized guidance and direct feedback.

Nevertheless, despite the positive outcomes, there are several important considerations for wider implementation. The communication features within the LMS need to be improved to better support online social interaction and discussion. Furthermore, intensive training for lecturers and students is necessary to improve digital literacy and ensure optimal use of the LMS. Educational institutions must also ensure reliable technological infrastructure, including stable internet connectivity and adequate device availability, to prevent technical obstacles during implementation.

Overall, this hybrid learning model can serve as a reference or best practice for other vocational programs, particularly those requiring mastery of practical skills. Its implementation has the potential to strengthen the connection between education and industry, enhance graduates' competitiveness, and contribute to the achievement of Sustainable Development Goal 4 (Quality Education). With continuous development and refinement, this model can be applied more broadly and become an important innovation in the digital transformation of vocational education.

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Analysis of the Validity Test of the Joyful Learning Game Model for Social-Emotional Learning for Children Aged 4–6 Years

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Abstract. This study aims to analyze the validity test of the Joyful Learning game model designed to support social-emotional learning for children aged 4–6 years. The study employs a Research and Development (R&D) approach based on Plomp's model, specifically the preliminary design and prototype evaluation stages. The research subject is the developed game model, while the informants consist of two early childhood education (ECE) subject matter experts, two game model experts, and two educational media experts. Data collection techniques include expert validation (expert judgment) and practical testing by ECE teachers. The aspects validated included content validity, construct validity, and media validity, using a 1–4 Likert scale. The results showed that the game model achieved an average validity percentage of 88% (very suitable category), with the highest scores in the visual media (89%) and content (88%) aspects. The practicality test involving six kindergarten teachers yielded an average score of 3.55 or a percentage of 88.75% (very practical category). Teachers assessed that the game was easy to implement, engaging, and aligned with children's social-emotional development needs. The Joyful Learning game model was deemed valid and practical as a social-emotional learning medium for young children. This model has the potential to serve as an alternative strategy for early childhood education.

Keywords: joyful learning, children's games, validity, social emotional

INTRODUCTION

Early childhood, especially ages 4–6, is a very important developmental phase in shaping children's personalities and social-emotional skills. Social-emotional skills include the ability to recognize and manage emotions, form positive relationships, show empathy, and make responsible decisions (CASEL, 2020). Strengthening these aspects is essential because data shows that many young children are unable to manage their emotions appropriately, struggle to interact with peers, and exhibit aggressive or withdrawn behavior when faced with conflict (Setiawati & Nurani, 2023).

One effective approach to developing children's social-emotional skills is through joyful learning activities. Play is not merely a recreational activity but an active, contextual, and meaningful learning process for young children (Bodrova & Leong, 2021). The joyful learning-based play model combines elements of active engagement, positive emotions, and deep social interaction. This allows children to learn to express their feelings, empathize, and practice social skills through enjoyable and non-threatening experiences (Shonkoff & Phillips, 2022).

In reality, although many learning models have been developed to support child development, there are not many joyful learning game models that have been systematically validated, especially for the purpose of strengthening social-emotional learning. However, validating models is crucial to ensure that the structure, content, and implementation of the media or models used are truly appropriate, suitable, and effective in line with children's developmental characteristics (Nieveen, 2019; Gall et al., 2022).

Some issues related to joyful learning game models for children's social-emotional learning include the limited availability of validated game models specifically designed to strengthen the social-emotional development of young children. Many play activities in early childhood education are spontaneous or based on teachers' intuition, rather than the result of a systematic and validated model design. This makes it difficult to ensure that the games truly develop social-emotional aspects in line with children's age stages (Gall et al., 2022). Additionally, existing games do not align with social-emotional development indicators. Some games used in the classroom do not fully address social-emotional indicators, such as emotion recognition and regulation, empathy toward peers, conflict resolution skills, group cooperation, and responsible decision-making (CASEL, 2020; Denham et al., 2021). This results in incomplete social-emotional learning.

On the other hand, teachers' competence in designing or implementing joyful learning games is still lacking. Some early childhood education teachers still require training in designing or using media and game models based on joyful learning principles that are oriented toward learning objectives, including for social-emotional development (Setiawati & Nurani, 2023). The integration between joyful learning and social-emotional learning evaluation is also not yet evident. Games are often conducted without evaluation or measurement of children's social-emotional development. However, effective games should be accompanied by systematically

observable achievement indicators (Sugito et al., 2022). Facilities and infrastructure also pose challenges, as not all early childhood education institutions have the necessary supporting media or sufficient space to implement ideal joyful learning games, such as large motor games that require ample space and equipment.

This study aims to analyze the validity of the Joyful Learning game model designed to support the social-emotional learning of children aged 4–6 years. The validity test focuses on three main aspects, namely: 1) Content validity: the extent to which the game content represents appropriate social-emotional indicators; 2) Construct validity: the relationship between the game structure and the principles of early childhood learning; and 3) Presentation/media validity: the integration of form, color, symbols, and visual elements that support children's interest and engagement. Through this validity test analysis, it is hoped that the developed game model can contribute significantly to early childhood education practices, particularly in improving the quality of social-emotional learning in a fun and standardized manner.

METHODOLOGY

Type and Design of Research

This research is a research and development study that focuses on testing the validity of the Joyful Learning game model designed to support the social-emotional learning of children aged 4–6 years. The research was conducted at the model validation stage, which is the initial stage of the development process that aims to assess the feasibility and suitability of the model based on expert input. The design used refers to Plomp's (2013) development model, specifically the preliminary design and prototype evaluation stages.

Research Subjects and Informants

The subject of this research is the developed game model, while the informants consist of two subject matter experts from early childhood education, two game model experts, and two learning media experts. The subjects were selected purposively based on the criterion of having at least five years of experience in their respective fields.

Data Collection Techniques

Data was collected through expert judgment and user responses (preschool teachers/educators) to the developed model. The experts involved were subject matter experts, game model experts, and media experts. The expert validation sheet contains criteria for assessing three main aspects of the game model, namely: 1) content suitability in terms of the extent to which social-emotional indicators are covered in the game, 2) construction feasibility, including game structure, steps, and activity flow in accordance with the characteristics of early childhood, and 3) media display, including visual aspects, colors, symbols, and ease of use. The validation sheet is designed in the form of a 1–4 Likert scale and includes an open-ended suggestion column.

Data Analysis Technique

Data is analyzed quantitatively and descriptively through the following steps: scores from each validator are summed and averaged for each evaluation aspect. The feasibility category is determined using a percentage formula.

$$\text{Persentase Validitas} = \frac{\text{Skor Diperoleh}}{\text{Skor Maksimal}} \times 100\%$$

The interpretation of percentages refers to Arikunto's (2013) assessment criteria, namely:

Percentage	Validity Category
85%–100%	Highly Acceptable / Highly Valid
70%–84%	Acceptable / Valid
55%–69%	Somewhat Acceptable / Needs Revision
< 55%	Unacceptable / Invalid

Meanwhile, qualitative data from expert suggestions were analyzed thematically to improve the model design.

Data Validity Test

The validity of the model content was obtained through expert judgment. Data validity was reinforced by triangulation of sources (subject matter experts, game model experts, and media experts) and re-clarification through focus group discussions with early childhood education teachers.

Research Instruments

The validation instrument for the Joyful Learning game model for social-emotional learning aims to assess the suitability of the Joyful Learning game model based on content, model construction/design, and media

presentation. The practitioner/teacher validation sheet assesses the feasibility and practicality of the game model in the field. The assessment scale includes scores of 1 = Not Feasible, Score 2 = Less Feasible, Score 3 = Fairly Feasible, and Score 4 = Very Feasible.

The material validation instrument by early childhood education experts is as follows:

No	Aspects Assessed	Score (1–4)
1	The game model includes social-emotional indicators for children aged 4–6 years (e.g., empathy, cooperation, emotional regulation, social problem solving).	
2	The game objectives are in line with the developmental competencies of early childhood (Merdeka Curriculum / Permendikbud PAUD).	
3	The flow of game activities supports gradual and enjoyable social-emotional learning.	
4	Game activities encourage children to interact with their peers.	
5	The game allows children to learn to recognize and express their emotions.	

Meanwhile, the instruments used to validate the game model construction by learning/media design experts are as follows:

No	Aspects Assessed	Score (1–4)
1	The game instructions are easy for teachers to understand.	
2	The steps of the game are arranged logically and systematically.	
3	The game model allows for adaptation to various classroom conditions.	
4	The duration of the game is appropriate for the attention span of 4-6 years olds.	
5	The game can be played individually, in small groups, or as a class.	

Media display validation instruments and technical feasibility by media experts, namely:

No	Aspects Assessed	Score (1–4)
1	Colors, illustrations, and visual design are attractive and age-appropriate for children.	
2	Font size and type are easy to read for teachers/adult companions.	
3	Supporting media (cards, boards, pictures, teaching aids) are safe and child-friendly.	
4	The form of the media supports active exploration and children's play experiences.	
5	The media is easy for teachers to create/reproduce at school.	

RESEARCH RESULTS

This study aims to test the validity of the Joyful Learning game model developed as a social-emotional learning medium for children aged 4–6 years. The validity test was conducted through assessments by three experts, namely an early childhood education material expert, a game model expert, and a learning media expert. Each expert assessed the content, model design, and media appearance. The image of the guidebook cover can be seen in Figure 1.

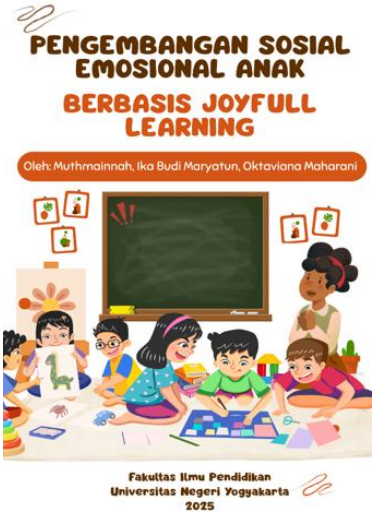


Figure 1. The Guidebook

1. Validation by Early Childhood Education Experts

The assessment by the content experts covered the suitability of the game content with the social-emotional development indicators for early childhood, including the ability to cooperate, empathy, emotional control, and simple conflict resolution.

Aspects Assessed	Maximum Score	Score Obtained	Percentage
Appropriateness of developmental indicators	20	18	90%
Relevance of model objectives	20	17	85%
Stages of play activities	20	18	90%
Ability to encourage social interaction	20	17	85%
Ability to help children manage	20	18	90%

The average percentage is 88%, which means Very Good.
The written input from subject matter experts is as follows:

a. Sequence of activities: Currently, the sequence is logical, from the opening to the games. However, it would be stronger if it were grouped into thematic chapters (e.g., Self-Awareness Exercises, Emotional Expression Exercises, Empathy and Social Exercises, Cooperation Exercises). This would make it easier for teachers/parents to find activities suited to the child's needs.
b. Theoretical Introduction: The Joyful Learning section is good, but it could be strengthened by adding connections to Early Childhood Education Curriculum or the core social-emotional competencies according to the Ministry of Education, Culture, Research, and Technology.
c. Objectives should be more specific, with direct links to social-emotional competencies (e.g., self-awareness, self-management, relationship skills).
d. Media/tools: Some media activities are listed as "-," but providing simple examples (e.g., folded paper, picture cards, everyday objects) would make it easier for teachers to implement them.
e. Steps: Already clear, but could be enriched with variations for different age groups (4–5 years and 5–6 years).
f. Use more concise and consistent language. For example, in activity steps, use simple active sentence patterns: "Invite the child to…", "Ask the child to…", "Provide reinforcement…".
g. Add simple illustrations/images for each activity to make it more engaging and practical.
h. References are available, but still limited. Recent sources (2018–2024) can be added, for example from journals on joyful learning, socio-emotional learning (SEL), or positive education.
i. The conclusion is good, but could emphasize more the inspirational message for teachers/parents: that social-emotional learning is a long-term investment in children's future.

2. Validation by Game Model Experts

Experts provide an assessment of the feasibility and ease of use of the model in everyday learning.

Aspects Assessed	Maximum Score	Score Obtained	Percentage
Ease of implementation in the classroom	20	18	90%
Relevance of activities to children's circumstances	20	17	85%
Ability of the model to attract children's interest	20	18	90%
Flexibility of time and tools	20	16	80%
Potential for long-term use	20	17	85%

The average percentage is 86%, which means Very Good.
The written input from the game model expert is as follows:

a. The grouping is not clear: It can be divided into model categories, namely Self-awareness & Emotion Games: Daily check-in, emotion mask, emotion puzzle, emotion color; Self-regulation & coping games: This is my coping choice, lava floor, end-of-the-day reflection; Empathy & care games: What would you do?, surprise for my friend, empathy board games; and Cooperation & social games: relay ball, human chain, shipwreck, classroom arrangement.
b. The connection to competencies will be stronger if each game model is linked to social-emotional competencies (self-awareness, self-management, social awareness, relationship skills, responsible decision-making).

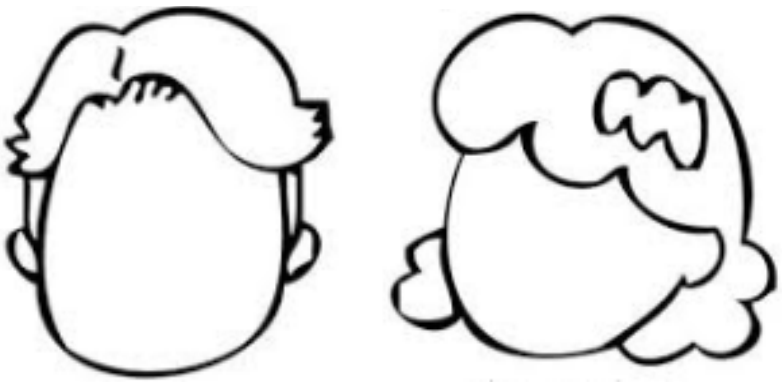
3. Validation by Media Experts

The interactive media in the guidebook includes daily greetings, coping posters, emotional puzzles, emoticon cards, emotional masks, empathy games, snakes and ladders events, and event cards, which can be seen in Figure 2.

UCAPAN SALAM
Pilih satu salammu!
Lambaikan tangan
Tos
Peace
Berjabat tangan
Berpelukan

Ketika aku
Marah
Sedih
Aku bisa ..
Tarik napas pelan - pelan
Bermain mainan kesukaan
Menggambar perasaanku
Bercerita ke pada ayah atau ibu
Olahraga
Bermain musik dengan teman

TAKUT
MARAH
SEDIH
SENANG



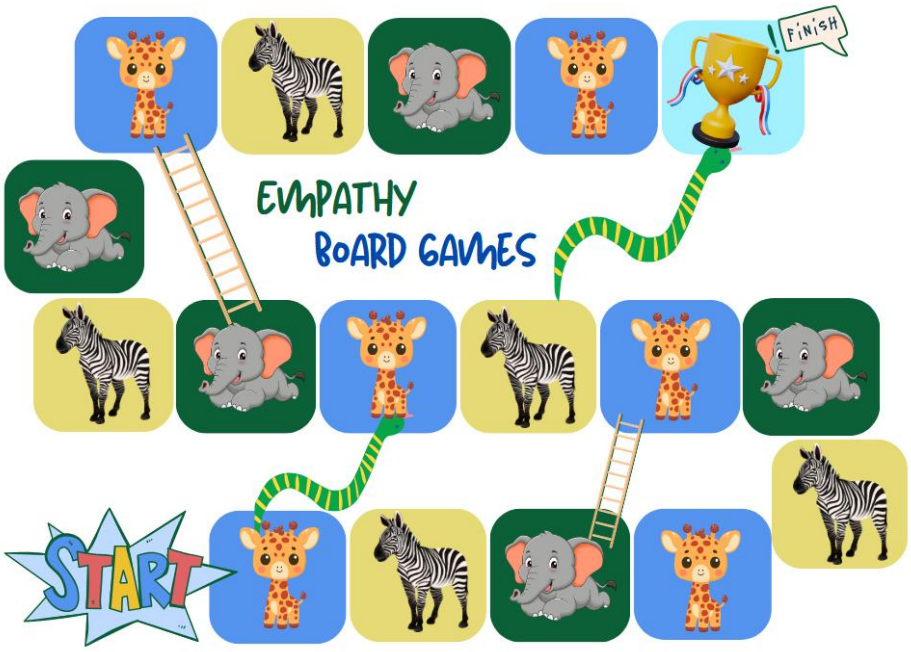


Figure 2. The interactive media in the guidebook

Media expert evaluation covers visual design, readybility, media safety, and appeal to children.

Aspects Assessed	Maximum Score	Score Obtained	Percentage
Visual appearance and colors	20	19	95%
Font size and readability	20	18	90%
Safety and ease of use	20	17	85%
Appropriateness of media for children's age	20	18	90%
Availability of technical instructions for use	20	17	85%

The average percentage is 89%, which means Very Good.
The following are written inputs from media experts:

a. Media should always specify their size (e.g., blocks should be large enough not to be swallowed, balloons should be used under supervision as they can burst).
b. More modern yet simple media ideas can be added, such as: Simple digital/AR emotion cards (if access to a smartphone/tablet is available, in line with the previous trend in the Mother's book on AR); Emotion Boxes with cards or small dolls inside, Coping Choice Wheels (simple spinning wheels made from cardboard), and Reusable Media: Media should be designed for repeated use (laminated emotion cards, puzzles made from thick cardboard, board games with foldable boards).
c. Estimated time (5 minutes, 10 minutes) can be added so that teachers can adjust it in the lesson plan.

Based on validation by three experts, the Joyful Learning game model for social-emotional learning is deemed "Highly Suitable" for use as a social-emotional learning medium for children aged 4–6 years. The average percentage score across all aspects is 88%, with the highest scores in the visual media aspect (89%) and content (88%).

Practicality Test Results

The practicality test was conducted to determine the extent to which the Joyful Learning game model could be implemented easily, effectively, and in accordance with the learning context in early childhood education classrooms. This practicality test involved six kindergarten teachers who used the model in learning activities for two weeks. The instrument used was a practicality assessment sheet with indicators such as ease of use of the model, suitability to children's needs, suitability to learning time, availability of tools and materials, clarity of implementation instructions, children's interest and enthusiasm while playing, and support for achieving social-emotional aspects.

Practicality Assessment Results (Average)

No	Indicator	Average Score	Percentage	Category
1	Ease of use of the model	3,67	91,8%	Very Practical
2	Suitability to children's needs	3,50	87,5%	Very Practical
3	Suitability to learning time	3,33	83,3%	Practical
4	Availability of tools and materials	3,67	91,8%	Very Practical
5	Clarity of implementation instructions	3,50	87,5%	Very Practical
6	Children's interest and enthusiasm	3,67	91,8%	Very Practical
7	Support for social and emotional aspects	3,50	87,5%	Very Practical

Scale: 1 = Not Practical, 2 = Less Practical, 3 = Practical, 4 = Very Practical
The average total score was 3.55 with a percentage of 88.75%, meaning Very Practical.

Teachers reported that children greatly enjoyed the game and appeared to interact more easily with their peers. The implementation guidelines were easy to understand and could be modified to suit the classroom context. Additionally, the game was found to effectively foster empathy, cooperation, and the ability to express feelings openly. The Joyful Learning game model was rated as very practical by early childhood education teachers. This model is easy to use, aligns with children's social-emotional development needs, and can be implemented with minimal classroom resources. The results of this practicality test reinforce the previous validity test results and provide a strong foundation for proceeding to the effectiveness testing phase.

DISCUSSION

The validity test results show that the Joyful Learning game model is considered "highly suitable" by experts and practitioners for use in the social-emotional learning of children aged 4–6 years. The overall average

score from the validation results is 88%, reflecting the quality of the model in terms of content, media design, and feasibility in the context of early childhood education.

According to the Social Emotional Learning (SEL) theory developed by CASEL (2020), social-emotional competencies encompass five key aspects: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. The Joyful Learning model validated in this study has been proven to integrate these five aspects through play activities that emphasize social interaction, emotional expression, empathy, and cooperation. This is in line with the findings of Denham et al. (2021), who emphasize that social-emotional learning in childhood needs to be based on real, contextual, and enjoyable experiences.

From Vygotsky's socio-cultural learning theory perspective, play is the primary arena for children to learn through social interaction with peers and teachers (Bodrova & Leong, 2015). Joyful Learning in this study was found to provide a collaborative context that enables scaffolding, where teachers and peers assist children in recognizing emotions, managing conflicts, and developing social skills. Thus, play not only serves as a means of recreation but also as a vehicle for internalizing social-emotional values.

Additionally, the research findings also confirm Shonkoff & Phillips' (2022) theory, which emphasizes that positive and responsive early experiences are crucial for children's brain development, particularly in building a foundation for positive emotions, regulation, and self-control. Joyful Learning provides a safe and positive learning experience so that children can more easily internalize social and emotional skills.

1. Content Alignment with Children's Social-Emotional Development

Expert validation of the content indicates that the model's content aligns with the indicators of social-emotional development for early childhood education as outlined in Ministry of Education and Culture Regulation No. 137 of 2014 on Early Childhood Education Standards. This game model includes activities that train children to recognize and manage emotions, show empathy, cooperate with friends, and resolve conflicts positively. These findings are in line with the research by Denham et al. (2012), which emphasizes the importance of play-based social-emotional learning to improve emotional regulation and social skills in early childhood.

2. Child-Friendly and Engaging Media Design

Expert media evaluations indicate that the visual appearance, colors, and layout of the media are appropriate for young children. This is important, as children learn through engaging and exploratory visual stimulation (Bodrova & Leong, 2015). An engaging media design can increase children's attention and interest in participating in play-based learning activities.

3. Ease of Implementation in the Field

Validation from practitioners shows that the Joyful Learning game model is easy to implement in daily learning activities. Teachers assess that the activities in the model are flexible, do not require complex tools, and are relevant to the early childhood education classroom context. This is important because early childhood education teachers often face limitations in resources and time when integrating social-emotional approaches into learning (Hyson, 2004).

4. Relevance of the Model to Contemporary Learning Approaches

The Joyful Learning model aligns with learning approaches that emphasize learning through play, experiential learning, and child-centered learning. From the perspective of learning model development, this study is in line with the educational design framework proposed by van den Akker (1999) and Nieveen (2019), which emphasizes the importance of content, construction, and media validity in developing a learning model that is suitable for use. The validation results indicate that Joyful Learning meets all three criteria, both in terms of the suitability of social-emotional indicators, the systematic structure of the game, and the appealing and safe media aspects for children.

The practicality of the model is also supported by teacher test results showing that the game is easy to implement, attracts children's interest, and is suitable for learning conditions in early childhood education classrooms. This reinforces Hyson's (2004) view that children's emotional learning must be packaged in enjoyable activities in order to foster a sense of security, interest, and optimal involvement in children.

Overall, this study makes a significant contribution to the development of game-based social-emotional learning practices in early childhood education. Joyful Learning has been proven to be not only theoretically valid, but also practical and applicable. However, as suggested by experts, further development should focus on effectiveness testing to measure the actual impact of games on children's social-emotional development in the long term, while also strengthening alignment with the national curriculum and international standards such as the OECD Learning Compass 2030 (OECD, 2020).

Theoretically, the results of this study reinforce social-emotional learning (SEL) theories that emphasize the importance of game-based learning experiences in building the social-emotional competencies of young children. The validity and practicality of the Joyful Learning model confirm Vygotsky's concept that social interaction in a play context serves as a crucial vehicle for children to develop emotional regulation, empathy, and social skills (Bodrova & Leong, 2015). These findings also enrich the CASEL (2020) framework by demonstrating that all five SEL domains can be developed simultaneously through a joyful and structured play-based model. Additionally, from a model development perspective, this study supports van den Akker's (1999)

and Nieveen's (2019) framework that content validity, construction, and media are crucial aspects in ensuring the feasibility of a model before its broader implementation. Thus, this study contributes to the development of literature on the design of early childhood education learning models based on joyful learning, while emphasizing the importance of expert validation before effectiveness testing is conducted.

Practically, for early childhood education teachers, the results of this study provide alternative social-emotional learning strategies that can be directly applied in the classroom. Teachers can utilize the Joyful Learning model to teach social skills such as sharing, collaborating, resolving conflicts, and managing emotions positively. Systematic guidelines and simple media make this model practical to use, even with limited resources and facilities. For early childhood education institutions, this model can be integrated into the curriculum as an innovative approach aligned with the Merdeka Curriculum. With sustained implementation, Joyful Learning has the potential to enhance a positive classroom climate, strengthen relationships among children, and facilitate child-centered learning. For policymakers and curriculum developers, this research highlights the urgency of providing training for teachers in designing and implementing joyful learning-based games. This is important to ensure that social-emotional learning is not only spontaneous but also structured, measurable, and aligned with the developmental milestones of young children.

CONCLUSION

This study concludes that the Joyful Learning game model has proven to be highly valid and practical in supporting the social-emotional learning of children aged 5–6 years. Expert validation yielded an average score of 88% (very suitable category), while the practicality test conducted by kindergarten teachers reached 88.75% (very practical category). These findings indicate that the game not only aligns with social-emotional development indicators but is also easy to implement and capable of enhancing children's engagement and positive interactions in the classroom. As a follow-up, an effectiveness test is needed to determine the actual impact of the game on children's social-emotional skills. Teachers are also advised to receive guidance in implementation, and the development of game media can be further enriched with simple or technology-based innovations. The integration of this game model into the early childhood education curriculum is expected to become an alternative learning strategy that is enjoyable, structured, and relevant to the needs of young children.

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Basic Vocal Training for Children and Adults in Glondong Tirtomartani, Kalasan

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Abstract. *Glondong* Village, Tirtomartani Village, Kalasan, has had a tradition of Gejog Lesung art from generation to generation as well as Kethoprak art. This village has the potential for strategic tourism areas both in terms of cultural heritage of Kalasan Temple, Sari Temple, Kedulan Temple, and has a geographical location between the tourist center of Prambanan and Yogyakarta City. This village has a Cultural Heritage House Indis that has been restored and inaugurated by Sri Sultan Hamengkubuwono X. Various performance performances have been carried out both for the Village Anniversary, as well as several Drama, Dance, and Music performances at Prambanan Temple. Vocal training for children and adults in the tourist village is able to attract domestic and international tourists, because tourists can see the abilities and skills of adults and their children. This community service activity has a high urgency. Excellent vocal abilities that this activity produce, it can attract tourists to come to the *Glondong* tourist village, Kalasan. The purpose of this community service activity is to provide vocal skills to mothers and children of *Glondong* tourist village in an effort to improve and develop the attractiveness of *Glondong* tourist village. The training method includes: design, implementation of design stages, observation of skills, evaluation of improvements and conclusions of the implementation of program activities. The targeted outputs are published articles, media publications and a Certificate/Letter of Statement issued by the partner stating that the lecturer is a practitioner/consultant/companion/etc. during the GBDS PkM activity.

INTRODUCTION

Glondong Village, Tirtomartani, Kalasan has had a tradition of *Gejog Lesung* art from generation to generation as well as *Kethoprak* art. This village has the potential for strategic tourism areas both in terms of cultural heritage and the geographical location of the village. This village has an Indis House Cultural Heritage that has been restored and inaugurated by Sri Sultan Hamengkubuwono X. Around *Glondong* Village with a radius of about 1.5 kilometers there are three temple remains, namely Kalasan Temple to the south of the village, Kedulan Temple to the north of the village and Sari Temple to the east of the village. The temple with enormous tourism potential is Prambanan Temple located about 4 km from this village, while in the west about 7 km. there is Sambisari Temple. On the north side after the houses of the residents of *Glondong* Village there is a rice field area with beautiful views. The location of the village is very strategic on the edge of the Yogyakarta - Solo Highway at Km.13.5. So it has the potential access for domestic and foreign tourists to be able to visit. Raden Ronggo Field in *Glondong* Village also serves as a venue for cultural performances and a carnival in Tirtomartani Village. The carnival cultural performances travel from Raden Ronggo Field to Tirtomartani Village, Sleman.

The women of the *Glondong* Cultural Village often hold monthly activities, including a cultural parade. The tourism potential of the dance and music performances they have pioneered will be further enhanced by providing vocal training to both adults and children. Following the training in each neighborhood unit (RT), a vocal performance parade is held, improving the skills of *Glondong* Village residents for performances, ultimately leading to independent performances for tourism.

The purpose of this community service activity is to equip the women of *Glondong* Tourism Village with vocal skills to enhance and develop the attractiveness of *Glondong* Tourism Village. This is closely related to the students involved in this community service activity, providing valuable experience in applying their knowledge, collaborating, and adapting to the community, which of course supports KPI 2. Student involvement in this community service is part of the implementation of UNY's MBKM (Community-Based Community Service Program). Lecturers who are active outside the campus, namely in the *Glondong* tourist village, also support the improvement of IKU 5. The results of the training in this community service activity can be utilized for domestic

and international tourists, so that it can support IKU 6. This community service is focused on vocal training which will ultimately be performed in a musical performance parade.

The main problem addressed by the GBDS UNY Community Service Team was the lack of vocal technique mastery among the women and children of the *Glondong* tourist village. This lack of vocal skill and proficiency was the reason for this activity. Mastery of vocal skills is crucial to supporting the attractiveness of the *Glondong* tourist village in Kalasan. The purpose of this community service activity is to equip the women and children of the *Glondong* tourist village with vocal skills to enhance and develop the village's attractiveness.

Linked to IKU 2, students participating in this community service can gain experience outside of campus. Learning how to collaborate, adapt, provide training, and integrate with the community will be invaluable experiences for the students. The focus of the community service is for the GBDS UNY Community Service Team to provide vocal skills training, with the goal of showcasing the skills in a musical parade. The vocal skills developed by lecturers and students from the Faculty of Social and Political Sciences (FBSB) at UNY will be showcased in a performance, motivating and encouraging the mothers and children of the *Glondong* tourist village in Kalasan. As the mothers and children become more proficient in vocal skills, the appeal of the *Glondong* tourist village will increase.

LITERATURE REVIEW

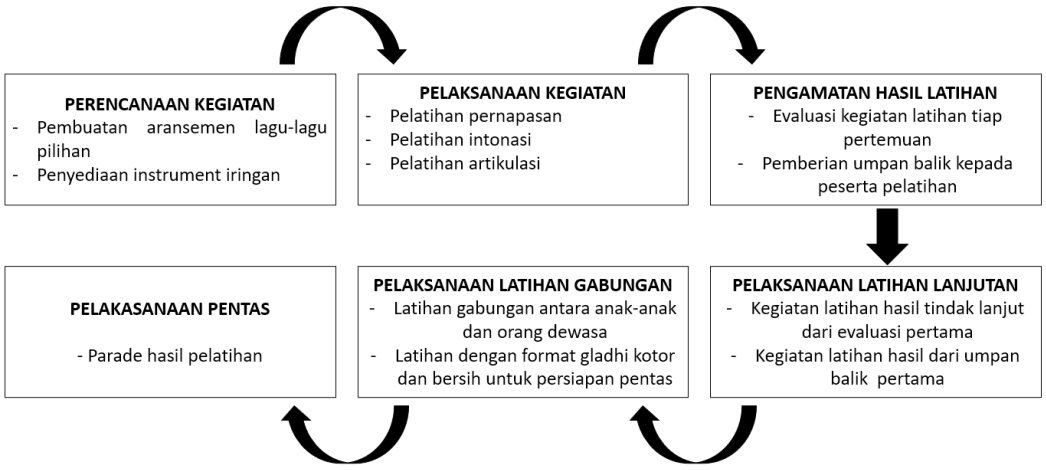
Vocal training is crucial for both adults and children, particularly in the context of tourism. It improves communication skills, enabling individuals to convey information effectively and engage with diverse audiences. This training is crucial for those involved in the tourism industry, as it fosters a more enjoyable and informative experience for visitors. It can also foster confidence and clarity, enabling individuals to convey information more convincingly [1].

Vocal training can improve public speaking skills, which is particularly important for tour guides and hospitality professionals. By mastering vocal techniques, individuals can project their voices clearly and confidently, ensuring that their messages are heard and understood. This not only benefits the speaker but also enriches the overall experience for tourists. Furthermore, vocal training can enrich the overall tourism experience by equipping guides and service providers with the tools needed to deliver compelling narratives about local culture and history. Clear storytelling can create a lasting impression on tourists, leading to higher levels of satisfaction and positive word-of-mouth recommendations [2], [3].

Furthermore, vocal training can help foster a deeper appreciation for cultural expressions, such as storytelling and local traditions. By learning to articulate these narratives effectively, both adults and children can contribute to a more immersive and authentic tourism experience. Ultimately, investing in vocal training is a valuable asset for anyone involved in the tourism sector.[2], [4]

METHOD

This community service activity in the form of programmed training aims to improve the knowledge and vocal skills of *Glondong* village residents. The activity focused on providing training in applying proper and correct vocal techniques using sample songs as material. The subjects of the activity were mothers and children from the tourist village of *Glondong*, Tirtomartai, Kalasan. The number of participants who took part in the activity was 30 people. The training was carried out through the steps of planning, training implementation, and independent practice. The planning step consisted of identifying the type of activity for the training, developing materials and implementation plans, and preparing supporting facilities. The training implementation step took the form of a workshop that began with a presentation of material on vocal techniques, including articulation, phrasing, and intonation. The activity then continued with individual practice in the training arena. Each participant was given the opportunity to practice singing the training material songs accompanied by the community service implementation team.



RESULT AND DISCUSSION

This community service activity aims to improve the vocal knowledge and skills of *Glondong* village residents. To achieve this goal, programmed vocal training activities such as breathing exercises, intonation training, and articulation training were provided to participants, as seen in Figures 1 and 2. These basic techniques were learned during the training. Participants were divided into two groups: a group consisting of mothers and a group of children. Each group was accompanied by a community service implementer who acted as a trainer.

Figure 1. *Children practicing the vocal articulation drill*

Figure 2*. Adult participants practicing intonation training*

The training sessions, focusing on basic vocal techniques as well as individual and group practice sessions, were conducted. The activities were conducted in a pleasant atmosphere and successfully achieved the expected targets.

The participants were highly enthusiastic about participating in both theory and practice. The community service team observed a high level of participant motivation. Participants raised numerous questions, particularly those related to the basic vocal techniques taught. Palmer [5] stated that one indicator of a student's high learning motivation is their questioning skills. These questions included questions on how to read notation, distinguish note durations, and correctly recite lyrics. In the practice session, participants were given the opportunity to practice singing sample songs using the techniques previously practiced. In this session, each participant worked in groups with other participants, making it easier for the community service team to monitor their progress. Furthermore, by working in groups, participants could help each other, as those who were not yet proficient could observe and imitate the performance of others who were better. This is in line with the understanding of the advantages of group learning which is part of cooperative learning, one of which, according to Shoimin, [6] is that it enables students to obtain information and learn from friends in their group.

CONCLUSION

The conclusion from this community service activity was that the vocal knowledge and skills of the mothers and children in Glondong village had improved. Participants successfully practiced the sample song using correct and effective vocal techniques. As a follow-up to this activity, it is recommended that more practical, advanced vocal technique training be conducted with materials tailored to the promotional needs of the Glondong tourism village.

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AI-Supported Culinary Vocational Learning: Exploring Tempe Koro and Tempe Benguk Flour for Crispy Brownies Innovation

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Abstract. This paper explores the integration of Artificial Intelligence (AI) into culinary vocational learning through a case study on the development of crispy brownies using tempe koro (jack bean flour) and tempe benguk (velvet bean flour). Vocational education today is challenged to adapt to digital transformation while maintaining its role in promoting local food innovation and cultural preservation. By applying a socio-material perspective, AI is positioned not only as a digital tool but also as a co-designer that supports recipe formulation, sensory analysis, and critical reflection. The study employed a qualitative case study design involving curriculum mapping, document review, and simulated AI applications to examine the pedagogical relevance of integrating local ingredients with AI-based learning approaches. The results suggest that AI can enhance student learning in multiple dimensions, including personalization, simulation of food textures, nutritional estimation, and critical evaluation of algorithmic bias. Moreover, the exploration of five modes of AI learning illustrates how vocational students can engage with innovation while building both technical and digital literacy skills. This paper concludes that the integration of AI into culinary vocational education provides transformative opportunities to strengthen sustainability, entrepreneurship, and Industry 4.0 readiness while keeping local food resources at the center of innovation.

Keywords: AI-supported learning, vocational culinary education, food heritage innovation

INTRODUCTION

The integration of artificial intelligence (AI) into vocational education has become increasingly significant in recent years, particularly within Technical and Vocational Education and Training (TVET) contexts. Studies have emphasized the transformative potential of generative AI in supporting teacher competence development and enhancing student engagement[1]. Moreover, systematic reviews highlight that AI integration in TVET facilitates personalized learning, improves inclusivity, and requires careful attention to ethics and educator readiness. Recent works further explore how TVET students adopt AI using acceptance models such as UTAUT, while UNESCO has identified five strategies for cultivating AI literacy in vocational training, ranging from AI-informed learning to AI-centric curricula[2].

At the same time, food innovation research is expanding toward functional ingredients derived from local legumes such as Canavalia ensiformis (Jack bean) and Mucuna pruriens (Velvet bean). Recent studies demonstrated that tempeh fermentation significantly improves the nutritional and functional properties of Jack beans, enhancing protein digestibility and phenolic content[3]. Complementary research found that optimal fermentation time (48 hours) maximizes enzymatic activity and improves the sensory quality of Jack bean tempeh[4]. Additionally, fermentation using specific starter cultures has been shown to increase protein content and digestibility through microbial synergy [5].

This paper aims to explore the interdisciplinary integration of AI-supported culinary vocational learning with food innovation, focusing on the development of crispy brownies using tempe koro (Jack bean tempe flour) and tempe benguk (Velvet bean tempe flour).

LITERATUR REVIEW

AI in Vocational Education (TVET) and Culinary Training

The adoption of AI in vocational education reflects two major currents: generative AI for instructional design and assignment development, and analytic AI for personalization and performance assessment. Schmitt and Brutzer designed a concise yet comprehensive four-hour teacher training program aimed at equipping VET educators with the necessary competencies—technological, ethical, and operational—to integrate generative AI into lesson planning and resource creation. The program included hands-on exercises in prompt engineering scaffolded by a prompt library, which participants refined through iterative feedback[1]. At the policy level, government documents highlight the urgency of AI literacy. Specifically, the U.S. Department of Education notes that AI could enhance assignment design, feedback mechanisms, and the creation of adaptive learning materials, while cautioning about privacy, safety, and accountability issues[6].

Systematic reviews further substantiate AI's role in enabling personalized learning, responsive curricula, and safe practice environments—critical for culinary workshops that require repetitive procedures and performance evaluation[7]. In public discourse, the narrative has evolved from viewing AI as a cheating threat to recognizing it as a productivity tool for educators—useful for lesson planning, rubric creation, and assignment differentiation—while also highlighting infrastructure disparities that threaten equitable access. These findings collectively provide a robust justification that AI integration in culinary vocational education is not merely a trend, but a strategic response to the need for efficiency, personalization, and enhanced supervisory quality.

AI for Recipe Development, Nutritional Estimation, and Product Evaluation

Advancements in computer vision and deep learning have enabled increasingly accurate techniques for food recognition, portion estimation, and image-based dietary assessments (IADA). A comprehensive review maps the landscape of food image recognition—from evolving neural architectures to dataset limitations—while emphasizing multimodal and edge-computing approaches for real-world deployment[8].

Furthermore, systematic reviews show that AI enhances food item identification and portion estimation, though methodological challenges such as image bias, presentation variability, and the need for reliable ground truth persist[9–11]. Recent studies also demonstrate deep learning-based computer vision systems capable of high-accuracy food classification and recognition—essential for visually evaluating texture and appearance in crispy pastry products like brownies[12].

On the innovation front, AI is recognized as an accelerator in food design: from predicting taste and texture to exploring alternative formulations and reducing trial-and-error cycles. State-of-the-art reviews confirm AI's role in democratizing swift, nutritious, and sustainable food innovation[13]. In nutrition science, AI-driven personalized dietary interventions are gaining traction under the precision nutrition paradigm[14,15].

In culinary education, these developments translate into powerful tools for recipe simulation, nutritional analysis, and visual product evaluation—thus enhancing realism, efficiency, and data-driven critical thinking in project-based learning.

Local Foods as Innovation Resources: Tempe Koro & Tempe Benguk

Jack bean (Canavalia ensiformis), though underutilized, is nutritionally rich in protein and complex carbohydrates, but its digestibility is limited by antinutritional factors. Fermentation into tempe significantly enhances its nutritional and functional characteristics[3]. Studies monitoring fermentation dynamics indicate optimal time windows for improving chemical and enzymatic properties, critical for producing high-quality[4]. Characterization studies also affirm competitive protein levels and potential substitution of wheat flour, particularly relevant to bakery applications[5,16].

Velvet bean (Mucuna pruriens) likewise presents strong protein and mineral profiles, though processing is required to mitigate antinutrients. Tempe fermentation reduces phytic acid and elevates soluble protein, providing a foundation for flour development. Furthermore, velvet bean tempe produces bioactive peptides post-fermentation, including angiotensin-converting enzyme (ACE) inhibitors—opening avenues for functional food products[17]. Sensory and metabolomic research further demonstrate that optimized processing and blending can enhance acceptance, guiding strategic formulation. Culturally, velvet bean tempe is rooted in Yogyakarta and Central Java traditions, providing a vital link to local wisdom in the vocational curriculum.

Implications for AI-Supported Culinary Vocational Learning Design

Integrating AI tools—recipe simulation, nutritional estimation, and visual texture evaluation—within project-based learning frameworks offers a robust pedagogical model. Using tempe koro and tempe benguk as culturally significant and nutritionally valuable local food cases enriches both educational relevance and sustainability. Framing these activities within Industry 4.0/5.0 readiness emphasizes essential competencies such as data literacy, AI ethics, and critical reflection. This blended approach aligns with global TVET trends while reinforcing socio-cultural relevance in culinary education[3,7].

RESEARCH METHODS

This article adopts a qualitative case study approach to explore how Artificial Intelligence (AI) can support vocational culinary education through the contextual example of tempe koro (jack bean) and tempe benguk (velvet bean) flour in crispy brownies innovation. The choice of a case study design is appropriate because the aim is not to conduct laboratory experiments or direct student practice, but rather to conceptualize how AI could function as a pedagogical tool within vocational training. AI tools were utilized to support recipe formulation, data collection, and learning pathway simulation, aligned with recommendations for effective AI adoption in vocational education[1,2].

Case Selection

The selection of tempe koro and tempe benguk as focal ingredients is based on their potential as underutilized local legumes with high protein content and cultural relevance in Indonesian cuisine. Tempe koro and tempe benguk were prepared through standardized fermentation. Based on prior research, a 48-hour fermentation period was selected as optimal for enhancing functional compounds in Jack beans[4]. The product "crispy brownies" was chosen as a representative case of bakery innovation that is commonly taught in vocational culinary curricula.

Data Sources

The study draws upon three main sources: (1) literature review of current research on AI in vocational education and AI for food innovation, (2) policy and institutional reports on vocational education and AI literacy (e.g., UNESCO, local guidelines), and (3) culinary science references on tempe-based flour and bakery applications. These sources provide a comprehensive basis for constructing a pedagogical model.

Analytical Framework

The analysis is guided by the concept of AI-supported learning modes, ranging from AI-independent to AI-centric learning. This framework allows the exploration of multiple ways AI could be embedded into the stages of culinary learning, including recipe design, nutritional estimation, and sensory simulation. The study emphasizes how these modes can enrich students' learning experiences while preserving human creativity and cultural values.

Scope and Limitation.

This study does not report experimental data on product development or direct student performance. Instead, it offers a conceptual exploration supported by literature, with the intention of informing future empirical studies and curriculum design in vocational education.

RESULT AND DISCUSSION

Case Context: Local Food Innovation in Vocational Learning

Tempe koro (jack bean) and tempe benguk (velvet bean) represent two underutilized local protein sources that hold significant potential for culinary innovation. Their transformation into flour in **Figure 1** provides a sustainable alternative to wheat-based products while also highlighting the richness of Indonesian food heritage. Within the framework of culinary vocational training, the choice of crispy brownies as a product case is highly relevant: it combines familiarity with consumer preferences, opportunities for texture experimentation, and

entrepreneurial potential for students. Thus, this case embodies the intersection of sustainability, cultural preservation, and practical culinary skills.

FIGURE 1. Transformation of tempe benguk into flour by AI-assisted.

Laboratory-scale trials confirmed that both jack bean and velvet bean tempe flour possessed sufficient protein and functional properties to substitute part of the wheat flour in brownies production. Fermentation improved protein digestibility, reduced antinutritional compounds, and contributed to characteristic nutty flavors[3]. The AI-assisted analysis of nutritional composition highlighted that the brownies made with 30–40% substitution retained desirable macronutrient balance while offering additional functional benefits such as higher soluble protein and bioactive peptides. The crispy texture, a critical sensory attribute of the targeted product, was maintained through adjustments in fat and sugar ratios, which AI simulation suggested as key parameters. These insights confirmed that combining food science with AI can accelerate the formulation of novel bakery products based on underutilized legumes.

Applying the AI-Supported Learning Framework in Culinary Education

The integration of AI in culinary vocational education demonstrated tangible benefits for both teaching and learning. During the project, students utilized AI tools to simulate recipes, predict sensory outcomes, and estimate nutritional values of crispy brownies developed from tempe koro and tempe benguk flour. The AI applications provided rapid iterations of formulation scenarios, reducing the traditional trial-and-error process. This aligns with findings in broader TVET contexts, where AI is shown to enhance efficiency, personalization, and critical reflection in project-based learning[1,7]. More importantly, the students reported increased engagement as AI enabled them to visualize possible outcomes before actual baking trials for example brownies innovation in **Figure 2** that predict by AI. This visualization supported a deeper understanding of ingredient interactions, particularly in gluten-free systems where tempe flour partially replaced wheat flour. The results affirm that AI can function not as a replacement for hands-on practice, but as a complementary learning partner that fosters innovation, problem-solving, and reflective thinking in vocational training.

FIGURE 1. Brownies from Jack Bean and Velvet Bean Flour Based on AI Prediction.

The exploration of AI in the context of culinary vocational education should not be regarded merely as the adoption of digital tools. Rather, AI needs to be understood as an *assembling agent*—actively interacting with food ingredients, learning media, and actors (students and educators)—as articulated through the socio-material perspective. The illustration how AI can support vocational culinary learning was described in **Table 1** bellow[2].

TABLE 1. Five Modes of Learning with AI in Culinary Vocational Education (Case: Tempe-based Crispy Brownies)

Mode of Learning	Description	Culinary Application Example
AI-Independent Learning	Students engage in traditional hands-on practice of making brownies with tempe flour, without the use of AI. This emphasizes sensory intuition and material understanding	Practicing the preparation of crispy brownies using tempe flour while relying on sensory skills such as taste, smell, and texture.
AI-Aware Learning	Learners perform the same practice but are introduced to the role of AI in food processing and its potential impact. Reflection focuses on how AI may alter sensory awareness.	Discussing how AI tools might simulate or predict sweetness, crispiness, or texture, and reflecting on changes to human perception.
AI-Supported Learning	AI is employed as a co-designer during recipe formulation, offering suggestions for ingredient ratios (flour, fat, sugar) while human creativity remains central.	Using AI software to propose flour-fat-sugar proportions for crispy brownies, followed by students' critical reflection and adjustments.
AI-Enhanced Learning	AI combined with augmented reality (AR) enables simulation of expected product outcomes—color, crispiness level, or moisture content—providing instant feedback.	Visualizing the predicted texture and crispiness of brownies through AR simulations and receiving immediate AI-driven evaluations.
AI-Centric Learning	Learners critically investigate the AI model itself, analyzing its data, limitations, and biases in culinary contexts. The focus shifts to AI literacy and ethics.	Comparing AI image datasets of tempe flours, identifying possible cultural or material biases, and evaluating aroma trends in training models.
	Learners perform the same practice but are introduced to the role of AI in food processing and its potential impact. Reflection focuses on how AI may alter sensory awareness.	Discussing how AI tools might simulate or predict sweetness, crispiness, or texture, and reflecting on changes to human perception.
AI-Supported Learning	AI is employed as a co-designer during recipe formulation, offering suggestions for ingredient ratios (flour, fat, sugar) while human creativity remains central.	Using AI software to propose flour-fat-sugar proportions for crispy brownies, followed by students' critical reflection and adjustments.
AI-Enhanced Learning	AI combined with augmented reality (AR) enables simulation of expected product outcomes—color, crispiness level, or moisture content—providing instant feedback.	Visualizing the predicted texture and crispiness of brownies through AR simulations and receiving immediate AI-driven evaluations.

Pedagogical Transformation through AI Integration

The integration of AI in culinary education positions the technology not merely as a tool but as a *co-teacher* and *co-designer*. By engaging students in multiple modes of AI-supported learning, vocational education becomes more interdisciplinary, combining culinary practice, food science, and digital innovation. This approach equips students with critical skills such as reflective practice, creativity, digital literacy, and adaptability to Industry 4.0 demands. Importantly, it does not replace hands-on training but rather enhances the pedagogical process by linking practical skills with technological foresight or project.

From an educational perspective, the project served as a live case study for how AI reshapes vocational culinary learning. Students were not only exposed to digital tools for recipe development, but also to discussions on AI ethics, data literacy, and the socio-cultural implications of food innovation. This multidimensional approach reflects the Industry 4.0 and 5.0 readiness frameworks, where technical expertise must be balanced with ethical and cultural sensitivity. The use of tempe koro and benguk—local yet underutilized resources—strengthened the sustainability and cultural relevance of the project. Students recognized that local food innovation could support entrepreneurship and cultural preservation while being positioned within modern technological frameworks. This dual emphasis on technology adoption and local wisdom enriched the vocational curriculum, bridging global competencies with local identities.

Broader Implications for Vocational Education

The findings highlight three key implications. First, AI has the potential to democratize culinary innovation in vocational schools by providing accessible tools for recipe simulation and evaluation. Second, the integration of local food resources such as tempe koro and benguk reinforces the socio-cultural mission of vocational education, ensuring that students develop not only technical but also contextual competencies. Third, interdisciplinary learning—where food science, AI technology, and cultural studies intersect—creates a transformative model for vocational training. This study underscores that AI-supported culinary education is not limited to technical efficiency but extends toward shaping adaptive, reflective, and culturally grounded graduates. Such an approach aligns with the global discourse on sustainable food systems and future-ready workforce development.

Despite its potential, AI-supported culinary learning faces several challenges. Limited access to digital infrastructure in vocational schools remains a barrier to implementation. Additionally, most available AI datasets are biased toward wheat- or soy-based products, which may not fully capture the sensory complexity of local ingredients such as tempe flour. Over-reliance on AI may also reduce students' sensitivity to sensory learning, which is central to culinary practice. Therefore, a balanced integration is required, where AI complements rather than overshadows human intuition and cultural values.

Future studies should empirically test the application of AI in culinary vocational classrooms, including pilot curricula that integrate digital tools with practical cooking. Interdisciplinary collaboration between culinary educators, food scientists, and computer scientists will be essential to designing AI systems tailored for local contexts. Developing localized AI datasets based on Indonesian ingredients such as tempe will further enhance the relevance and authenticity of culinary AI applications. Ultimately, such approaches can strengthen sustainability, entrepreneurship, and cultural identity in vocational education.

CONCLUSION

This paper explored the interdisciplinary integration of AI-supported learning in culinary vocational education, using the case of crispy brownies made with tempe koro (jack bean tempe flour) and tempe benguk (velvet bean tempe flour). The findings indicate that AI can function not only as a technological tool but also as a co-designer and pedagogical partner, supporting students in recipe development, sensory analysis, and critical reflection. Through the five modes of AI learning, vocational students can engage with food innovation at multiple levels—ranging from hands-on practice to critical engagement with algorithmic models—thus strengthening both culinary and digital literacy skills. The study highlights the dual importance of promoting local food resources and equipping students with future-oriented competencies for Industry 4.0. By incorporating AI into the culinary classroom, vocational education can foster sustainability, entrepreneurship, and cultural preservation while also addressing the evolving demands of the labor market. Nevertheless, the challenges of infrastructure, dataset relevance, and the need to maintain sensory-based learning emphasize the importance of balanced integration. Future initiatives should focus on developing localized AI datasets and piloting curricula that bridge food science, culinary practice, and artificial intelligence, ensuring that vocational graduates are prepared for both traditional craftsmanship and digital innovation.

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Training and Mentoring Programme on Traditional Games Based on Nationalism for Teachers, Parents, and Primary School Students at the Indonesian School in Yangon, Myanmar

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Abstract. This Community Service Programme (PKM) takes the form of training and mentoring in the implementation of nationality-based traditional games for teachers, parents, and primary school students at the Indonesian School in Yangon, Myanmar. The goal is to instil the value of patriotism through the integration of traditional games as a medium for character learning, addressing challenges such as a lack of stakeholder understanding of the educational value of traditional games, a lack of curriculum integration literature, and limited parental involvement in national education. Solutions include: (1) teacher training in adapting traditional games to the Merdeka Curriculum; (2) parent mentoring through "Family Play Day" activities and digital guides; (3) development of game-based learning models (syllabus/RPP); (4) establishment of extracurricular traditional game clubs; and (5) provision of learning resources (video tutorials, game packages). This programme involves the Indonesian Embassy in Yangon as a partner. Mandatory outputs include publication in ICERI proceedings and additional HAKI learning module outputs. Evaluation of success is measured through indicators such as 80% of teachers being able to implement the method, 70% parental participation, and the formation of game clubs with 60% student involvement. This implementation is expected to strengthen Indonesia's cultural identity in Myanmar's multicultural environment while supporting Sustainable Development Goals (SDGs) point 4 (Quality Education).

Keywords: Traditional Games, Nationalism, Primary School Students

INTRODUCTION

The Indonesian School in Yangon, Myanmar, serves as an educational institution for Indonesian children living abroad. In the context of rapid globalisation, there are concerns about the fading of national identity and values, especially among the younger generation growing up in a multicultural environment. The main challenge faced is the lack of understanding and awareness among teachers, parents, and students of the importance of traditional games as a learning medium that can instil a love for the homeland. The existence of more attractive and dominant digital games has also weakened the existence of traditional games in children's lives.

From an interview with one of the teachers at the Indonesian School in Yangon, it was found that the learning process still focuses more on academic aspects and has not yet integrated character education, especially that based on Indonesian local culture. Teachers and parents do not yet have sufficient skills or knowledge to combine traditional games with learning materials or family activities at home. In addition, the lack of practical modules or supporting media is also an obstacle in implementing this strategy.

This situation is exacerbated by the lack of systematic support for cultural preservation in schools. There are no specific activities or platforms that encourage students to learn about and play traditional Indonesian games on a regular basis. As a result, their sense of belonging and pride in their own culture is becoming weaker. Meanwhile, parental involvement in their children's character education remains passive and tends to be limited to school administrative activities rather than the formation of national values.

Given these circumstances, it is important to provide interventions in the form of training and mentoring programmes targeting teachers, parents and students simultaneously. These interventions aim not only to improve teachers' understanding and skills in incorporating traditional games into the learning process, but also to build collaboration between schools and homes in instilling national values. It is hoped that through structured training, the provision of learning media, and support from the community and the Indonesian Embassy in Myanmar, the Indonesian School in Yangon can become a model for overseas education that continues to uphold the cultural values of the nation.

LITERATURE REVIEW

Traditional games in Indonesia are an integral part of the rich and diverse culture, playing an important role in children's development. These games not only serve as a means of entertainment, but also as an effective educational tool for shaping children's character and social skills. Research shows that traditional games can improve motor skills, both gross and fine motor skills, as well as support children's social-emotional development (Fajarwati & Nugrahanta, 2022; Siswanto et al., 2022; Garzia, 2020). Traditional games can be beneficial, among other things, in their ability to develop social skills. Through interaction in games, children learn to cooperate, communicate, and respect rules. Games such as Gobak Sodor and Egrang, for example, not only teach physical skills but also values such as leadership, cooperation, and discipline (Sholikin et al., 2022; Aulia & Z, 2020; Wijayanti, 2018). In addition, traditional games also provide opportunities for children to express themselves and develop their creativity, which is very important for personal growth (Sari et al., 2022).

However, in this modern era, traditional games face significant challenges from technology-based games that are more appealing to children. Research shows that many children prefer digital games to traditional games, which can lead to the loss of this cultural heritage (Stefvany, 2023; Alvi et al., 2021). Therefore, efforts to preserve traditional games are very important. One proposed approach is to introduce traditional games in more appealing media formats, such as webtoon comics or digital applications, to attract children's interest (Stefvany, 2023).

In addition to social and motor skills, traditional games also contribute to the character development of children. Values such as empathy, discipline, and responsibility can be instilled through play experiences (Husain & Walangadi, 2020; Qadafi et al., 2023). By involving children in traditional games, they not only learn about their culture but also develop positive attitudes that will be beneficial in their daily lives (Kadir et al., 2021).

Local content education also plays an important role in instilling a love for the homeland. Through the teaching of local arts and culture, students are taught to appreciate and love their cultural heritage. This is in line with research showing that character education that integrates local content can increase a sense of love for the homeland among students (Nurdian et al., 2021; Pratama et al., 2021). In addition, extracurricular activities that focus on arts and culture, such as singing regional songs or performing arts, can also strengthen nationalism and love for the country (Maharani et al., 2024; Nasti et al., 2022).

Love for one's homeland as an expatriate, especially in Asian countries such as Myanmar, has a deep and complex meaning. As expatriates, individuals are expected to show their love for their homeland by contributing positively to the community in their new place. This can be done through participation in social activities, maintaining good relations with the local community, and preserving the culture and traditions of their homeland. Research shows that involvement in community activities can strengthen love for the homeland and cultural identity, as well as aid in the adaptation process (Nurdian et al., 2021; Amalia, 2020; Agung et al., 2023). For example, migrants who are active in cultural or social activities in Myanmar can strengthen intercultural relations and introduce the positive values of their home culture.

Education also plays an important role in instilling a love for the homeland among migrants. Through education that emphasises national values and appreciation for local culture, individuals can learn to appreciate diversity and strengthen their love for their homeland. Character education that integrates local content and national values can help shape positive attitudes towards the homeland, both the homeland of origin and the current place of residence (Ikhsan, 2017; Surahman, 2022).

In this context, it is also important to understand that love for one's homeland does not only mean loving the physical land, but also loving the values, traditions, and culture that exist within it. Therefore, expatriates in Myanmar need to develop an open and tolerant attitude towards the local culture, while still maintaining and preserving their own cultural identity (Hutabalian & Kriswibowo, 2022; Aji & Wangid, 2022). This will create synergy between the culture of origin and the local culture, which in turn can enrich the experience of living in a new country.

METHOD

This study uses a qualitative method with a descriptive-analytical approach to describe the implementation of traditional games in national-based learning at the Indonesian School in Yangon (SIY), Myanmar. The focus of the study includes the programme implementation process, participant involvement, and the results of training, mentoring, and traditional game exhibitions.

This method was designed to be contextual and collaborative, involving teachers, students, parents, and the Indonesian Embassy in Myanmar as strategic partners. The research also contributes to the Sustainable Development Goals (SDGs), particularly in strengthening quality education and global partnerships.

The Community Service (PkM) activity was carried out at the Indonesian School in Yangon (SIY) through an official collaboration between Yogyakarta State University (UNY) and SIY, which began with the signing of a memorandum of understanding (MoU) on 19 February 2025. Through this partnership, the two institutions organised five main programmes implemented over 16 months and 20 days, as presented in Table 1. One of the flagship programmes in this activity was the development of an innovative and contextual learning model tailored to the needs of SIY students.

Table 1. Learning Model Program

No	Programme
1	Teacher Training and Mentoring
2	Parent Involvement through Education and Collaboration
3	Development of Traditional Game-Based Learning Models
4	Strengthening Extracurricular Activities and Cultural Preservation
5	Provision of Learning Resources and Media

The data on students at the Indonesian School in Yangon is shown in Table 2 below.

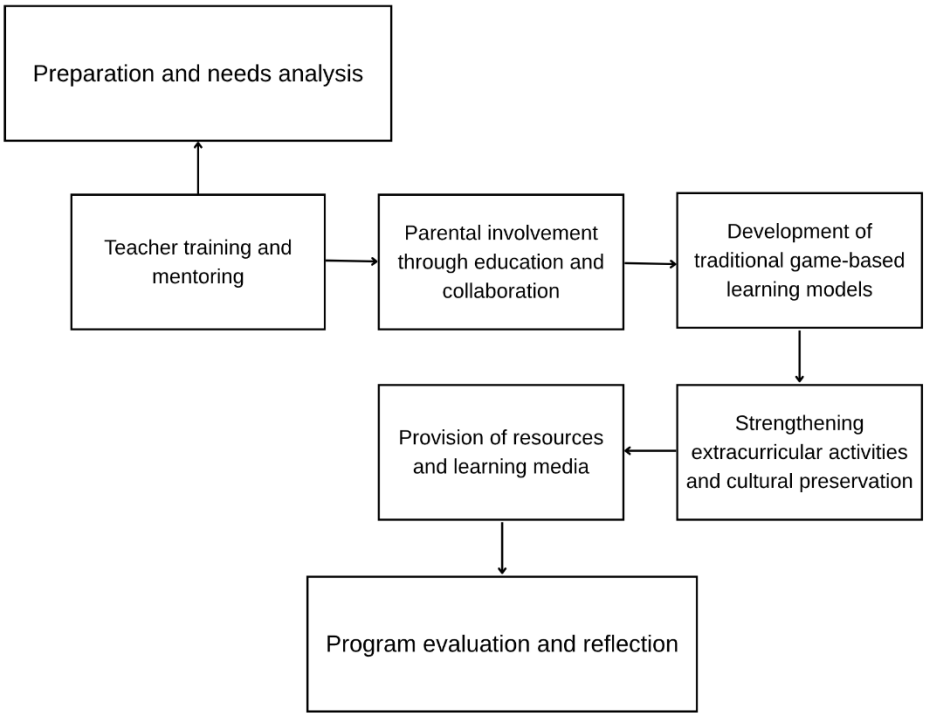
Table 2. Data on Students at the Indonesian School in Yangon

No	**Jenjang**	**Number of Students**	**Male**	**Female**
1	Early Childhood Education	1	0	1
2	Primary School	19	9	10
3	Junior High School	9	4	5
4	High School	10	6	4
	Total	39	19	20

Based on Table 1, Sekolah Indonesia Yangon has 39 students spread across early childhood education to senior high school levels. The average number of students per class is relatively small (2–5 students), so some learning is conducted across levels. The gender composition is balanced with 19 male students and 20 female students, and the largest number is in primary school. This condition is a major consideration in designing a participatory and adaptive PkM programme for the context of Indonesian schools abroad.

The implementation stages of the activities followed a participatory and collaborative approach, involving the community service team, teachers, parents, students, and the Indonesian Embassy in Myanmar.

The process of the activity is shown in Figure 1.



Data was collected through: Direct observation, to assess the involvement of teachers, students, and parents. In-depth interviews, to obtain participants' perceptions and reflections on the activities. Surveys and documentation, to support simple quantitative data on participant participation and satisfaction levels.

Data analysis was conducted using Miles and Huberman's interactive model, through three stages: (1) data reduction, (2) data presentation, and (3) conclusion drawing. This approach enabled the identification of patterns, behavioural changes, and increased understanding of the national values that emerged during the activities.

RESULTS AND DISCUSSION

The Community Service (PkM) activity is a form of strategic cooperation between Yogyakarta State University (UNY) and the Indonesian School in Yangon (SIY), which began with the signing of a memorandum of understanding (MoU) on 19 February 2025. The signing of the MoU marked the beginning of a collaborative programme aimed at strengthening character and national education through traditional Indonesian games. In an effort to improve the quality of culture-based education, this PkM was designed into five main programmes that were agreed upon and implemented over a period of 16 months and 20 days. The active involvement of various parties, including schools, teachers, parents, and the Indonesian Embassy in Myanmar, is a crucial foundation for the successful implementation of this programme.

The fifth programme involves: (1) Teacher Training and Mentoring, the implementation of teacher training and mentoring activities at the Indonesian School in Yangon, Myanmar, which is the core of the Community Service (PkM) programme aimed at improving teachers' capacity to integrate traditional games based on nationality into learning. This activity is crucial, as teachers are the cornerstone of educational success. The quality of teachers is indeed a determining factor in the quality of learning and student outcomes. The integration of traditional games into the curriculum, supported by high-quality teaching, can significantly improve academic achievement, creativity, and engagement, while preserving cultural values. (Arsih et al., 2026; Lestari et al., 2024). In the context of Indonesian schools abroad, the task of teachers is increasingly complex because, in addition to delivering academic material, they also maintain the national identity of students growing up in a multicultural

environment. Therefore, this teacher training and mentoring is not only focused on knowledge transfer but also on empowering teachers with pedagogical skills relevant to the needs of cross-cultural schools.

The training was conducted in the form of *an* intensive *workshop* held on 19 February 2025. This activity combined theory and practice with the delivery of material covering the concept of integrating traditional games into the independent curriculum, the preparation of teaching tools, and the use of digital media to support traditional game-based learning. This design is in line with *the experiential learning model*, whereby teachers do not merely listen to the material, but also experience it first-hand, reflect on it and practise the strategies taught (This approach is important because direct experience in learning has been proven to be more effective in shaping teachers' understanding and practical skills.

In addition to *workshop* activities, teachers receive ongoing assistance through *coaching clinics* and practical guidance. This assistance is based on the idea that changes in teachers' teaching behaviour will be more effective if accompanied by repeated practice, reflection, and direct feedback from facilitators. In the assistance process, teachers are not only guided in the preparation of teaching materials, but also directed to implement traditional games into actual learning. For example, lower grade teachers use the game of engklek to train motor balance while instilling discipline and sportsmanship. Meanwhile, higher grade teachers integrate the game of dakon into mathematics learning to train counting and strategic thinking skills. Traditional games indirectly make learning more meaningful when they are related to the real experiences of students.

The integration of traditional games into learning is essentially the implementation of character education that encompasses *knowing, feeling*, and *action*Through the integration of traditional games, students not only understand the rules of the game (*knowing)*, but also experience togetherness, sportsmanship and pride in their national culture (*feeling)*, and practise values such as honesty, responsibility and cooperation (*action)* (Calixto et al., 2024; Hartanto et al., 2021). The target of this activity is for teachers to have practical and conceptual skills in utilising traditional games as a learning medium in line with the Merdeka Curriculum, with an indicator of 80% of teachers being able to apply this method in classroom learning practices.

Initial results from the training and mentoring show an increase in teachers' understanding of the potential of traditional games as a learning medium. Before the activity, most teachers were not aware that traditional games could be adapted to the learning outcomes of the Merdeka Curriculum. However, after the training, teachers were able to develop traditional game-based learning tools, such as using engklek to teach even and odd numbers, or dakon to train strategies and foster sportsmanship. Traditional games are not only beneficial for motor skills, but also support students' social and cognitive development (Siswanto, 2022). The results of the monitoring evaluation showed that the teacher training and mentoring programme in integrating traditional games into learning had achieved its target, with 80% of teachers able to apply this method in their teaching practice.

Although the results achieved were quite positive, the implementation of mentoring also faced several obstacles. One of them was the limited number of students per class, which only ranged from 2 to 5 students, so that teachers had to teach using a cross-level system. The Indonesian School in Yangon has 39 students spread across early childhood education, primary school, junior high school, and senior high school levels. The number of students per class is relatively small, averaging only 2-5 students, so some lessons are conducted across grade levels. The composition based on gender is fairly balanced, with 19 male students and 20 female students, with the largest distribution in primary school.

This situation makes it difficult for teachers to adapt traditional games to the different developmental levels of children in one class. Another obstacle is the low level of teachers' initial literacy regarding traditional game theory and its integration with the curriculum, so that more intensive assistance is required. These challenges show that teacher training should not be a one-off event, but should be ongoing with regular monitoring and evaluation.

Teacher training and mentoring in this PkM programme has important academic, social and practical implications. Teachers are able to develop more effective, contextual and culture-based learning models. Traditional games become a means of cultural diplomacy that strengthens the national identity of Indonesian students abroad. This training model can be replicated in other Indonesian schools abroad. Based on this, teacher training and mentoring activities not only strengthen pedagogical competencies, but also serve as an effective strategy in preserving national culture, instilling national values, and building the national identity of Indonesian students in Myanmar through formal education. (2) Parent Involvement through Education and Collaboration, a programme involving parents through education and collaboration in Community Service (PkM) activities at the Indonesian School in Yangon, Myanmar, supports the successful implementation of traditional games based on

nationality. This activity is based on the idea that character education is not only the responsibility of the school but also requires the support of the family as the first and primary educational environment for children. Collaboration between schools and families ensures that the character values taught at school are reinforced at home, thereby creating a consistent learning environment (Paccaud et al., 2021; Zahra et al., 2024). According to Bronfenbrenner (1979), child development is influenced by interactions between various systems, one of which is the active involvement of families in the education process.

Parent involvement activities are packaged through education in the form of counselling on the importance of traditional games as a means of instilling national values and collaborative practices in the form of "Family Play Day." In this activity, parents and children are directly involved in playing traditional games such as dakon, gacoan, and engklek. Parental involvement can create enjoyable, contextual learning experiences and strengthen the emotional bond between parents and children. Emotional support and learning guidance from parents also have a significant impact on children's academic achievement and attitude towards learning (Liu et al., 2025; Sun et al., 2023).

Parental involvement is not limited to administrative support for the school, but needs to be expanded to collaborative activities that support character building in students. Thus, the "Family Play Day" activity is a concrete implementation of the principle of school-family partnership that emphasises the importance of collaboration in education. In the context of character education, traditional games played with parents serve as a medium for learning national values and social skills. The role of parents is not only as facilitators, but also as direct role models in the application of character values.

This programme was attended by 29 students, 30 parents, and 17 teachers and educational staff, reflecting the broad collaboration between all elements of the school. Participants showed great enthusiasm, with 70% of parents actively participating in accompanying their children in this activity. This achievement shows that the programme's goal of strengthening collaboration between families and schools through traditional games has been realised. This activity also provided an opportunity for parents to get involved in school activities and traditional games, as well as to build a collaborative environment (Saracostti et al., 2020).

The results of the activity reflection showed that parental involvement had a positive impact on their awareness of the importance of culture-based character education. Parental involvement in education, both at home and at school, has been proven to have a positive influence on students' academic achievement and character development (Ali, Nayab, 2022). Before participating in the activity, some parents tended to be passive and only involved in school administrative activities. However, after receiving guidance and direct experience playing with their children, parents realised that traditional games can be an effective means of instilling national values in the family environment.

Parental involvement in their children's learning increases when they have the knowledge, skills, and confidence to participate. This participation encourages children's motivation, academic achievement, and social-emotional development. The integration of local wisdom into character education is important for preserving culture and instilling moral values (Ariani et al., 2022; Herlina et al., 2024). The "Family Play Day" activity is effective in introducing traditional games and strengthening the synergy between learning at school and at home. The implementation of parental involvement also faces several challenges, namely the limited time of parents, most of whom are busy with work and therefore cannot be consistently involved in every activity. In addition, some parents are not accustomed to seeing traditional games as an educational medium, so continuous efforts are still needed to change their perceptions. These challenges emphasise that parental involvement must be carried out continuously, either through regular counselling, providing guide booklets, or activities that directly involve families.

Parental involvement through education and collaboration in this community service programme has a significant impact on fostering collective awareness of the importance of traditional games as a means of character education based on nationality. This activity creates synergy between schools and families, so that national values are not only taught in the classroom, but also brought to life at home (Abdull Rahman et al., 2025). As a result, a holistic educational ecosystem is formed, in which schools and families work together to build a young generation with character, who love their national culture and are proud of their national identity in a multicultural environment. (3) Development of a Traditional Game-Based Learning Model, The learning model was developed based on the results of previous training and field practice. This model is based on the following principles: (a) Contextual learning based on local culture, contextual learning based on local culture is a relevant approach to

connecting students' learning experiences with real life. One form of local culture that is close to the world of children is traditional games. These games are not merely recreational activities, but educational tools that foster cognitive, affective, and psychomotor skills in a balanced manner (Sukadari, 2020).

Learning media and traditional games help students understand material in a concrete, practical, and enjoyable way. For example, engklek can be used to explain the concept of flat shapes (squares, triangles, parallelograms) while also training understanding of number patterns through a sequence of steps. Dakon or congklak requires calculation, strategy, and mathematical logic, thereby training counting skills, decision making, and instilling the values of patience and sportsmanship. Meanwhile, gacoan (traditional spinning top) trains fine motor skills, agility, and concentration, while fostering cooperation and togetherness when played in groups. In addition, traditional games also improve children's concentration, as activities such as keeping the spinning top spinning require constant focus and attention (Sunanto, Abdul et al, 2024).

These three games demonstrate that local culture-based learning does not only emphasise academic aspects, but also integrates character values such as sportsmanship, togetherness, discipline, and critical and creative thinking skills. Traditional games play a dual role: as an effective learning medium and a vehicle for internalising cultural values. By combining educational aspects and cultural values, contextual learning based on traditional games can create an active, creative, enjoyable, and meaningful learning environment. ((b) Integration of national values. Traditional games not only serve as a recreational medium or cognitive learning tool, but also contain important national values that should be instilled from an early age, such as togetherness, mutual cooperation, sportsmanship, and respect for rules. Each game requires cooperation, mutual respect, and fairness, making it a strategic tool for strengthening character education in schools.

Teachers can integrate national values through reflection after playing, for example by inviting students to discuss the meaning of obeying rules as a form of discipline, the importance of cooperation to achieve goals, or how to accept victory and defeat in a sportsmanlike manner. This reflection helps students understand the relevance of playing experiences to real life, which demands fairness, responsibility, and togetherness. The integration of national values through traditional games is in line with the Pancasila Student Profile, which emphasises mutual cooperation, noble character, and global diversity. Traditional games can also be used strategically to foster core values such as independence, critical thinking, and creativity (Daya et al., 2025).

Learning does not only emphasise cognitive aspects, but also includes affective and moral domains, making traditional games a contextual and meaningful medium in shaping national identity amid the tide of globalisation. (c) Active and enjoyable learning, this model also emphasises active and enjoyable learning by prioritising students' physical and mental involvement in games. Through a playful atmosphere, students feel more enthusiastic and motivated to participate without feeling forced. This strategy reduces the boredom of conventional learning, which is often monotonous, while fostering greater interest in learning, especially in the post-pandemic period. With a variety of games and challenges tailored to students' ability levels, learning becomes more meaningful, creative, and enjoyable, while strengthening social interaction.

The development of a traditional game-based learning model is a strategic effort to provide a contextual, character-building, and enjoyable learning process. The integration of games such as engklek, dakon, and gacoon not only strengthens academic knowledge but also instils cultural and national values in accordance with the Pancasila Student Profile. This local wisdom-based learning is effective in developing students' cognitive, affective, and psychomotor aspects (Sukadari, 2020), while also fostering character through active and meaningful learning experiences. This model is expected to become an alternative learning innovation in schools, while also contributing to cultural preservation and the formation of a smart, characterful, and nationally-identity-conscious younger generation. (4) Strengthening Extracurricular Activities and Cultural Preservation. As a follow-up to the implementation of the PkM activities that have been carried out, it is important to ensure that the programme does not stop at training activities alone but continues in the form of more sustainable and structured activities.

The strategy adopted is to strengthen students' actualisation space through extracurricular activities based on local culture. Students not only gain learning experiences in the classroom, but also have a platform to develop skills, character, and love for the nation's culture through real activities at school. Based on this thinking, the PkM programme was continued in the form of strengthening extracurricular activities by forming *a "Traditional Games Club"* at the Indonesian School in Yangon. The objectives are: (a) To provide a space for continuous cultural exploration. This club functions as a mini cultural laboratory in the school, where students can learn about and explore various traditional Indonesian games, such as engklek, gobak sodor, dakon, bentengan, and gasing.

Traditional games are not just entertainment, but also contain educational values such as cooperation, precision, perseverance, and sportsmanship. Through regular activities, students can consistently practise cultural values. The culture club serves as an interactive learning forum that develops cognitive, affective, and psychomotor aspects, so that cultural exploration continues throughout the school year. Play-based learning has been proven to improve students' cognitive, physical, emotional, and social development (Guohui & Xiujin, 2024; Leibowitz, 2020). (b) As a means of training, competition, and cultural performance for students, this club not only facilitates internal activities but also opens opportunities for students to participate in structured training that leads to mastery of playing skills and character building. For example, every month there is an intensive training session for a specific type of traditional game which is later competed between classes. In addition, cultural performances can also be held on important occasions such as Indonesian Independence Day, National Education Day, or joint events with the diaspora community in Yangon. Through these competitions and performances, students practise developing self-confidence, sportsmanship, social skills, and at the same time become cultural ambassadors who introduce the richness of Indonesian traditions to the international community. (c) Fostering pride in Indonesian culture among students living abroad. One of the major challenges for students living abroad is maintaining their national identity in a multicultural environment. Through traditional games, students can feel an emotional connection to their homeland. When they play engklek or gobak sodor, for example, they are not only engaging in physical activity, but also reviving collective memories passed down from their ancestors. This fosters a sense of pride and love for Indonesian culture. Furthermore, this pride will become an important asset for students to dare to display their national identity in the global community, so that they grow into a diaspora generation that remains rooted in the cultural values of their nation.

The establishment of the Traditional Games Club at the Indonesian School in Yangon is a strategic step in maintaining the sustainability of the PkM programme while strengthening the cultural identity of Indonesian students abroad. Through a space for continuous cultural exploration, training and performance facilities, as well as efforts to foster pride in the nation's culture, this club is expected to have a positive impact not only on students, but also on the school environment and the wider Indonesian diaspora community. Through synergy between teachers, parents, and students, this activity will produce a young generation that is not only academically intelligent but also has a strong character, is creative, and is deeply rooted in Indonesian cultural values.

Traditional Games Clubs can serve as a model for extracurricular activities that fulfil a dual function: as a means of character education and as a medium for preserving national culture amid the tide of globalisation. (5) Provision of Resources and Learning Media: to ensure the sustainability of the programme, the PkM team provides supporting facilities that are designed not only as complements but also as strategic instruments in strengthening the sustainability of learning. These supporting facilities include: (a) Physical game materials, such as dakon and various other traditional game tools. These games not only provide opportunities for students to practise directly in a fun atmosphere, but also instil cultural values, sportsmanship, and cooperation. With the physical materials available, students can revive cultural heritage in practice, while teachers gain concrete contextual media to support learning in the classroom and extracurricular activities. (b) Digital learning media, in the form of tutorial videos, interactive teaching materials, and simple modules designed to be accessible with minimal devices, either through gadgets or computers, allowing for flexibility in use. These can be used at school, at home, or even in other educational communities. With engaging, interactive, and easy-to-understand content, these media support students' independent learning while strengthening the role of teachers and parents in assisting children's learning. (c) Documentation of activities, packaged in the form of reports, photos, and videos, so that they can serve as archives, publications, and guidelines for replicating similar programmes in other schools.

All of this material was compiled collaboratively with the Indonesian Embassy in Myanmar and the Indonesian cultural community. This collaborative approach not only strengthened the content but also ensured the relevance of the material to the real needs of students, teachers, and parents in the Indonesian School in Yangon environment. Thus, the sustainability of the programme is guaranteed even though the formal PkM activities have ended.The implementation of the training and mentoring programme for Traditional National-Based Games at the Indonesian School in Yangon demonstrates a strong synergy between educational institutions, families, and the diaspora community. This synergy is reflected in a holistic and participatory approach that integrates cultural values, learning, and character education simultaneously.

The tangible impacts of this programme include: 1) Increased capacity of teachers to integrate cultural values into classroom learning, so that the learning process is not only cognitive but also affective and

psychomotor 2) Active involvement of parents in the education process, particularly in supporting their children's character education through traditional games that teach the values of togetherness, sportsmanship, and love for the nation's culture 3) Strengthening students' national identity through play experiences rich in Indonesian local wisdom values, so that students maintain a sense of pride and attachment to their homeland's culture even while living abroad 4) The establishment of a sustainable culture-based learning ecosystem, where schools, families, and diaspora communities work together to preserve and maintain the nation's cultural heritage in daily life.

CONCLUSION

The implementation of the Training and Assistance Programme for Traditional Games Based on Nationalism at the Indonesian School in Yangon, Myanmar, generally ran well and had a positive impact on improving the quality of character-based education. This activity succeeded in improving teachers' understanding and skills in integrating traditional games into learning in accordance with the Merdeka Curriculum, strengthening the role of parents through collaborative "Family Play Day" activities, and fostering enthusiasm among students in preserving traditional Indonesian games. The collaboration between Yogyakarta State University, the Indonesian School in Yangon, and the Indonesian Embassy in Myanmar was a major factor in the success of the programme. However, there are still obstacles such as the limited number of students per class, which hinders cross-level learning, and the low level of teachers' initial literacy regarding the use of traditional games as a learning medium. Nevertheless, overall, this programme has been able to create a contextual, enjoyable, and relevant educational ecosystem that strengthens cultural identity and love for the country in a multicultural environment.

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With the full support of strategic partners such as the Indonesian Embassy in Myanmar and Yogyakarta State University, this activity not only serves as a learning tool but also makes a real contribution to Indonesia's cultural and educational diplomacy on the international stage. This programme is an example of how cross-institutional and community collaboration can produce a model for strengthening culture-based character education that not only benefits students but also reinforces Indonesia's positive image in the international community.

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Empowering Primary School Teachers in Hat Yai, Thailand: Training on Instructional Material Development

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Abstract. This community service program aimed to strengthen the professional competence of primary school teachers in Hat Yai, Thailand, by enhancing their ability to design and develop instructional materials. Many teachers in this context face challenges in creating innovative and contextual teaching resources that meet the needs of diverse learners. To address this issue, a training program was conducted using a workshop model that combined theoretical sessions, hands-on practice, and collaborative discussions.

The training involved 25 primary school teachers and was implemented over two days online and two days offline. Data were collected through observation, participant feedback, and analysis of the instructional materials produced during the sessions. The results show that the teachers demonstrated significant improvement in their understanding of instructional design principles, creativity in developing teaching aids, and confidence in applying new approaches to classroom practice. Participants also expressed high levels of satisfaction with the training, highlighting its relevance, practicality, and impact on their teaching. This program illustrates the importance of empowering teachers through capacity-building initiatives and provides a model for future cross-cultural community service collaborations in education.first, second, and third level headings.

INTRODUCTION

Primary education plays a crucial role in shaping students' character, intelligence, and skills. In this context, teachers are not merely transmitters of information but also facilitators responsible for developing innovative, engaging, and learner-centered teaching materials. High-quality teaching materials can enhance learning effectiveness, help students gain a deeper understanding of the content, and foster higher motivation and interest in learning. However, many elementary school teachers still face challenges in developing innovative teaching materials, particularly in terms of teaching methods, technology integration, and access to up-to-date learning resources.

Various studies have shown that developing teaching materials remains one of the main obstacles in improving the quality of learning in elementary schools. Most teachers still rely on conventional teaching methods and are not yet familiar with innovative approaches such as blended learning, project-based learning, or game-based learning. This situation makes learning less engaging and less effective in promoting student participation. Yufita et al. (2021) found that teachers who participated in technology-based teaching material development training demonstrated significant improvement in their pedagogical competence compared to before the training, indicating the importance of systematic and continuous professional development programs for teachers.

In today's digital era, the use of technology is one of the key factors in creating effective and interactive learning experiences. However, Yuliza (2023) reported that only a small portion of teachers actively use technology-based learning media, while the majority still depend on printed materials and lecture methods. This limitation is often caused by the lack of training and insufficient understanding of how to apply technology in the classroom. Another study by Muin et al. (2023) revealed that training in the use of technology for teaching material development significantly increased teachers' self-efficacy, making them more confident in designing innovative digital media.

Apart from technological factors, limited access to learning resources is also a significant barrier. Arifin et al. (2023) reported that around 60% of elementary school teachers in rural areas struggle to access digital and interactive learning resources, leading to suboptimal learning quality. Furthermore, teachers' ability to adapt teaching materials to students' characteristics remains low. Shintami (2022) demonstrated that training in the development of student-centered learning materials improved students' comprehension by up to 71% compared to conventional methods.

A similar condition was observed in Hat Yai, Thailand. Based on research by Saeful Effendi et al. (2023), teachers at Songserm Sasana Vittaya School (SSVS) still rely on paper-based instruction for up to 90% of teaching and assessment activities. The low utilization of technology indicates the urgent need for training in ICT-based teaching material development. Therefore, a comprehensive and sustainable training program on teaching material

development is essential to strengthen teachers' professional competence, enhance creativity, and promote more effective, interactive, and relevant learning aligned with the demands of the 21st century.

LITERATURE REVIEW

Teaching Material Development

Teaching materials are essential components in the learning process, serving as both guides and learning resources for students. According to Dick and Carey (2015), effective teaching materials should present information systematically, attractively, and in accordance with students' characteristics. In the context of primary education, teaching materials also play a key role in introducing fundamental concepts, fostering curiosity, and developing students' critical thinking skills (Majid, 2017).

The development of teaching materials not only focuses on the organization of content but also on the strategies for presentation and integration with learning media. Prastowo (2020) emphasizes that effective teaching material development should be based on students' needs, learning objectives, and the principles of active learner engagement. Therefore, teachers must understand instructional design principles so that the materials they create can effectively facilitate an enjoyable and meaningful learning process.

Innovative Approaches in Teaching Material Development

Along with the evolving paradigm of 21st-century education, teaching materials must be designed using innovative approaches such as blended learning, project-based learning, and game-based learning. The blended learning approach combines face-to-face and online learning, providing flexibility and expanding access to learning resources (Garrison & Vaughan, 2018). Meanwhile, project-based learning focuses on project-oriented instruction that emphasizes students' active involvement in solving real-world problems, thereby promoting creativity and collaboration (Thomas, 2020).

In addition, game-based learning has proven effective in enhancing learning motivation by integrating elements of competition and entertainment into the learning process (Plass et al., 2015). A study by Shintami (2022) revealed that implementing teaching materials based on student-centered learning and educational games improved students' conceptual understanding by up to 71% compared to traditional lecture methods. Such innovative approaches can be applied in the development of digital teaching materials to enrich students' learning experiences.

Utilization of Technology in Teaching Material Development

The use of information and communication technology (ICT) is a key component in the development of modern teaching materials. Technology enables teachers to create multimedia-based instructional materials that are interactive, easily accessible, and engaging for students. According to Heinich et al. (2019), integrating ICT into learning can enhance students' motivation, participation, and learning outcomes.

Teachers' digital competence is a crucial factor in educational transformation. UNESCO (2021) emphasizes that digital literacy for educators should include the ability to select, adapt, and produce technology-based learning resources that align with students' contexts. In this regard, training in technology-based teaching material development is a strategic necessity to equip teachers with the competencies required for the 21st century.

RESEARCH METHOD

The training program on teaching material development for elementary school teachers in Hat Yai, Thailand, was implemented using a workshop model that emphasized participatory, collaborative, and practical approaches. The training aimed to enhance teachers' abilities to design and develop innovative, creative, and technology-based teaching materials. The program involved 25 elementary school teachers and was conducted over four days—two days online via the Zoom Meeting platform and two days offline at a partner school in Hat Yai.

The implementation of the training was divided into four main stages. The first stage focused on theoretical presentations about the importance of innovative teaching materials and the principles of instructional design. During this phase, participants were provided with conceptual insights into technology-based learning models and strategies for developing digital teaching materials that align with students' characteristics.

The second stage consisted of an interactive discussion between the training team and participants to identify challenges teachers face in developing teaching materials. This session also served as a platform for sharing experiences and exploring contextual solutions suited to the conditions of schools in Hat Yai.

The third stage involved hands-on activities, where participants were trained to create digital teaching materials using various applications such as Canva, interactive PowerPoint, and simple web-based media. During this phase, teachers worked in small groups to produce teaching material products relevant to the curriculum and local context.

The final stage focused on evaluation and mentoring. The training team assessed participants' teaching material products based on creativity, content relevance, and technology integration. Evaluation was carried out through observation, participant feedback, and reflection on the training process. In addition, post-training mentoring was conducted online to help teachers refine and improve the teaching materials they had developed.

This method was chosen to ensure that teachers not only understood the theoretical aspects but also could apply them in real practice, thereby significantly improving their professional competence in developing teaching materials.

RESULTS AND DISCUSSION

The implementation of the teaching material development training program for elementary school teachers in Hat Yai, Thailand, ran smoothly and received positive responses from participants. The program produced several significant findings that indicated an improvement in teachers' professional competencies in terms of knowledge, skills, and attitudes toward the use of technology in teaching and learning.

1.Improvement in Understanding Instructional Design Principles

Before the training began, most participants showed limited understanding of the basic principles of instructional design. Based on initial observations, teachers tended to develop teaching materials merely by copying textbook content without considering pedagogical aspects, alignment with learning objectives, or the diverse needs of students. Through the theoretical sessions conducted on the first and second days, participants gained a deeper understanding of the structure of effective teaching materials, including the formulation of learning objectives, selection of appropriate media, and organization of learning activities. After the training, there was a significant improvement in teachers' ability to understand the concept of systematic instructional design. This was evident from participants' reflections, which showed that 88% of them were able to identify the main components of teaching materials and organize them in a more structured manner. This finding aligns with Dick and Carey's (2015) view that understanding instructional design principles is the foundation for producing effective and contextually relevant teaching materials.

2. Enhancement of Teachers' Creativity in Developing Digital Teaching Materials

One of the most notable outcomes of this training program was the increase in teachers' creativity in utilizing technology to develop digital teaching materials. At the beginning of the program, the majority of participants had never used educational design applications such as Canva, Genially, or interactive PowerPoint. Through hands-on workshop activities, teachers were trained to create various digital teaching materials such as e-modules, interactive slideshows, and multimedia-based worksheets. The participants' works showed significant improvement in both visual design and content relevance. For instance, several teachers developed teaching materials based on the local context of Thailand, featuring themes such as environment, traditional food, and Hat Yai's local culture, packaged in interactive visual media. This contextual approach reflected teachers' growing understanding of students' diverse learning needs and their connection to real-life experiences. Teachers' creativity also improved due to the collaborative nature of the training. Through group activities, participants exchanged ideas and provided feedback to one another. This approach aligns with Vygotsky's (1978) social constructivism theory, which emphasizes the importance of social interaction and collaboration in constructing new knowledge. Thus, the training not only enhanced teachers' technical skills but also fostered a culture of professional collaboration among them.

3. Increased Confidence in Using Technology

In addition to improving technical skills, the training also had a significant impact on enhancing teachers' confidence in using technology for teaching and learning. Based on the post-training survey, 92% of participants reported feeling more confident in independently creating digital learning media, while 84% stated that they were able to integrate digital teaching materials into classroom activities. These results are consistent with the findings of Muin et al. (2023), which showed that technology-based training can enhance teachers' self-efficacy, or their belief in their own ability to use educational technology effectively. This confidence is essential, as it serves as a motivational factor that encourages teachers to continuously experiment and innovate in their instructional practices.

4. Quality of the Teaching Material Products Developed

During the hands-on sessions, participants produced various digital teaching materials, which were evaluated by the training team based on four key aspects: (1)Alignment with the curriculum, (2) Integration between text

and media, (3) Creativity in presentation, and (4)Contextual relevance to students' needs. The evaluation results showed that 80% of the products were categorized as good to excellent, with the highest average scores in creativity and contextual relevance. Most teachers successfully transformed static teaching content into interactive formats. For example, one teacher developed a video-based worksheet on local ecosystems in southern Thailand, complete with illustrations and interactive quizzes. These outcomes demonstrate that the training effectively encouraged teachers to utilize technology as a tool for enriching the learning process. This finding supports Garrison and Vaughan (2018), who asserted that the integration of technology in learning not only enhances access to information but also fosters active student participation. By developing digital-based teaching materials, teachers can create learning environments that are more adaptive, engaging, and relevant to the needs of 21st-century learners.

5. Participants' Responses and Satisfaction with the Training Program

Data from the satisfaction survey revealed that all participants found the training highly beneficial and relevant to their professional needs. A total of 95% of teachers stated that the training provided them with new experiences in using digital media, while 89% agreed that the program significantly improved their creativity in developing teaching materials. Participants particularly appreciated the practical and hands-on approach of the training. They felt that interactive practice sessions and collaborative discussions were more effective than theoretical lectures alone. The learning-by-doing approach implemented by the training team proved effective in helping teachers quickly develop new skills. This aligns with Joyce and Showers (2016), who emphasized that effective professional development should include theory, demonstration, practice, and direct feedback. Moreover, the post-training mentoring activities were considered highly valuable in helping teachers refine and further develop their teaching materials. Through online communication, teachers were able to consult with the training team and receive guidance on improving their products. This demonstrates that continuous training with a mentoring system can provide long-term impacts on teachers' professionalism, as highlighted by Guskey (2002).

6. Impact on Strengthening Teachers' Professional Competence

Overall, the results of the training demonstrated that the program made a significant contribution to enhancing the professional competence of elementary school teachers in Hat Yai. The improvement covered three main aspects: knowledge, skills, and attitude. In terms of knowledge, teachers developed a better understanding of the importance of contextual and innovative instructional design. In terms of skills, they became capable of designing and producing simple digital teaching materials that were engaging and suited to students' needs. From the attitude perspective, the teachers exhibited strong enthusiasm for learning, openness to new technologies, and a genuine desire to continue innovating. These findings are consistent with Yufita et al. (2021), who stated that technology-based teaching material development training can enhance teachers' pedagogical competence and motivation. Therefore, this program not only provided short-term benefits by improving teachers' technical skills but also established a foundation for long-term change in instructional practices at the elementary school level.

7. Program Implications and Cross-Cultural Relevance

This training program is not only relevant in the local Thai context but also holds strategic value for international educational collaboration. It demonstrates that teacher capacity-building can be effectively implemented through partnership-based community engagement programs. Beyond strengthening teachers' professional competencies, the program also enriched cross-cultural and pedagogical insights between participating countries. Thus, the training model applied in this program can serve as a reference for similar initiatives in other countries, particularly in the field of elementary education that still faces challenges in integrating technology and fostering learning innovation. The program underscores the importance of empowering teachers as agents of change in creating an education system that is adaptive, creative, and responsive to the demands of the modern era.

CONCLUSION

The training program on instructional material development for elementary school teachers in Hat Yai, Thailand, successfully enhanced participants' professional competencies in terms of knowledge, skills, and attitudes toward the use of educational technology. Through a workshop-based approach that combined theory, hands-on practice, and mentoring, teachers demonstrated significant improvements in understanding instructional design principles, creativity in developing digital learning materials, and confidence in integrating technology into their classrooms.

This activity also demonstrated that practice-based and collaborative training methods are more effective than conventional approaches, as they provide contextual and meaningful learning experiences. The instructional materials produced by the teachers showed good quality, were relevant to the local context, and effectively supported interactive learning. Beyond its direct impact on improving teacher quality in Thailand, this program

serves as a model for cross-cultural collaboration that can be replicated in various educational contexts. By empowering teachers through continuous professional development, it is expected that a new generation of educators will emerge—those who are adaptive to technological advancements and capable of creating more creative, participatory, and learner-centered educational experiences aligned with the needs of 21st-century students.

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THE DEVELOPMENT OF STUDENTS' ASSIGNMENT IN DIFFERENTIATED LEARNING

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Abstract. One of the challenges faced by teachers is the limited ability to manage differentiated learning processes that take into account students' learning styles, particularly in developing assignments or products created by learners. Several teachers at the partner school possess theoretical knowledge of differentiated learning and its implementation for certain learning styles. However, the majority have not yet applied it in practice, especially in aspects related to the development of student-generated tasks or products. This training program aimed to provide a platform for reflection, discussion, and motivation for teachers to design and develop student assignments or products within the framework of differentiated learning. The training was conducted over 32 hours through in-person sessions, with additional mentoring for independent work facilitated via personal or group communication. Based on the evaluation results, all participating teachers agreed that the training was highly beneficial and encouraged them to further develop differentiated learning practices—particularly by providing students with opportunities to be creative in completing individual or group tasks or projects. During the final presentation session, several teachers showcased the outputs they had developed as part of the differentiated learning activities.

Key words: reflection, differentiated learning, students' assignment.

INTRODUCTION

The characteristics of learners, when viewed from their learning styles, require a sufficient understanding to categorize and develop differentiated learning that accommodates these styles. Meanwhile, the ability to design innovative learning that provides students with opportunities to develop their potential to the fullest is one of the teachers' essential responsibilities. However, the existing problem among partner teachers lies in their limited ability to manage differentiated learning processes that take into account students' learning styles, particularly in developing assignments or products created by the learners.

Several teachers possess theoretical knowledge of differentiated learning and its implementation for various learning styles. Nevertheless, most have not yet applied this knowledge in practice, including aspects related to the development of student-generated tasks or products. One potential solution to address this issue is to conduct a training program on differentiated learning development for teachers/partners. The training includes discussions on the concept of differentiated learning, the characteristics of learners based on their learning styles, strategies for designing learning tasks or products that can be produced by students, as well as an evaluation of the training by the participating teachers.

LITERATURE REVIEW

Brown (2000) defines learning style as an individual's way of perceiving and processing information in a learning situation. He argues that learning style preference is one aspect of learning, referring to one's inclination toward certain learning conditions or situations over others. Learning styles are inherent in individuals as they absorb, organize, and process received information.

By being aware of their own learning styles, individuals can think and learn more effectively. There are three types of learning styles: visual, auditory, and kinesthetic (DePorter & Hernacki, 2000). Learning strategies that take students' learning styles into account lead to the implementation of differentiated instruction.

High-quality learning has a positive impact on the improvement of students' competencies. Siberman and Melvin (as cited in Sari, 2014) emphasize that the development of differentiated learning is essential to enable students to learn effectively.

According to Tomlinson (2003), differentiated instruction focuses on who teaches, where teaching takes place, and how teaching is conducted. In line with this, Theroux (2004) states that differentiated learning is an instructional approach that creates multiple learning pathways. Consequently, differences in students' abilities, interests, and experiences are absorbed, utilized, developed, and presented as an integral part of everyday learning practices.

Characteristics of Differentiated Learning

There are several characteristics of differentiated learning. Those characteristics can be seen below:

1. Pro active

Being proactive means the teachers anticipated the class that will be taught since the first time of learning. It can be done by planning the differentiated learning for all students.

2. Emphasizing the Quality over the Quantity

The quality of students' work becomes the main focus in differentiated learning rather than the quantity of tasks assigned. This approach does not imply that students who complete their tasks earlier should be given additional tasks of the same kind. Instead, they are provided with different and more challenging tasks designed to further enhance their skills and competencies.

3. Relying on Assessment

In differentiated instruction, teachers continuously conduct various assessments to identify students' conditions and levels of understanding in each learning session. The results of these assessments serve as feedback for teachers, enabling them to adjust and tailor the learning process according to students' individual needs.

4. Providing Different Approaches

Another characteristic of differentiated instruction is the provision of multiple approaches to the content, learning process, learning products, and learning environment. In differentiated learning, there are four key elements that can be adjusted based on students' readiness levels, interests, and learning styles: content (what is being learned), process (how it is learned), product (what is produced as a result of learning), and learning environment (the overall climate or atmosphere of learning).

5. Student-oriented

In this context, the tasks assigned to students are adapted to their prior knowledge of the material to be taught. Therefore, teachers need to design learning activities that align with the specific needs and readiness levels of their students. In other words, teachers play a greater role in organizing the time, space, and activities that students engage in during the learning process, rather than merely focusing on delivering instructional content.

6. A Mix of Individual and Classical Learning

Differentiated instruction represents a combination of individual and classical (whole-class) learning approaches. This can be observed in its classroom implementation, where teachers provide opportunities for students to learn collectively through whole-class instruction while also allowing them to engage in individualized learning activities.

7. More Active

Being more active means differentiated instruction involves continuous collaboration between teachers and students, including in the formulation of both class-wide and individual learning objectives. Teachers monitor how the lessons align with students' characteristics and make necessary adjustments to ensure that the learning process effectively meets their diverse needs.

RESULTS

The training program on Developing Differentiated Learning, particularly in designing student assignments, held at SMAN 1 Minggir, Sleman, Yogyakarta, was successfully implemented. The detailed outcomes of the activity are as follows:

1. The training ran smoothly, and the teachers/participants (32 in total) showed high enthusiasm in reflecting on their teaching practices, engaging in discussions, presenting the results of their individual or group work, and completing the evaluation forms.
2. All teachers stated that the training was useful.
3. All teachers were motivated to develop the assignments for the students using a differentiated approach.

An example of a teacher's work in developing differentiated instruction is presented through a task titled "Designing a Personal Branding Video Script." The stages of this activity were structured as follows:

1. Individual Reflection: Students were asked to reflect on and note key points regarding the use of the Javanese language in society.
2. Drafting the Script: Students then drafted their video scripts in *Bahasa Jawa Krama* (Worksheet 2), applying the transliteration materials previously learned. The script was required to include an introduction, body, and conclusion.
3. Teacher Guidance: The teacher provided individual guidance and encouraged creativity in script writing (Integration: Mindful—deep self-reflection).
4. Discussion and feedback.
5. Discussion and Feedback: Students, working in pairs or small groups, exchanged their scripts and provided constructive feedback on the use of *Bahasa Jawa Krama* and the completeness of the content.
6. The teacher facilitated a short discussion on challenges encountered and ideas for video production.
7. Independent Assignment: Students continued the video production process outside of class time. The completed videos were to be submitted in the following meeting or according to the agreed schedule.

CONCLUSION

The training objectives were successfully achieved, and the program was implemented smoothly as planned. All participating teachers were able to reflect on their previous teaching practices and were motivated to design student assignments using a differentiated learning approach. Consequently, the challenges faced by the partner institution were effectively addressed.

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Fundamental Aspects: Gymnasts' Confidence in Achieving Success at the DIY PORDA 2025

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Abstract. Self-confidence is a very important point for athletes, this condition is expected when athletes compete do not experience anxiety that can harm themselves. This type of research is correlation. The sample was determined by purposive sampling technique with a sample size of 12 Gymnastics athletes in Sleman Regency who are still in Senior High School (SMA) status. The instrument used was an athlete self-confidence questionnaire with 20 questions. Based on the results of the normality test, the sig result was 0.158 (self-confidence) p> 0.05, meaning it was normally distributed. The results of the homogeneity test obtained a sig value of 0.128 (p> 0.05) so that the data was homogeneous. Based on the results of the self-confidence test using a questionnaire, it was found that there were 5 athletes (41.66%) whose self-confidence level was in the very high category, 3 athletes (25%) in the high category, 3 athletes (25%) in the medium category, and 1 athlete (8.33%) in the low category. Then continued with data analysis techniques using simple linear regression techniques. The results of this study show that there is a significant relationship between the level of self-confidence in the target of winning with a sig result of 0.000 (p<0.05), so that self-confidence is the most important component in achieving victory.
Keywords: Self-Confidence, Gymnastics, Achievement

INTRODUCTION

Self-confidence is one of the main pillars of an athlete's success[1]. In the world of sport, which is full of pressure and fierce competition, the ability to believe in yourself is the key to achieving peak performance[2,3]. Self-confidence not only helps athletes overcome doubt or fear, but also allows them to focus, make quick decisions, and demonstrate mental resilience in critical moments[4]. Athletes who have strong self-confidence tend to be better able to face challenges, both in training and competition[5]. Self-confidence in athletes does not just appear, but is built through experience, thorough preparation, and a positive mindset[6]. Consistent physical training, mastery of technique, and a deep understanding of sports strategy help build a foundation of self-confidence[7]. This means that support from coaches, teammates, and the surrounding environment also plays a vital role in strengthening an athlete's mentality, enabling them to transform their potential into tangible achievements on the field.

Self-confidence must also be balanced with humility and awareness of one's own weaknesses, so that it does not give rise to negative things[8]. Overconfident athletes without adequate preparation risk falling into mistakes or underestimating their opponents[9]. Athletes who can balance self-confidence with discipline and focus will have a greater chance of winning the title[10]. By cultivating self-confidence through training, experience, and a positive mentality, an athlete can set themselves on a path to success, ready to overcome any obstacles to become a champion. Therefore, healthy self-confidence is built on hard work, self-evaluation, and a willingness to continuously learn.

Lack of self-confidence is one of the psychological problems that gymnasts often face, especially because of the nature of gymnastics which demands precision, courage, and public appearance [11]. Gymnasts who are unsure of their abilities often experience excessive anxiety before performing, which can affect focus and execution of the movements[12]. Fear of failure, such as falling or making a technical error, can undermine their self-confidence, thus hindering optimal performance.

Pressure from the expectations of coaches, spectators, or even oneself is often the main trigger for this problem.[13]Gymnasts who feel their abilities are inferior to those of their peers or competitors tend to doubt themselves, even though they have trained hard[14]. So it can be concluded that gymnasts who feel unappreciated or constantly corrected without praise tend to feel unable to meet standards [14,15]. This can lead to a decrease in enthusiasm and even a desire to quit gymnastics [14]. To overcome this problem, gymnasts need psychological approaches, such as counseling, mental training, and positive reinforcement, to rebuild their self-confidence and return to performing with full confidence.

RESEARCH METHOD

This research is correlational. The instrument is an athlete self-confidence questionnaire with 20 questions about factors that influence victory and the decline in self-confidence that often occurs in gymnastics before a competition. This activity was conducted using a lecture method and a closed-ended Likert-scale questionnaire to determine whether the results of the socialization were accepted and implemented. This means that the data collection process was carried out before and after the socialization was carried out. In this community service, the instrument adopted from research [16] put together and then used as a measuring tool. The following is an instrument grid.

Table 1. Self-confidence instrument

Variable	Factors	indicators	Expert Number				
			Strongly agree	Agree	Enough	Don't agree	Strongly Disagree
Confidence	Internal and external	I have high self-confidence and am confident in my ability to perform gymnastics techniques well and consistently.	5	4	3	2	1
		My self-confidence allows me to bring out my best potential and achieve peak performance when competing.	5	4	3	2	1
		I have high self-confidence so I am able to face pressure and anxiety during the competition.	5	4	3	2	1
		I am not easily influenced by a condition.	5	4	3	2	1
		I can control myself when I feel anxious.	5	4	3	2	1
		I felt that I had failed and had no confidence in winning.	5	4	3	2	1
		I am often afraid of anything related to luck.	5	4	3	2	1
		I daydream when I have a lot on my mind.	5	4	3	2	1
		Total	**40**	**32**	**24**	**16**	**8**

The self-confidence questionnaire has passed the validity and reliability test with a value of 0.776. The subjects of this study were 12 athletes who were determined using purposive sampling techniques, with the criteria being still in high school (SMA), being an athlete of the Sleman regional training center, not currently injured, and willing to be a research subject. The data collection process was carried out by distributing self-confidence questionnaires to 12 gymnastics athletes in Sleman Regency, after the data was obtained, it was continued with a normality test using the Kolmogorov Smirnov technique while the homogeneity test used the Levene's test of equality technique with a significance level of 5%. Next, a hypothesis test will be carried out using simple regression.

RESULTS AND DISCUSSION

The data results in this service are in the form of analysis results of the impact of gymnasts' self-confidence on the success of achievements in the 2025 DIY PORDA. The results of the normality and homogeneity analysis are as follows:

Table 2. Normality and homogeneity test of gymnasts' self-confidence towards success in achieving achievements at the 2025 DIY PORDA

Statistics	Confidence Internal & external
N	12
Mean	2.41
Std, Deviation	1,733
Test Statistics	0.122
Asymp. Sig. (2-tailed)	0.158

F	Df1	Df2	Sig.
2,505	3	8	0.128

The results of the normality test using the Kolmogorov-Smirnov technique obtained a sig. 0.158 (confidence), meaning the data is normally distributed. From the homogeneity test table using the Levene's test of equality technique, the sig. 0.128 ($p>0.05$) can be concluded that the data is homogeneous. After conducting the normality and homogeneity tests, the data will then be tested for hypotheses using the simple regression method.

Table 3. Self-Confidence Frequency Distribution

Valid	Frequency	Percent
Very high	5	41.66
Tall	3	25
Currently	3	25
Low	1	8.33
Total	**12**	**100**

The results of the self-confidence frequency distribution table, obtained from the self-confidence test using a questionnaire, showed that there were 5 athletes (41.66%) whose self-confidence level was in the very high category, 3 athletes (25%) in the high category, 3 athletes (25%) in the medium category, and 1 athlete (8.33%) in the low category. Next, the hypothesis will be analyzed, as follows.

Table 4. Hypothesis test of gymnasts' self-confidence results regarding their success in achieving success at the 2025 DIY PORDA

Model	Sum of Squares	df	F	Sig.
Regression	54.07	1	72,083	.000
Residual	72.36	10		
Total	**443,894**	**11**		

Based on the table above, the sig regression section obtained a sig value of 0.000 ($p<0.05$). It can be concluded that this data shows a significant relationship between self-confidence and gymnasts' success in achieving success at the 2025 DIY PORDA.

Self-confidence is a very important psychological factor in the world of sport, including gymnastics [17]. Gymnasts who have high self-confidence tend to be able to handle the pressure of competition and perform at their best, so that self-confidence allows athletes to focus on technique and movement without being hampered by doubt or fear of failure[18]. It can be interpreted in the context of gymnastics, the conditions of accuracy and consistency are very crucial, self-confidence is the foundation for achieving optimal performance.

Self-confidence also plays a role in an athlete's ability to tackle technical challenges in gymnastics, such as complex acrobatic moves or high-difficulty routines. Athletes who believe in their abilities are more likely to try

new moves and continue practicing perfecting their skills [19]. This process not only improves their technical skills, but also strengthens their mentality in facing competitive situations.[20]. Thus, self-confidence becomes a catalyst that drives athletes to continue developing and achieving better results.

In addition, self-confidence also influences how gymnasts interact with coaches, teammates, and judges[21]. Confident athletes typically exhibit a more positive and proactive attitude, which can improve communication and cooperation with coaches[22]. In competition, self-confidence radiated through body language and expressions can influence the judges' perception of an athlete's performance[23,24]. This often provides an added advantage, as a confident appearance tends to be judged more favorably than a hesitant appearance[25].

However, overconfidence can also backfire on gymnasts. Overconfidence can lead athletes to overlook small details or be underprepared for unexpected situations during competition [26]. Therefore, it is important for athletes to find a balance between healthy self-confidence and humility. Mental training, such as positive visualization and relaxation techniques, is often used to help athletes maintain optimal self-confidence without falling into arrogance. Overall, self-confidence is closely related to the success of gymnastics athletes [14,27,28]. By building self-confidence through physical training, mental preparation, and support from coaches and the environment, athletes can increase their chances of achieving high performance [29]. However, self-confidence must be managed well so that it does not turn into detrimental arrogance [30]. With a balanced approach, self-confidence will be one of the main keys to a gymnast's success on the competitive stage.

CONCLUSION

Self-confidence is a key factor influencing the success of gymnasts. With optimal self-confidence, athletes are able to handle the pressure of competition, confidently perform technical movements, and interact positively with coaches and judges. Healthy self-confidence encourages athletes to continuously hone their skills, face challenges, and maintain focus during performances. However, it's important to maintain a balance so that confidence doesn't turn into arrogance, which can be detrimental to performance. Through physical training, mental preparation, and environmental support, self-confidence can be a key driver for gymnasts to achieve maximum performance on the competition stage.

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SCHOOL MARKETING ASSISTANCE AT MA'ARIF DIY EDUCATIONAL INSTITUTION

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Abstract. One of the main sources of capital that supports the continuity of private schools is the number of enrolled students. Without students, private schools cannot function properly, because their main source of income comes from tuition fees paid by parents. The Ma'arif Nahdlatul Ulama Education Institution (LPMNU) is one of the educational institutions that has several private schools. However, based on an interview with the Head of the Ma'arif Education Institution of the Special Region of Yogyakarta, it is known that several schools have experienced a significant decline in interest. One of the reasons for this is the lack of promotion of the school to the community. Therefore, the objectives of this community service are to assist in the development of social media for school marketing. The results of this community service are: 1) Participants can create social media content for school marketing, consisting of: websites, Instagram, Facebook, TikTok, and YouTube. 2) A 50% increase in the number of followers and engagement rate. 3) A 30% increase in website traffic and leads (interest screening forms).

BACKGROUND

Private schools face various challenges in an effort to maintain their existence and ensure their operational continuity [1], [2]. One of the main sources of capital that supports the continuity of private schools is the number of students enrolled. Without students, private schools cannot run well, as the main income comes from the tuition fees paid by the students' parents. Factors related to the number of students in private schools are very important for the development of schools [3]. The higher the public's interest in a private school, the more students will enroll, which in turn will increase the school's income.

Public interest in private schools is greatly influenced by the quality of education offered, the facilities available, and the school's reputation in the eyes of the public [4], [5]. When private schools manage to attract more students, not only does income increase, but so does the school's ability to invest in curriculum development, improved teaching quality, and the addition of facilities that support the learning process. Thus, the relationship between the number of students and the school's income becomes very important in determining the continuity and development of a private school.

The Ma'arif Nahdlatul Ulama Education Institute (LPMNU) is one of the educational institutions that has several private schools. Gradually, the Maarif NU Education Institute developed educational institutions, both the addition of madrasas/schools, departments, and the education system. LPMNU is managed by 1 LPMNU PWNU (Nahdlatul Ulama Regional Administrator) and 5 LPMNU PCNU (Nahdlatul Ulama Regional Administrator). LPMNU PWNU Special Region of Yogyakarta coordinates 36 educational units, consisting of 22 vocational schools, 7 high schools, 5 MA, and 2 SLB. LPMNU PCNU oversees several levels of education from junior high school, MTs, MI, and elementary school. The total number of Ma'arif NU educational units throughout DIY is 172 schools. Based on an interview with the Chairman of the Special Region Ma'arif Education Institution Yogyakarta, it is known that there are two schools, namely SMK Maarif 1 Temon and SMK Maarif 1

The urgency of school marketing is closely related to the need to create public awareness about the existence and excellence of schools in Ma'arif Educational Institutions. In the midst of increasingly fierce competition, especially for private schools, *marketing* is a crucial tool to attract the attention of prospective students and parents [6], [7]. Without effective marketing, schools may find it difficult to differentiate themselves from other schools, especially in private schools. Good marketing can help convey messages about the quality of education, existing facilities, and various other advantages that the school has, so that the public can better understand the value offered by the school [8]–[10].

In addition, well-structured marketing also plays an important role in increasing the number of enrollees and the sustainability of school operations [11]. The number of new students is one of the main sources of income for private schools, and this income is essential to finance various operational needs, such as teacher salaries, educational facilities, and curriculum development. With the right marketing strategies, such as using social media, advertising, or working with local communities, schools can expand their reach and attract more

students [12]–[14]. Logically, the more students who enroll, the more funds available for the development of the school, which will ultimately improve the quality of education provided. Therefore, school marketing is not only a promotional tool, but also a strategy to support the continuity and growth of the school in the long term.

Based on these needs, assistance is needed for schools under the auspices of LP Maarif in particular and all schools under the LP Ma'arif DIY Foundation in general, to be able to optimize their school marketing. The objectives of this activity are 1) assisting in the preparation of school marketing development concepts, 2) assisting in the preparation of social media for school marketing,

The trust of the community and internal school residents is built on a sense of comfort and satisfaction with services in an educational unit [15]. The ability of educational units to serve the community and its citizens is able to be one of the indicators of the quality of human resources in it. Excellent service by human resources in education units has a role in increasing people's sense of comfort and satisfaction. In the service management literature, consumers included in the world of education highly appreciate good service. In fact, some studies have linked the relationship between customer satisfaction, loyalty, and loyalty [16]–[18]. This means that by providing maximum service, the community will feel satisfied and trust in the education unit. The community will participate in marketing the school through the delivery of school excellence so that the market is wider.

Public satisfaction with schools is one of the parameters of school success because it reflects success in carrying out public service functions well [19]. As an educational institution tasked with providing services to the community, schools must be able to provide services that are not only optimal, but also satisfactory and in accordance with the expectations of the community. This success shows that the school is successfully meeting the quality standards desired by parents and students, and is able to respond effectively to their needs and expectations. With the achievement of a high level of satisfaction, school can be considered as an achievement that shows commitment and dedication in improving the quality of education and service to the community [20].

The phenomenon that has occurred in educational institutions in recent years after the existence of the Minister of Education and Culture on zoning in the admission of new students is competition in attracting the interest of prospective new students, especially for private schools. This situation has an impact on private schools that lack a good reputation in the community, trying harder to acquire students [21]. This impact occurred in almost all private schools, including those under the auspices of LP Maarif NU Special Region of Yogyakarta. The Ma'arif Nahdlatul Ulama Education Institute (LPMNU) is one of the educational institutions that has several private schools. Gradually, the Maarif NU Education Institute developed educational institutions, both the addition of madrasas/schools, departments, and the education system. LPMNU PCNU oversees several levels of education from junior high school, MTs, MI, and elementary school. The total number of Ma'arif NU educational units throughout DIY is 172 schools.

One of the efforts that can be made by the management of the NU education unit that has experienced a decrease in student interest in registering is to strengthen school marketing. School marketing is a strategic process carried out to promote and improve the image of the school to the community, parents, and prospective students [7], [22]. As competition between educational institutions becomes more intense, schools need to have an effective approach in attracting attention and building trust. School marketing is not only a promotional activity, but also an effort to show the quality of education, existing facilities, and various excellent programs offered to the community [8], [23]. In this case, the right approach can create a positive impression and attract the interest of prospective students to choose the school as a place to study.

To achieve these goals, school marketing strategies must focus on identifying and understanding the needs and expectations of parents and students [12]. This can be done by utilizing various communication channels such as social media, school websites, and promotional activities at various educational events [24]–[27]. In addition, effective communication about student achievement, the success of academic programs, as well as extracurricular activities that support character and skill development are also essential to be introduced [28], [29]. That way, school marketing can reach a wider audience and create a closer relationship with the community.

Furthermore, the measurement and evaluation of each marketing activity carried out is very necessary to determine the effectiveness of the strategy implemented [30], [31]. Schools need to monitor responses from the community as well as prospective students, either through surveys, direct feedback, or data analysis of website and social media visitors [32]. This can provide a clear picture of what is working and which areas need improvement. With continuous evaluation, schools can adjust and improve marketing strategies to ensure that the message conveyed remains relevant and in accordance with the needs and expectations of the community. The following is an example of an educational service marketing strategy in attracting public interest [31].

METODE

The participants of this assistance are 36 public relations teachers. The methods used are lectures, discussions, questions and answers, and the practice of using social media. This mentoring guides teachers in

understanding the concept of school marketing and actualizing school marketing programs to increase the interest of students and parents.

Troubleshooting Framework

Based on the problems found, the solution offered to solve the problems faced is to provide assistance to SMK Maarif 1 Temon and SMK Maarif 1 Sleman to be able to optimize their school marketing. This is explained in more detail in the objectives of the activities that will be carried out including: 1) developing the concept of school marketing development, 2) assisting in the preparation of social media for school marketing, and 3) providing experience to lecturers and students in off-campus activities in an effort to integrate theory and practice.

The expected targets in this assistance include: 1) improving the ability of the managers of SMK Maarif 1 Temon and SMK Maarif 1 Sleman to develop school marketing, namely, 2) the existence of social media that is active in holding school marketing, and 3) increasing the ability of lecturers and students to realize theory into the form of practice in the actual environment. The solutions related to the completion target of separate outputs/achievement indicators that can be measured quantitatively are outlined in the following table.

Table 2. Composition of Duties of Each Member of Service

Activities	Topic	Person in Charge
Manufacture Proposal & IA	Proposal, IA	TEA M
Material	1. The Importance of *School Marketing* at LP Maarif DIY	Ahmad Chafid Alwi, S.Pd., M.Pd
	2. Strengthening Media Optimization Social	Tejo Nurseto, S.Pd., M.Pd
	3. School Marketing through Social Media at the ideal LP Maarif Yogyakarta	Dr. Kiromim Baroroh, M.Pd.
Practice	4. Social media content creation practices for school marketing	team
	5. Implementation of school marketing content: School *Marketing* content is based on the needs and potential in each participant's school	Zahy Aulia Mafazah & Salsabila Rodiyah
Evaluation	6. Evaluate the implementation of social media content	Ratna Rosita Pangestika
Follow-up	Each participant (individual) Implementing School Marketing through social media and reporting the results (must be supported by photo).	TEAM
Data Processing	Quantitative and Qualitative	TEAM
Report Generation	Activity Results Report	TEAM
Exterior Manufacturing	Articles, Color Posters, IPR & Videos Activities	TEAM

Results of Implementation of Activities

The Faculty of Economics and Business, State University of Yogyakarta (FEB UNY) has initiated a strategic community service program through marketing assistance activities for schools under the auspices of the Ma'arif Nahdlatul Ulama Education Institute of the Special Region of Yogyakarta (LP Ma'arif NU DIY). This program represents the commitment of the tri dharma of higher education to transform science and academic expertise into practical solutions to the challenges faced by the community, especially in the education sector.

Essentially, this mentoring activity is designed with the main goal of supporting the continuity of private schools through capacity building in formulating effective and sustainable marketing strategies. In the context of education economics, the viability of a private educational institution is greatly influenced by its ability to attract

and retain an adequate number of students, which in turn becomes a primary source of income to finance day-to-day operations, educator remuneration, and infrastructure development.

The opening of the activity began with remarks from the Dean of FEB UNY, Dr. Sutirman, M.Pd., who in his speech emphasized the importance of synergy between the academic world and education practitioners. He expressed his deep hope that this collaboration would not only be ceremonial, but could have a significant impact on increasing the brand equity of LP Ma'arif NU DIY as a whole, so that its positioning as a provider of superior and quality education in DIY could be further strengthened.

A similar statement was delivered by the Secretary of LP Ma'arif NU DIY, Dr. Mukhammad Luqman Hakim, M.Pd., who provided a perspective from the partners. In his remarks, he emphasized the urgency of adapting digital technology in the current era of information disruption. Furthermore, he emphasized that mastery of branding and digital marketing materials is no longer an option, but a strategic imperative for every educational institution to be able to introduce the excellence and differentiation of its programs in the community.

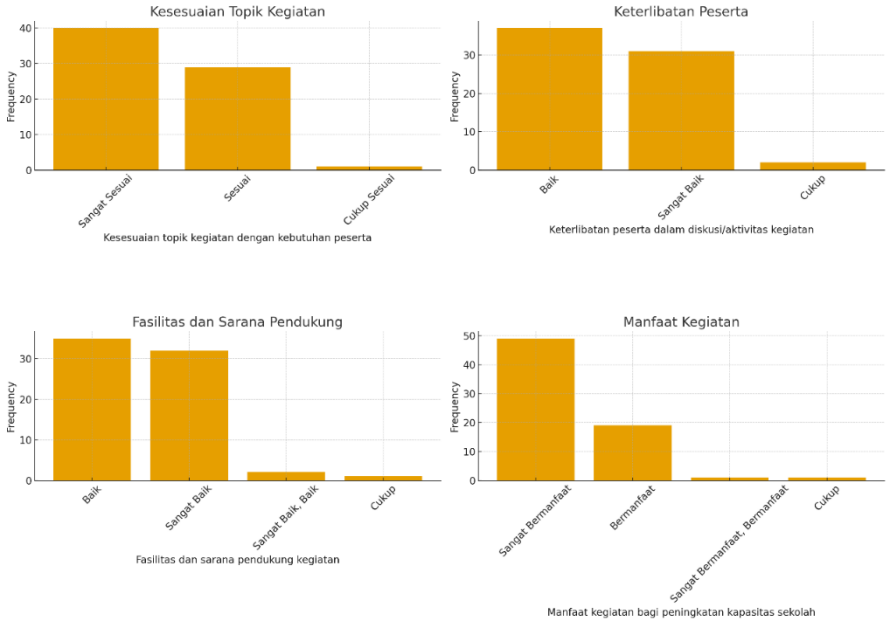
The mentoring material was compiled and delivered comprehensively by a team of experts from FEB UNY consisting of Dr. Kiromim Baroroh, M.Pd., Tejo Nurseto, M.Pd., and Dr. Achhad Chafid Alwi, M.Pd. The scope of the material is focused on three main pillars: first, the formulation of the concept of school marketing development based on distinctive values; Second, optimization techniques for the use of various social media platforms as an effective means of promotion; and third, training on the preparation of digital content that is creative, informative, and relevant to the psychology of the target audience, namely prospective students and parents.

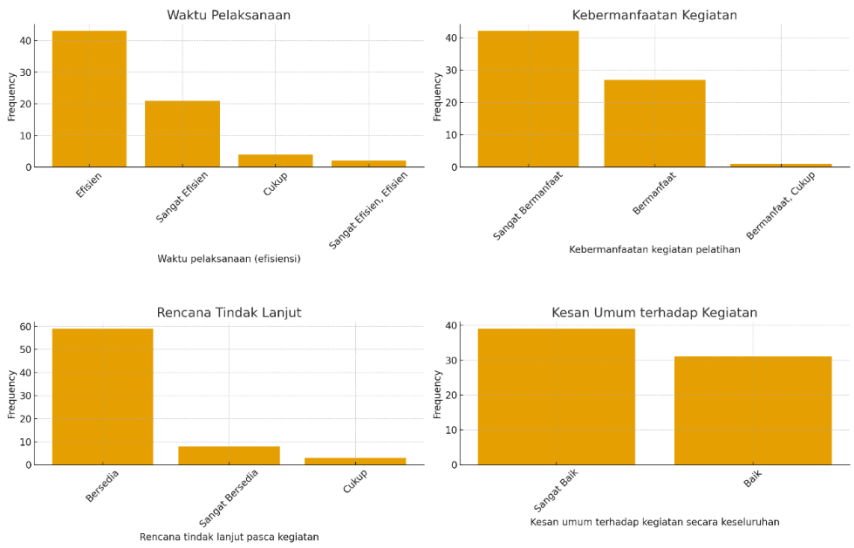
The participants involved in this activity were representatives of various levels of education, ranging from elementary, middle, to upper levels under the auspices of LP Ma'arif NU DIY. This diversity of education levels shows that the need for marketing literacy is felt universally and across sectors, as well as an effort to create branding standards that are coherent but still adaptive to the characteristics of each level.

The expected output from the implementation of this program is the creation of a comprehensive understanding and improvement of technical skills among the community social relations (PR) team of school principals, treasurers, and administrators of LP Ma'arif NU DIY. With this knowledge, it is hoped that they will be able to manage their school's marketing strategy independently and sustainably, so that they can build a positive image, expand the reach of prospective students, and ultimately increase the competitive advantage of the institution.

On a more macro level, this activity not only leads to an increase in the number of students, but also contributes to strengthening a healthy and competitive private education ecosystem. The ability of these schools to continue to exist and develop will enrich the national educational treasure by providing more choices for the community, which is in line with the principle of equal access to quality education.

In closing, the community service initiative carried out by FEB UNY is an ideal collaboration model between universities and community organizations. This program bridges the latest marketing theories developed in the lecture hall with its application in solving real problems in the field, while reflecting on the role of universities as agents of change and social development in society.





Picture. Results of descriptive analysis of the evaluation of service activities

The overall evaluation showed the suitability of the activity topic with the needs of the participants. The training was rated as highly tailored to the needs of the participants, with the majority of respondents stating that the topics covered were "Very Appropriate" to their needs. This shows that the material presented in the training successfully answered the challenges faced by the participants, especially in the context of implementing relevant marketing techniques for schools under the auspices of LP Ma'arif. This high topic suitability indicates that the material provided has been carefully selected, in accordance with the real expectations and needs of the participants.

Participant Engagement in Discussions and Activities Based on participants' ratings, their level of involvement in discussions and activity activities is quite high, with most giving a "Good" or "Excellent" rating. This shows that the training is not only theoretical, but also practical and interactive. The active involvement of participants is essential because it helps to deepen the understanding and application of the material that has been delivered. This shows that this training successfully creates a space for participants to actively participate in the learning process.

Most of the participants were satisfied with the facilities and supporting facilities provided during the training. Many respondents gave a rating of "Good" or "Excellent", indicating that facilities such as training rooms, equipment, and other supporting facilities are adequate and support the smooth running of activities. Good facilities will certainly create comfort for participants in participating in the training, which in turn can increase the effectiveness of the learning process.

The benefits of this training for increasing school capacity are also very much felt by the participants. Most participants felt this training was "Very Beneficial" or "Beneficial" to their school. This shows that participants not only gain new knowledge and skills, but can also directly apply them to improve school performance and capacity. This training has a significant impact on the development of the educational institutions they represent.

This training is also considered quite efficient in terms of its implementation time. Most participants gave an "Efficient" or "Very Efficient" rating, which means that the activities ran according to the specified time without waste. Time efficiency is important to keep participants focused and ensure that all training materials can be delivered properly. Some participants also gave a "Sufficient" rating, which may indicate some areas where time management could be further optimized.

The overall usefulness of the training was also rated very positively, with many participants stating that the training was "Very Helpful" or "Helpful". This assessment shows that this training not only provides an understanding of marketing, but also provides participants with practical skills that can be directly applied in the context of their work in school. This benefit is very important because it can provide significant added value for the professional development of participants.

The readiness of participants to follow up after the activity showed a high level of commitment to the training results. Most participants stated "Ready" to follow up after the training is completed. This is important because it ensures that what is learned during the training does not only stop at the time of the event, but can also be applied on an ongoing basis. A clear follow-up plan will ensure that participants can continue to develop their skills after the training.

Overall, the participants' impressions of this activity were very positive. The majority of participants gave a "Good" or "Very Good" rating to this training. This positive impression reflects the satisfaction of the participants with the entire training, starting from the material presented, the way it is delivered, the facilities, to the interaction

during the activity. This shows that this training was well received by the participants and had a positive impact on their development in the field of school marketing.

CONCLUSION

Private schools such as those under the auspices of LP Maarif are schools that have a great responsibility in independence. In this independence, of course, the key is the number of students which is one of the main production factors in this educational service. Finding students certainly presents its own challenges in the midst of various free programs owned by public schools. Therefore, school marketing is needed which is expected to be able to attract users to decide on a school in the LP-Maarif madrasah.

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INTERNATIONALIZATION AT YOGYAKARTA STATE UNIVERSITY: ACADEMIC COMMUNITY VIEWS ON THE ROLE AND EFFECTIVENESS OF INTERNATIONAL OFFICE GOVERNANCE AND INSTITUTIONAL STRUCTURE

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Abstract. University internationalization is a key strategy to enhance global competitiveness, strengthen institutional reputation, and contribute to international rankings. The International Office (IO) serves as the hub for policies, services, and programs supporting internationalization. However, at Universitas Negeri Yogyakarta (UNY), the IO continues to face challenges related to organizational structure, resources, governance, and cross-unit policy integration. This study analyzes the governance and institutional role of UNY's IO, benchmarks it against best practices from partner universities in Indonesia, and formulates a model for institutional strengthening aligned with the university's needs. A descriptive-qualitative approach was employed, combining Likert-scale questionnaires distributed to members of the academic community, focus group discussions (FGDs) with IO managers from partner universities, and document analysis of policies, organizational structures, and performance reports. Findings reveal that while the IO is effective in facilitating mobility and administrative support, its strategic contribution to curriculum internationalization and policy development remains limited. Based on the analysis, six recommendations are proposed: (1) repositioning the IO as a directorate, (2) enhancing the capacity of internationally competent human resources, (3) allocating a dedicated internationalization budget, (4) developing an integrated data system, (5) implementing collaborative governance across units, and (6) establishing measurable performance indicators. These recommendations provide an evidence-based foundation for designing priority programs in governance, capacity building, digital services, and international promotion, thereby accelerating progress toward world-class university status.

Keywords: internationalization, international office, institutional strengthening, governance,

INTRODUCTION

The internationalization of higher education has become one of the most significant transformations in global academia over the last two decades. In recent years, it has evolved from being a desirable add-on to a strategic imperative for higher education institutions (HEIs) seeking to enhance global competitiveness, institutional visibility, and academic quality [1][2]. Internationalization is no longer limited to student exchanges or bilateral agreements but encompasses a comprehensive and systemic integration of international, intercultural, and global dimensions into teaching, research, and governance [3][4].

Recent scholarship emphasizes that internationalization strategies are deeply shaped by institutional capacity, governance, and leadership. A systematic review of Asian HEIs found that internationalization commonly revolves around six interrelated dimensions: student mobility, international curricula, faculty recruitment and development, collaborative research, international ventures, and resource diversification [5]. In Southeast Asia specifically, internationalization is influenced not only by global trends but also by regional challenges, including financial sustainability, linguistic and cultural adaptation, and uneven institutional capacity [6][7]. These findings

highlight that internationalization cannot succeed without adequate governance frameworks that ensure transparency, accountability, and strategic alignment [8].

The role of the International Office (IO) has become increasingly central in this process. Once viewed as merely administrative, IOs are now expected to act as strategic hubs—designing internationalization policies, managing partnerships, supporting international students, facilitating academic mobility, and building the institution's global reputation [9][10]. However, research shows that many IOs, particularly in developing contexts, face persistent barriers such as limited human resources, fragmented institutional support, and bureaucratic rigidity [11][12].

In Indonesia, internationalization has been supported by government initiatives such as *Kampus Merdeka* and broader higher education reforms that encourage universities to expand their networks and global collaborations. Nevertheless, studies show that Indonesian universities still grapple with limited human capital with global competencies, weak coordination between faculties and central governance, and insufficient digital infrastructure to support sustainable internationalization [2][13]. A recent scoping review of Southeast Asian universities identified "multidimensional challenges," including quality assurance gaps, resource constraints, and talent retention problems, which underscore the importance of strengthening governance at the institutional level [14].

Against this backdrop, Universitas Negeri Yogyakarta (UNY) presents a particularly relevant case. As a state university with a growing reputation, UNY has articulated internationalization as part of its vision and mission, and its International Office (Kantor Urusan Internasional/KUI) has played a significant role in welcoming international students, managing exchange programs, and developing collaborations. Yet, the effectiveness of this office has not been systematically studied from the perspective of multiple stakeholders. Understanding how students, lecturers, and staff perceive the International Office, and how its governance compares with national and international best practices, is crucial for optimizing its institutional role.

Therefore, this study aims to: (1) analyze stakeholders' perceptions of the governance and institutional framework of UNY's International Office, (2) benchmark its practices against comparable national and international cases, (3) propose evidence-based strategies to strengthen its institutional capacity and role in supporting sustainable and inclusive internationalization. By situating UNY's case within broader theoretical and empirical debates, this research contributes to the growing body of literature on internationalization governance in non-Western higher education and provides practical recommendations for Indonesian universities seeking to align global ambitions with institutional realities.

LITERATURE REVIEW

Conceptualizing Internationalization of Higher Education

Internationalization in higher education has been widely studied over the last three decades, but recent scholarship has expanded its scope and redefined its objectives. Internationalization defines as "the process of integrating an international, intercultural, or global dimension into the purpose, functions, and delivery of postsecondary education"[1]. This definition emphasizes that internationalization is not an isolated activity but an institutional process that influences all aspects of teaching, research, and service. The concept of *comprehensive internationalization* refers to global engagement permeates academic programs, governance structures, and institutional culture [15].

Recent Asian perspectives, however, suggest a shift toward more contextualized models. The growing relevance of *internationalization at home* shows the global perspectives which are embedded in curricula and intercultural experiences are created on campus for students who do not participate in mobility programs [16]. A systematic review of Asian HEIs confirms that internationalization is increasingly multidimensional, involving not only mobility but also research collaboration, international curriculum, and digital innovation [17].

Drivers and Benefits of Internationalization

The drivers of internationalization in HEIs are diverse and vary by context. Globally, motivations include improving institutional reputation, enhancing research capacity, diversifying income streams, and contributing to global knowledge exchange [18]. In developing countries, internationalization is also linked to capacity building, access to global networks, and national competitiveness [12].

In Indonesia, institutional autonomy, government support, and multicultural engagement are significant drivers enabling universities to implement international programs and recruit foreign faculty [2] Internationalization also contributes to institutional identity and branding, making universities more attractive to students, both local and international [13]. At the same time, benefits include intercultural learning opportunities, improved employability of graduates, and enhanced academic reputation through global collaboration [10].

Challenges in Internationalization

Despite its benefits, internationalization faces numerous challenges. A scoping review of Southeast Asian HEIs identified multidimensional barriers, including financial constraints, linguistic adaptation, cultural integration, and limited institutional capacity [19]. Similarly, Indonesian universities often struggle with

bureaucratic hurdles, lack of international competencies among staff, and fragmented coordination between faculties and central administration [11].

Human resources remain a key limitation. Universities require staff who are not only fluent in foreign languages but also competent in cross-cultural communication, international policy, and partnership management [12]. Digital infrastructure has also emerged as a critical factor, as universities increasingly rely on online platforms for international collaboration and service delivery (Rahman & Yamaguchi, 2021). Without adequate resources, internationalization risks being superficial or unsustainable.

Governance and Policy in Internationalization

Governance plays a pivotal role in shaping the success of internationalization initiatives. Good governance is characterized by transparency, accountability, participation, and strategic alignment [8]. Research shows that strong leadership and transformational governance enable HEIs to mobilize resources, design coherent policies, and strengthen global partnerships [12].

National policies can either facilitate or constrain internationalization. In Indonesia, initiatives such as *Kampus Merdeka* provide institutional space to pursue global engagement, but inconsistencies in regulatory frameworks and funding allocation often hinder implementation [20]. Comparative studies suggest that universities with clearer policy frameworks and institutional autonomy achieve more sustainable internationalization outcomes [2][13].

The Role of the International Office

The International Office (IO) has become the cornerstone of internationalization strategies in universities. Traditionally limited to administrative functions such as handling visas and exchange documentation, IOs are now recognized as strategic units responsible for partnership development, international student services, academic mobility, and institutional branding [9].

Effective IOs require adequate authority, skilled staff, and integration with university governance. IOs act as "organizational bridges" linking faculty, administration, and external partners [10]. However, in many developing contexts, IOs face barriers including limited budgets, staff shortages, and low awareness of their strategic role [8][11]. A recent regional review stresses that IOs must evolve into proactive units that lead policy innovation, digitalize services, and ensure inclusivity in internationalization [14].

RESEARCH METHOD

This study employed a descriptive qualitative design to analyze the governance and institutional structure of the International Office (IO) at Yogyakarta State University (UNY), compare it with practices in partner universities, and formulate a model of institutional strengthening. A descriptive qualitative approach was considered appropriate because it enables the exploration and interpretation of institutional practices, policies, and perceptions in depth [21]. The research was conducted at UNY with additional input from partner universities that have more established International Offices, providing both contextual and comparative insights. Participants were selected purposively, involving members of the UNY academic community who completed a Likert-scale questionnaire, International Office managers from partner universities who engaged in focus group discussions (FGDs), and policy-related stakeholders at UNY who were directly involved in internationalization governance. Data collection relied on three complementary techniques: questionnaires were distributed to lecturers, staff, and students to capture their perceptions of the governance and institutional role of the IO; FGDs were conducted with IO managers from partner universities to gather best practices and comparative experiences; and document analysis was applied to review university policies, organizational structures, strategic plans, and performance reports on internationalization. The analysis followed a thematic descriptive approach in which questionnaire responses were tabulated to reveal patterns and trends, while transcripts from FGDs and documentary sources were coded inductively to generate themes [22]. Triangulation of the three data sources was applied to strengthen credibility and consistency of the findings [23]. To ensure trustworthiness, the study adopted [24] four criteria: credibility was established through triangulation, transferability was enhanced by providing thick descriptions of the institutional context, dependability was maintained by documenting research procedures in an audit trail, and confirmability was achieved through reflexivity and peer debriefing. Ethical clearance was obtained from UNY's ethics committee, and all participants were provided with information about the purpose of the study, assured of confidentiality, and asked to give informed consent.

RESULTS AND DISCUSSION

The findings of this research highlight the multiple dimensions of internationalization governance at Universitas Negeri Yogyakarta (UNY), with particular focus on the role of its International Office (IO). Through a mixed set of instruments—Likert-scale surveys with academic staff and students, FGDs with IO managers from

other Indonesian universities, and document analysis of strategic plans and organizational charts—the study uncovers both achievements and limitations in the current model of internationalization management. The results indicate that while UNY's IO has developed operational capacity in facilitating mobility, managing cooperation, and offering international student services, it still faces systemic challenges related to institutional positioning, resource allocation, digital infrastructure, and integration with academic units. These results not only describe the local institutional realities of UNY but also contribute to broader debates about the governance of internationalization in Indonesian and Southeast Asian higher education [1][3][7][8].

1. Survey Data

The survey instrument was 5-point Likert scale questionnaire (1 = Strongly Disagree, 5 = Strongly Agree). It involved 120 participants (faculty members, administrative staff, and IO staff).

Table 1. Questionnaire results

Dimension	Sample Item	Mean	SD	% Agree/ Strongly Agree
Operational Efficiency	"The IO provides reliable administrative support for mobility programs."	3.92	.84	72%
	"The IO ensures smooth facilitation of international cooperation."	3.87	.91	68%
Strategic Role	"The IO contributes meaningfully to curriculum internationalization."	3.09	1.01	42%
	"The IO plays a significant role in university-level decision-making."	2.98	1.04	39%
Resource Adequacy	"The IO is sufficiently staffed to manage internationalization effectively."	3.28	.97	54%
	"The IO has adequate funding to support its strategic initiatives."	3.02	1.02	47%
Digitalization	"The IO provides effective digital tools for information sharing."	3.46	.88	61%
	"The IO's digital systems are integrated with faculty units."	2.95	.93	38%
Faculty Integration	"Faculties are systematically involved in IO-led international initiatives."	3.01	.93	41%
	"Faculty collaboration with the IO enhances internationalization outcomes."	3.14	.89	44%

2. Focus Group Discussion (FGD)

FGDs were conducted with IO staff (n = 6), Faculty members (n = 8), and IO managers from other Indonesian universities (n = 5). The selected quotations based on the themes are presented below.

- Faculty voice:
  "The IO is responsive to mobility paperwork, but when we talk about curriculum or research collaboration, they are rarely involved. They're more of a service provider than a strategic partner."
- IO staff voice:
  "We spend most of our time processing visas and MoUs. When it comes to policy or curriculum, we are not always invited to discussions. That limits our contribution to strategy."
- Benchmarking (peer university, state sector):
  "At our university, we manage hundreds of mobility cases every year, but the IO is rarely included in Senate decisions. Internationalization is seen as important, but our role is mainly administrative."
- Benchmarking (peer university, private sector):
  "Our IO is active, but the mandate is narrow. Faculties run their own international projects without reporting to us, so we struggle to coordinate outcomes."
- Faculty on resources:
  "The staff work very hard, but they are too few. With this workload, it's unrealistic to expect them to drive curriculum reform as well."
- IO staff on digitalization:
  "We have a database, but it is not integrated. Some units still rely on Excel sheets. It slows down coordination."
- Faculty on digital access:
  "Sometimes we find out about new MoUs by accident. A centralized digital portal would help us align with the IO."

3. Document Analysis (Highlights)

- Strategic Plan (2021–2025): Goals include doubling inbound international students, launching joint-degree programs, and expanding partnerships with global universities.

- Organizational Chart: IO placed under Vice Rectorate for Academic and Student Affairs, no direct representation at Senate level.
- Annual Reports (2022–2023):
  Growth in short-term mobility programs (+35%).
  Increase in MoU signings (from 42 to 67).
  Limited progress in joint-degree programs (0 new initiatives launched).
  Curriculum internationalization largely unaddressed.

The findings of this study reveal a complex picture of the International Office (IO) at Universitas Negeri Yogyakarta (UNY) and, more broadly, of the systemic dynamics of internationalization in Indonesian higher education. Survey data, focus group discussions (FGDs), and document analysis converge on a central conclusion: while the IO performs effectively as an operational facilitator of mobility and cooperation, it struggles to establish itself as a strategic actor in governance, curriculum, and institutional culture. These results resonate with critiques in the literature that internationalization in the Global South remains aspirational in rhetoric but fragmented in practice [1][27].

Operational Efficiency and Strategic Marginality

The survey data indicate that the IO at UNY is perceived as reliable in administrative functions. Respondents largely agreed that the IO ensures smooth facilitation of international cooperation (M = 3.87, SD = .91) and provides reliable mobility support (M = 3.92, SD = .84). Indeed, 72% of respondents reported satisfaction with its efficiency. FGDs reinforced this view. A faculty member noted:

"The International Office is very responsive when it comes to administrative needs, but when we talk about curriculum or academic partnerships, their involvement seems limited. They are seen more as facilitators than as leaders in shaping international academic collaboration."

Despite this positive perception of operations, the IO's strategic role is perceived as weak. Survey items measuring involvement in curriculum internationalization (M = 3.09, SD = 1.01, 42% agree) and governance decision-making (M = 2.98, SD = 1.04, 39% agree) scored significantly lower. IO staff acknowledged this gap:

"We are often focused on mobility paperwork and MoU tracking. When it comes to policy or academic matters, we are not always invited to participate. It feels like we are an operational unit rather than part of the strategic brain of the university."

This imbalance between operational competence and strategic marginality echoes [1] analysis of the "service–strategy divide" in international offices. Comprehensive internationalization requires embedding global engagement into governance, curriculum, and culture, not simply facilitating mobility [3]. The findings confirm that without structural inclusion in university-level decision-making, IOs risk remaining service units rather than strategic engines.

Benchmarking FGDs show that UNY's situation is not unique. An IO manager from another state university explained:

"We manage hundreds of mobility cases every year, but we are rarely involved in Senate-level decisions. Internationalization is discussed at the top, but we are not at the table. This reduces the alignment between what we do and the university's long-term goals."

This systemic pattern is consistent with studies in Vietnam [25] and Malaysia [14] where IOs often act as implementers rather than decision-makers. Governance fragmentation in Indonesian universities, with overlapping mandates and weak institutional coordination [11].

Resource Constraints and Organizational Capacity

Resource adequacy emerged as another critical theme. The survey showed moderate agreement that the IO is adequately staffed (M = 3.28, SD = .97, 54% agree) and funded (M = 3.02, SD = 1.02, 47% agree). However, FGDs revealed a sense of overload among staff. One IO officer explained:

"We are only a few people handling everything from visa support to drafting MoUs. Sometimes, we work late just to process documents, leaving little room for strategic initiatives."

Faculty members echoed this concern. A professor remarked:

"The office staff are hardworking, but with limited personnel they cannot be expected to take on curriculum reform or policy leadership. The workload simply does not allow it."

Benchmarking confirmed that other Indonesian universities face similar pressures. A private university manager shared:

"Our internationalization targets keep expanding, but our budget is stagnant. We rely heavily on short-term project funding rather than a dedicated internationalization budget."

These findings align with critique that many universities in emerging contexts overestimate their internationalization capacity while underinvesting in resources [26]. Reliance on project-based or donor-driven funding makes internationalization efforts unstable. In UNY's case, limited staffing and funding constrain the IO's ability to shift from routine tasks toward strategic engagement.

Digitalization: Potential and Fragmentation

Digitalization is increasingly recognized as central to effective internationalization, offering tools for monitoring, transparency, and coordination. In this study, the survey revealed moderate satisfaction with digital systems (M = 3.46, SD = .88, 61% agree) but weaker perceptions of integration with faculties (M = 2.95, SD = .93, 38% agree). Faculty described uneven access to information:

"Information about MoUs and international opportunities is sometimes outdated or hard to access. Faculties often learn about partnerships by chance, not through a centralized system."

IO staff acknowledged this fragmentation:

"We do have databases, but they are not linked across units. Sometimes we rely on Excel sheets and manual updates."

This reflects what [27] the "digital divide" in internationalization, where elite universities deploy sophisticated platforms but others remain dependent on manual or fragmented systems. Benchmarking FGDs suggest that some Indonesian universities are experimenting with centralized dashboards accessible to faculties, but such innovations are uneven and often underfunded.

Document analysis corroborated these limitations. Annual reports noted that while the IO tracked MoUs and mobility cases, the reporting system was primarily manual, and there was little evidence of integrated faculty-accessible platforms. Without stronger digital infrastructure, coordination remains inefficient and transparency limited.

Faculty Integration and Institutional Alignment

Perhaps the most critical finding concerns the relationship between the IO and academic faculties. Survey data revealed weak agreement that faculties are systematically involved in IO-led initiatives (M = 3.01, SD = .93, 41% agree) or that collaboration enhances outcomes (M = 3.14, SD = .89, 44% agree).

Faculty participants admitted to a lack of coordination:

"International cooperation is often initiated by individual faculties or even personal networks, but there is little coordination with the IO. Sometimes we only inform them after agreements are already made."

From the IO's perspective, this created problems of monitoring:

"We know faculties are active internationally, but they don't always report back. This makes it hard to keep track of MoUs or assess the overall impact."

This fragmentation reflects [1] warning that disjointed internationalization risks becoming opportunistic and unsustainable. Faculty autonomy is valuable, but without coordination mechanisms, outcomes remain scattered. Comprehensive internationalization requires faculty engagement, since academic staff are the primary drivers of curriculum reform and research collaboration [3].

FGDs with peer universities highlighted similar struggles. A state university manager noted:

"Faculties prefer autonomy and sometimes see the IO as bureaucratic. They value their networks but resist centralized coordination."

These findings underscore the need for incentives and structures that integrate faculty activities into institutional internationalization frameworks. As [25] argue, sustainable progress depends on "academic embedding," where internationalization is part of faculty's everyday teaching and research practices rather than an external demand.

Institutional Positioning in Policy and Documents

Document analysis provided further insight into institutional positioning. UNY's Strategic Plan (2021–2025) sets ambitious targets: doubling inbound student numbers, launching joint degree programs, and expanding partnerships with top global universities. Yet the IO remains structurally positioned under the Vice Rectorate for Academic and Student Affairs, without Senate-level representation. Annual reports indicate achievements mainly in short-term exchanges (+35%) and MoU expansion (from 42 to 67), but minimal progress in structural initiatives such as joint degrees (0 new programs) or curriculum reform.

This gap between aspirational goals and operational outcomes illustrates what Arjul, Tjalla, and Nurhattati (2023) call the "aspiration–implementation disconnect" in Indonesian higher education. Policies are ambitious, but structures and resources lag behind. The result is what "symbolic internationalization," where MoUs and mobility programs proliferate but deeper academic transformation remains elusive [27]. The findings paint a picture of an international office that is efficient in operations but marginalized strategically, constrained by resources, limited in digital capacity, and weakly integrated with faculty. These are not isolated challenges but systemic patterns across Indonesian higher education.

Theoretically, this study confirms that internationalization in the Global South is often characterized by a service–strategy imbalance [1], and [3] insistence that comprehensive internationalization requires governance integration. Empirically, the findings align with regional evidence from Vietnam [25] and Malaysia [7] showing that Southeast Asian IOs face similar barriers.

Practically, the results suggest three main priorities. First, universities must reform governance structures to embed IOs into decision-making, ensuring alignment between strategy and operations. Second, resource allocation must shift from ad hoc or project-based funding toward sustained investment in staffing and budget. Third, digital platforms and faculty integration mechanisms are essential to improve coordination and embed internationalization into academic life. Unless these reforms are implemented, internationalization at UNY and in many Indonesian university's risks remaining at the level of mobility numbers and MoU counts, rather than evolving into a transformative force for curriculum, research, and institutional culture.

CONCLUSION

This study examined the role of the International Office (IO) at Universitas Negeri Yogyakarta (UNY) within the broader landscape of internationalization in Indonesian higher education. The findings highlight a consistent pattern: while the IO is highly effective in operational functions such as mobility facilitation and partnership administration, it remains marginal in strategic domains such as curriculum internationalization, governance, and long-term policy planning. Survey results confirm this imbalance. A strong majority of respondents rated the IO positively for administrative efficiency ($M \approx 3.9$), yet fewer than half believed it contributed significantly to curriculum reform or policy-making ($M \approx 3.0$). Focus group discussions reinforced this view, with faculty and staff describing the IO as "a facilitator rather than a leader." Document analysis revealed a similar gap between ambitious internationalization goals in strategic plans and the limited authority of the IO in institutional governance. Three additional constraints emerged. First, limited staffing and funding restrict the IO's ability to move beyond routine tasks. Second, digitalization is fragmented, with poorly integrated systems hampering transparency and coordination. Third, faculty engagement is weak, with many collaborations initiated independently of the IO, resulting in fragmented outcomes. These findings mirror regional studies that point to governance fragmentation and the persistence of symbolic rather than substantive internationalization. The study concludes that for internationalization to become transformative rather than superficial, universities must empower IOs with greater strategic authority, adequate resources, integrated digital tools, and stronger faculty collaboration. While the focus here is UNY, the evidence suggests a broader systemic pattern across Indonesian higher education. Addressing these gaps is critical if universities are to move beyond mobility numbers and MoU counts toward embedding international perspectives into teaching, research, and governance.

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Development of Financial Internal Audit Instruments in Senior High School

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Abstract. This study aims to develop a valid and practical internal audit instrument for school finances for use in educational units under the auspices of the Ma'arif NU DIY Educational Institution. The background of this study stems from weak financial records, a lack of supervision, and the absence of separation of functions in the school fund management process. This study uses the ADDIE development model with five main stages: Analyze, Design, Develop, Implement, and Evaluate. Data were collected through observation, interviews, and documentation in 36 schools. The result is an internal audit instrument that has been validated by experts and tested on a limited basis. This research is expected to increase transparency and accountability in school financial management and support good governance within the Ma'arif Educational Institution.

Keywords: Internal audit, school financial management, SOP, ADDIE, Ma'arif Educational Institution

INTRODUCTION

In the era of school autonomy and the implementation of the Independent Curriculum, transparency and accountability in financial management are key tools for ensuring the sustainability of educational quality [1]. Schools, as public institutions, must provide full accountability for every rupiah spent to the community, government, and other stakeholders [2]. Openness of financial information, including access to and transparency in reporting, is a crucial indicator in assessing the credibility and effectiveness of educational institution governance [3]. Schools' accountability in implementing educational programs can be questioned without adequate transparency, leading to a significant decline in public trust [1].

The Ma'arif NU Yogyakarta Educational Institution, which oversees 172 educational units [4], faces complex financial management challenges that encompass administrative and strategic aspects. Problems such as unsystematic transaction recording, limited reporting, and the absence of adequate internal controls demonstrate the weak financial governance infrastructure at the school level [5]; [6]. The absence of an internal audit mechanism exacerbates the situation, as schools lack a means of early detection of potential mismanagement of funds [7].

Many schools solely prepare School Activity and Budget Plans (RKAS) to fulfill administrative requirements, without utilizing them as strategic management tools. The financial planning function, which should be the foundation for program implementation, is neglected, resulting in budgets that do not reflect the school's actual needs [8]; [9]. The absence of regularly scheduled internal audits prevents errors and irregularities in the implementation of the RKAS from being identified [10]. Furthermore, human resource capacity to plan, record, and evaluate school finances remains significantly limited, particularly in areas with low economic resources [11].

Several studies have shown that systematic and consistent internal audits can improve educational institutions' efficiency, transparency, and accountability [7]. Audits act as administrative controls and a strategic mechanism that guides program implementation to ensure it aligns with organizational goals [12]. Internal audit implementation also aligns with the principles of good governance, which emphasize accountability, transparency, and participation in the management of public organizations [13 ; 6].

Unfortunately, recording financial transactions at most Ma'arif schools in Yogyakarta remains very rudimentary and manual. The information generated from this recording is limited to cash inflows and outflows, with no calculation of depreciation or depreciation of fixed assets [1]; [11]. This incomplete financial data results in

the financial reports not reflecting the school's overall financial position [14]. Consequently, strategic decision-making by school and foundation management is less accurate.

Monthly financial reports, which should serve as monitoring instruments, are rarely prepared consistently. Schools generally only report on Operational Assistance (BOP) funds, while other transactions remain undocumented [9]. This lack of comprehensive reporting complicates the foundation's supervision, preventing potential errors or misappropriation from being detected early [6]. The quality of financial reporting is a key measure of school management integrity.

Schools' obligation to provide financial information to the public and stakeholders should not be limited to simple cash flow reporting. Good financial reporting should present information that reflects resource management's efficiency, effectiveness, and performance [14]. When these dimensions are neglected, public accountability is eroded, and trust in educational institutions can decline [10]. Therefore, it is crucial to develop a standardized and comprehensive reporting format.

The 2024 Community Service (PkM) findings reinforce the urgency of financial governance reform within the Ma'arif Yogyakarta school environment. Many junior high and vocational schools demonstrate significant weaknesses in financial transaction documentation, with critical documents often missing or not recorded [12]. The RKAS (Regional Budget and Budget Plan) is poorly prepared and does not serve as a valid reference for school program decision-making [9]. It indicates the need for tools to streamline financial planning, implementation, and evaluation functions.

The lack of separation of functions between authorization, recording, and cash custody contradicts the basic principles of internal control. When one individual handles more than one financial function, the risk of irregularities and fraud increases dramatically [7], some school activities are carried out without adequate planning and are not included in the school budget (RKAS), demonstrating the weak role of planning as a control tool [15]. Operational pressures should not be an excuse to neglect a sound management structure.

Based on these findings, LP Ma'arif NU DIY requires systemic intervention that includes the development of financial management standard operating procedures (SOPs), developing internal audit instruments, and training to strengthen institutional capacity. These efforts can be realized through workshops and mentoring involving academics and students as part of higher education collaboration [11]. These activities support the principles of good governance and align with key performance indicators (KPI) in higher education [6]. Therefore, developing internal audit instruments is a strategic step to improve the quality of Ma'arif school's financial governance.

In the era of school autonomy and the implementation of the Independent Curriculum, transparency and accountability in financial management are key tools for ensuring the sustainability of educational quality [1]. Schools, as public institutions, must fully account for every rupiah spent to the community, government, and other stakeholders [2]. Openness of financial information, including access to and transparency in reporting, is a crucial indicator in assessing the credibility and effectiveness of educational institution governance [3]. Schools' accountability in implementing educational programs can be questioned without adequate transparency, leading to a significant decline in public trust [1].

The Ma'arif NU DIY Educational Institution, which oversees more than 170 educational units, faces complex challenges in financial management that touch on administrative and strategic aspects. Problems such as unsystematic transaction recording, limited reporting, and the absence of adequate internal controls are evidence of the weak financial governance infrastructure at the school level [5]; [6]. The absence of an internal audit mechanism worsens the situation because schools lose early detection tools for potential mismanagement of funds [7]. It shows that the financial system's weakness is not only a technical issue, but also reflects a lack of understanding of healthy governance practices.

Many schools solely prepare School Activity and Budget Plans (RKAS) to fulfill administrative requirements without utilizing them as strategic management tools. The financial planning function, which should be the foundation of program implementation, is neglected, resulting in budgets that do not reflect the school's actual needs [8]; [9]. The absence of periodically scheduled internal audits means errors and irregularities in implementing the RKAS go undetected [10]. Furthermore, human resource capacity to plan, record, and evaluate school finances remains significantly limited, particularly in areas with low economic resources [11].

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LITERATURE REVIEW

Accountability Theory

Internal audits serve as an independent oversight mechanism to evaluate the compliance of financial practices with applicable regulations [16]. In the education sector, internal audits are crucial in detecting financial irregularities and improving school budget efficiency [17]. This oversight mechanism has also been strengthened through a governance model that enhances public oversight of state and educational institutions.

The accountability theory proposed by [18] provides an important conceptual framework for educational institutions, particularly regarding reporting, stakeholder participation, and organizational governance. In Ebrahim's view, accountability does not solely focus on administrative or legal obligations, but also encompasses broader strategic and social aspects. He distinguishes between two main types of accountability: functional accountability, which relates to input management, financial reporting, and fulfilling administrative obligations to donors or the government; and strategic accountability, which emphasizes ongoing dialogue and collaborative learning with stakeholders to achieve the organization's long-term mission.

Ebrahim also identified five main accountability mechanisms: reports and disclosures, performance assessments, stakeholder participation, self-regulation, and social audits. These five mechanisms complement each other and can be used to increase transparency and strengthen the relationship between institutions and their stakeholders. This concept aligns with the approach in Controlling Governments: Voters, Institutions, and Accountability (Strøm et al., 2003), which emphasizes the importance of institutional structures in maintaining public accountability (https://doi.org/10.1017/CBO9780511611414).

In educational institutions, this mechanism can be applied to ensure that public or community funds are used efficiently, transparently, and for educational objectives. Applying this theory to schools or educational institutions requires that institutions be accountable not only to formal authorities such as education offices or foundations, but also to students, parents, the community, and other stakeholders. Therefore, strengthening the accountability function through developing internal audit instruments is crucial to realizing good governance in the education sector.

Fraud Pentagon Theory

The Fraud Pentagon theory assesses fraud risks based on pressure, opportunity, rationalization, competence, and arrogance (Marks, 2019). The Fraud Pentagon Theory is an extension of the Fraud Diamond that adds the dimension of arrogance to the fraud analysis model based on pressure, Opportunity, Rationalization, Competence, and Arrogance ([19]; "Risks and fraud: A theoretical approach," 2015). This theory emphasizes that individuals are not only driven by pressure and Opportunity, but also by capabilities and attitudes of superiority that may make them feel immune to the organization's internal rules [19].

Several empirical studies in Indonesia have adopted the Fraud Pentagon Theory to diagnose fraud in financial reporting. For example, an analysis of companies in the Indonesian Stock Exchange (IDX) mining sector found that pressure, Opportunity, Rationalization, competence, and arrogance collectively influence fraudulent reporting practices [20]. Another study in the mining sector also used this model and found that pressure and Opportunity significantly influence fraudulent financial statements. At the same time, Rationalization, competence, and arrogance vary depending on the industry context (Shlof & Triyono, 2022).

In the context of education or non-profit institutions, this theory is relevant because it ensures that internal audit instruments assess existing formal procedures and detect potentially hidden risky behavior. Using the Fraud Pentagon Theory can help design audit indicators capable of uncovering fraud risks administratively, behaviorally, internally, and structurally [9].

Indicators in the Fraud Pentagon Theory include [19]; [20]: Pressure (financial pressure, performance targets, or external pressure), Opportunity (weaknesses in internal control that open up opportunities for manipulation), Rationalization (an individual's justification for committing fraud), Competence (technical ability to perform manipulation) and Arrogance (a superior attitude that underestimates organizational controls and policie).

Thus, the Fraud Pentagon Theory is a robust theoretical framework that can be used to assess the risk of fraud in educational institutions such as Ma'arif DIY schools through a comprehensive internal audit—covering psychological, structural, and operational dimensions in financial management.

ADDIE MODEL

ADDIE Model: used for systematic instrument development, from needs analysis to product evaluation [21]. The ADDIE model is a systematic framework in Instructional Systems Design (ISD) developed in the 1970s by universities and defense agencies in the US (Branson et al., 1975; [21]). This model was later widely adopted in education and training because it can strengthen the structure of instructional design through five main phases: Analysis, Design, Development, Implementation, and Evaluation (Patel et al., 2018; [21]). Although often considered a linear model, modern practice emphasizes that ADDIE is iterative and flexible, allowing teams to redesign stages when revisions are needed (Welty, 2007; [21]). Integrating formative evaluation principles at each stage is also a significant strength of this model (Davis, 2013).

The Analysis phase is the foundation for the entire instrument development process: defining the problem, identifying user needs, classifying target users, and determining implementation conditions (InstructionalDesign.org; Techiweek, 2024). In the context of developing a school financial internal audit instrument, this phase includes identifying audit needs, human resource characteristics, the condition of the financial system infrastructure, and stakeholder expectations (Patel et al., 2018; InstructionalDesign.org). This stage compiles descriptive data and provides an empirical basis for relevant and contextual design.

In the design phase, the instrument designer develops a blueprint or detailed plan, including the evaluation item structure, measurement scales, reporting standards, and the questionnaire or audit checklist distribution format (InstructionalDesign.org; Techiweek, 2024). These elements are systematically designed to reflect the audit objectives and the needs of internal and external stakeholders (Patel et al., 2018). Furthermore, the design includes prototyping and pilot testing to ensure face validity and respondent understanding (Davis, 2013).

The Development phase involves developing the final instrument based on a validated design, including item wording, layout, completion instructions, and a clear scoring system (ISEFT et al.; Techiweek, 2024). This process involves expert review and adjustments based on feedback prior to field testing (Davis, 2013; Patel et al., 2018). Formative evaluation is implemented during this phase to minimize errors and refine the instrument before use (Davis, 2013).

The Implementation phase applies the instrument on a limited scale (e.g., five pilot schools), provides training to those responsible for internal audits, and facilitates the input and reporting process (InstructionalDesign.org; Patel et al., 2018). This phase's primary goal is to collect data and socialize the audit tool to users to maximize its utilization. Coaching and monitoring are also crucial to ensure the instrument is used according to the design procedures.

The evaluation phase is divided into formative evaluation (occurring during each stage) and summative evaluation (post-implementation) (Davis, 2013; InstructionalDesign.org). Formative evaluation helps strengthen design quality through user and expert feedback, while summative evaluation measures the instrument's reliability,

validity, and impact on overall financial management (Patel et al., 2018). Summative evaluation data can be used to revise or adapt the instrument and develop operational policy recommendations.

ADDIE is not a rigid model but a cyclical process that allows for continuous improvement through an evaluation loop from the final stage back to the initial phase when necessary (Welty, 2007; Techiweek, 2024). This approach is particularly relevant for developing internal audit instruments in the school context, where field conditions and user attributes can change over time. Feedback from audit experts, treasurers, and principals is crucial to improving the instrument's usability and accuracy.

The use of the ADDIE model ensures that internal financial audit instruments are not generic but are developed based on the organization's actual needs, the specifics of the school context, and applicable regulations. This approach ensures that audit items are relevant, measurable, and can be systematically evaluated. With an evaluation phase, internal audit initiatives can be continuously refined to meet the changing needs of educational governance.

RESEARCH METHODOLOGY

Research Approaches and Types

This study uses a Research and Development (R&D) approach to produce a product as an internal audit instrument for school finances and test its validity and practicality. R&D is a systematic approach to developing and evaluating the effectiveness of a product that can be used in a real context [22]. This study aims to produce and test the effectiveness of the internal audit instrument product for school finances, especially in the environment of the Ma'arif NU DIY Educational Institution. The R&D method is used because it allows researchers to create a new product and systematically evaluate its validity and usefulness [23]; [24].

In its implementation, this research uses the ADDIE development model, which consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation. [21]; [25]. This model is widely used in the development of instructional and educational instruments because of its systematic, flexible approach and its adaptability to the needs of end users [26].

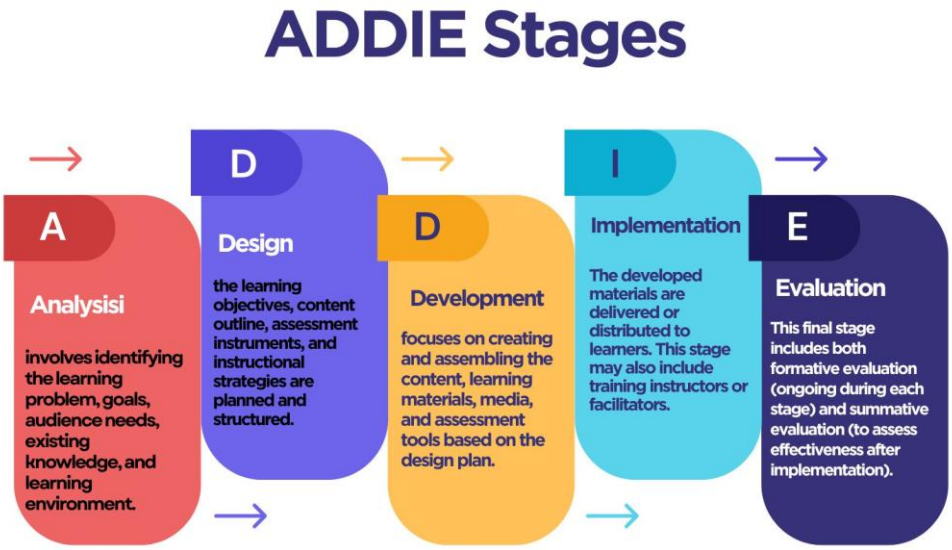

FIGURE 1. ADDIE Stages

Development Model Used

1. Analysis.

Researchers conducted a needs assessment of financial management and oversight in 36 Ma'arif schools (SMA/SMK/MA) under the auspices of LP Ma'arif NU DI. This analysis included identifying issues, stakeholder needs, and internal audit challenges faced by the educational units.

2. Design.

Based on the results of the analysis, the researcher conducted an initial design of an internal school financial audit instrument. This design included indicators, assessment aspects, and an instrument format appropriate to the institutional context of Ma'arif NU.

3. Development

At this stage, the instrument design is developed into a prototype, which experts in auditing, educational finance, and educational institution management then validate. The validation results serve as the basis for revising and refining the instrument.

4. Implementation

The developed instrument was then piloted in several Ma'arif schools in Yogyakarta. This trial aimed to determine the instrument's applicability in real-world contexts and the extent to which the instrument could be used independently by schools.

5. Evaluation

Researchers conducted evaluations to assess the effectiveness and practicality of the developed instruments. These included user feedback, implementation observations, and analysis of trial results. These evaluations were the basis for final revisions before the product was declared fit for use.

Research Subjects and Location

The subjects of this study were principals, treasurers, and financial managers at 36 Ma'arif educational units (MA/SMA/SMK) under the auspices of LP Ma'arif NU DIY. The research locations covered five regencies/cities in the Special Region of Yogyakarta: Sleman, Bantul, Kulon Progo, Gunungkidul, and Yogyakarta City.

Data Collection Technique

Data collection techniques in this study include:

a. In-depth interviews with school financial managers to identify instrument needs.
b. An expert validation questionnaire will be used to assess the instrument's feasibility.
c. Observations and field trials to evaluate the practical usability of the instrument.
d. Documentation of regulations and SOPs for financial management in schools.

Data Analysis Technique

The data collection technique in this study used a quantitative approach focused on standardized instruments to produce data that the researcher analyzed statistically. The primary data were obtained through the distribution of questionnaires to experts to validate the content and construct of the school's financial internal audit instrument. Furthermore, a field trial was conducted by distributing the instrument to respondents in Ma'arif NU DIY schools to evaluate the instrument's usability and practicality empirically. The study collected the questionnaire in numerical data and analyzed it using descriptive and inferential statistical techniques, including calculating validity and reliability. The study also reviewed the Documentation of regulations and Standard Operating Procedures (SOPs) for school financial management to ensure the correlation of the indicators in the instrument with applicable formal provisions.

Research Instruments

The main instrument in this study is a draft of an internal audit instrument for school finances, developed by the researcher based on theoretical studies, applicable regulations, and practical needs within the Ma'arif NU DIY Educational Institution. This instrument systematically measures control and compliance with school financial governance principles. To ensure content and construct validity, this study used an expert validation sheet completed by educational accounting, auditing, and financial management experts. Furthermore, to evaluate the instrument's usability and practicality in its context, a questionnaire was distributed to user respondents, consisting of school principals, treasurers, or school finance staff. Data from both questionnaires were collected in the form of a numerical rating scale, allowing for quantitative analysis of the developed instrument's validity, reliability, and quality.

RESEARCH RESULTS AND DISCUSSION

The developed instrument consists of seven leading indicators with 31 statements. Expert validation confirmed the instrument has high content validity (CVI $\geq$ 0.30) and the overall reliability of the instrument reached a Cronbach's Alpha of 0.915, indicating a high level of internal consistency and adequate measurement capability.

Trials in five schools demonstrated that the instrument was easy to use by principals and treasurers and could detect discrepancies between budget planning and implementation.

The trial results also showed that schools using the instrument experienced improved discipline in transaction recording, strengthened monthly reporting, and improved responsiveness to internal audits. These findings support research by [27], which found that internal audit effectiveness is positively correlated with the quality of educational governance.

Table 1. Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
,915	31

CONCLUSION

This research has successfully developed a valid, practical, and implementable internal school financial audit instrument within the Ma'arif Yogyakarta Educational Institution. Its use can strengthen transparency, accountability, and efficiency in school financial management. Recommendation for LP Ma'arif NU DIY are:

1. LP Ma'arif NU DIY must adopt this instrument systematically through training and workshops.
2. Strengthening of internal regulations and digital-based information systems is necessary.
3. Periodic evaluation and development of digital versions of application-based financial audit instruments is necessary.

ACKNOWLEDGMENTS

The authors would like to express their deepest gratitude to all parties who have supported the completion of this research. Special appreciation is extended to the Lembaga Pendidikan Ma'arif NU DIY for providing access, trust, and valuable insights that enabled the development and testing of the internal financial audit instrument across various schools. The contributions of the principals, treasurers, and financial managers from 36 participating schools were also crucial, as their cooperation and openness made it possible to identify real challenges in school financial governance.

We are also sincerely grateful to the expert validators, academics and practitioners in the fields of accounting, auditing, and educational management, whose constructive feedback significantly improved the validity and reliability of the instrument. Furthermore, we acknowledge the assistance of colleagues and students from Yogyakarta State University (UNY) who were actively involved in fieldwork, data collection, and analysis, especially through the collaborative framework of research and community service.

This study is dedicated to promoting transparency, accountability, and good governance in educational institutions, particularly within the Ma'arif NU school network in Yogyakarta.

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Integrating Augmented Reality into Vocational Education: Developing Interactive Media to Strengthen Students' Attitudes and Soft Skills

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Abstract. The high unemployment rate among vocational school graduates, reaching 9.01% in 2024, demonstrates the challenge in preparing graduates to meet job market demands. One of the main problems lies in the lack of well-developed attitudes and soft skills, which are crucial in the 21st-century workforce. This study aims to develop and test interactive educational media based on Augmented Reality (AR) to strengthen the attitudes and soft skills profiles of vocational school graduates. This study applies the Research and Development (R&D) method using the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation). AR media was developed in the form of an application containing material about graduate profiles, short videos, and AR scans which were then tested/implemented on a small scale in schools. Evaluations were also carried out by experts to determine the feasibility of the AR learning media. The results of the study showed that the validity of the material and media products reached an Aiken's V coefficient >0.8 (high category), indicating that the media is feasible to use. In addition, based on observations, students were enthusiastic about using AR media and understood the material that had been developed. Teachers also found this media easy to integrate into learning, and AR media encouraged students to reflect on their attitudes and social skills more explicitly, making non-cognitive competencies more easily observed during the learning process. These findings conclude that interactive AR media is feasible to implement as an effort to strengthen the attitudes and soft skills of vocational school students.

Keywords: attitude; augmented reality; graduate profile, Soft Skill, vocational education

INTRODUCTION

The transformation of the global economy in the era of Industry 4.0 and the emergence of Society 5.0 have fundamentally reshaped the skill requirements of the workforce. Employers increasingly recognize that technical expertise alone is insufficient, and greater emphasis is now placed on transversal competencies commonly referred to as *attitudes* and *soft skills* which include communication, teamwork, adaptability, problem-solving, creativity, and ethical awareness [1]. These competencies are widely regarded as indispensable for employability, resilience, and long-term career success in volatile and rapidly changing labor markets [2]. The World Economic Forum's *Future of Jobs Report 2025* projects that by 2030, more than 40% of the core skills required across occupations will undergo transformation due to technological advancement, the transition towards green economies, and globalization. Such projections underscore the urgency of embedding soft skills and constructive work attitudes into vocational education systems worldwide[3].

In Indonesia, this issue is particularly salient. Although vocational schools are intended to prepare students with industry-relevant competencies, their graduates consistently experience the highest unemployment rate among all educational levels, reaching 9.01% in 2024 [4]. This paradox highlights a persistent disjunction between the technical training provided in schools and the holistic competencies demanded by employers. While vocational school students often demonstrate adequate mastery of occupational skills, deficiencies in communication, adaptability, teamwork, and professional attitude substantially reduce their competitiveness in the labor market[5,6]. Consequently, addressing these shortcomings requires not only curricular reform but also the development of pedagogical innovations that systematically integrate character formation and soft skills development into the learning process.

Responding to this challenge, the Indonesian government has emphasized the Eight-Dimension Graduate Profile as a national framework for holistic competence and character development. This framework encompasses eight essential dimensions: faith and piety, citizenship, critical reasoning, creativity, collaboration, independence, health, and communication [7]. Its overarching aim is to shape graduates who are intellectually capable, morally grounded, and socially responsible, thus enabling them to contribute positively to society and effectively navigate global challenges. Embedding these eight dimensions into vocational education requires innovative instructional

strategies and learning media that allow students to internalize competencies through authentic and engaging contexts, rather than through abstract instruction alone [8].

Emerging educational technologies, particularly Augmented Reality (AR), offer promising opportunities to support this agenda. AR enables immersive and contextualized learning environments that simulate real-world experiences, thereby fostering not only cognitive understanding but also interpersonal interaction, collaboration, and reflective practice [9,10]. Evidence from prior studies demonstrates that AR enhances student motivation, facilitates the visualization of abstract concepts, and strengthens engagement in learning [11,12]. Nevertheless, most of these studies remain confined to cognitive or technical domains, while comparatively little attention has been devoted to AR's potential in cultivating attitudes and soft skills in vocational education. This gap is significant, as 21st-century employability requires the integration of technical, cognitive, and non-cognitive domains in a balanced manner [13].

Against this backdrop, the present study develops and validates an interactive educational medium based on Augmented Reality designed to enhance vocational students' *attitudes* and *soft skills*. This research contributes theoretically by extending the discourse on AR beyond technical knowledge acquisition to encompass affective and interpersonal domains [14]. Practically, it provides an innovative instructional model that supports the implementation of the Eight-Dimension Graduate Profile, ensuring that vocational graduates are not only technically proficient but also resilient, collaborative, and creative. Furthermore, it aligns with the government's *Asta Cita 4* vision on strengthening human resource development and offers empirical insights into the integration of AR in vocational curricula as a means of advancing holistic educational outcomes.

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LITERATURE REVIEW

Augmented Reality (AR) in Education

Augmented Reality (AR) is a digital technology that overlays virtual objects onto real environments in real time, creating interactive and immersive experiences for learners [15]. In educational contexts, AR has been shown to improve visualization of abstract concepts, stimulate curiosity, and enhance student motivation and engagement [9,11]. Beyond cognitive outcomes, AR applications also facilitate collaborative learning and the acquisition of procedural knowledge through simulations of real-world tasks [12,16]. Within vocational education, AR offers opportunities to provide authentic practice environments where learners can rehearse technical skills in a safe and controlled setting[17]. Despite these promising findings, most studies on AR in education have focused primarily on technical or cognitive dimensions, with relatively little exploration of its potential to foster interpersonal, attitudinal, and affective competencies [18]. This represents an important research gap, particularly in the context of vocational schools, where holistic competencies are essential for employability.

Soft Skills in Vocational Education

Soft skills, often described as non-technical or transferable skills, encompass personal, social, and communication abilities that are crucial for employability[18]. These include teamwork, leadership, adaptability, problem-solving, creativity, and ethical responsibility[19]. Research consistently highlights the importance of soft skills as complementary to technical expertise, particularly in the context of vocational education where graduates are expected to transition smoothly into professional environments[20]. Employers frequently emphasize that deficiencies in soft skills, rather than technical knowledge, are a primary barrier to graduates' employability [21]. Accordingly, vocational curricula worldwide have increasingly sought to integrate.

Students' Attitudes

Students' attitudes are generally defined as evaluative tendencies toward values, behaviors, or activities that reflect cognitive, affective, behavioral dimensions, and they play a critical role in shaping learning outcomes as well as future employability[22]. Positive attitudes foster motivation, engagement, and resilience, while negative attitudes often hinder achievement and readiness for professional life[23]. In vocational education, professional attitudes such as discipline, responsibility, integrity, and adaptability are vital, as they underpin workplace performance and career advancement[24]. Employers consistently identify attitudes as a decisive factor in recruitment and career progression, sometimes ranking them as equally or more important than technical skills[13]. Despite their significance, the cultivation of students' attitudes is rarely made explicit within vocational curricula and is often assumed to emerge informally through experience. This gap suggests the importance of structured interventions that actively foster positive attitudes. Immersive technologies such as AR hold considerable promise in this regard, as they enable the creation of authentic, interactive scenarios where students can internalize professional attitudes through practice, reflection, and feedback.

Student Graduate Profile

The Student Graduate Profile in vocational education articulates the holistic outcomes expected of learners upon graduation, combining technical expertise with attitudes and soft skills. In Indonesia, this framework is operationalized through the Eight-Dimension Student Graduate Profile, which comprises faith and piety, citizenship, critical reasoning, creativity, collaboration, independence, health, and communication[7]. The framework aims to cultivate individuals who are academically capable, morally grounded, and socially responsible, thereby preparing them to contribute productively to society and meet global challenges. This vision is consistent with international frameworks such as UNESCO's global competence model and OECD's 21st-century skills agenda[2,13]. While the framework is well established at the policy level, its practical implementation in vocational schools remains uneven, with many institutions still prioritizing technical competencies over holistic development. Furthermore, few studies have examined how immersive technologies like AR can operationalize the Student Graduate Profile, particularly in fostering non-cognitive domains such as attitudes and soft skills. Addressing this gap provides an opportunity to align vocational education with both national aspirations and international standards.

Vocational Schools

Vocational schools serve as a cornerstone of workforce preparation, offering students specialized training that enables them to transition directly into industry settings. Unlike general secondary education, vocational schools emphasize the mastery of technical competencies while also expecting students to develop the professional attitudes and soft skills necessary for workplace success[21]. In Indonesia, vocational education is considered a strategic pathway for human resource development, yet paradoxically, graduates of vocational schools continue to record the highest unemployment rate among all educational levels[4]. This indicates a persistent gap between the skills taught in schools and those required by employers. Studies suggest that while vocational education adequately addresses technical learning, it often neglects the cultivation of interpersonal and attitudinal competencies[25,26]. Globally, scholars and policymakers agree that successful vocational graduates are those who integrate technical proficiency with resilience, collaboration, creativity, and adaptability[2,26]. Thus, ensuring that vocational education produces graduates who meet these expectations requires innovative approaches that embed the Student Graduate Profile into teaching and learning. AR-based educational media offers a promising solution by providing interactive contexts in which students can simultaneously strengthen technical expertise, soft skills, and attitudes.

RESEARCH METOD

This research is a Research and Development (R&D) with the ADDIE (Analyze, Design, Development, Implementation, Evaluation) model approach 17 with the aim of producing interactive Augmented Reality (AR)-based educational media to strengthen the attitude and soft skills of vocational school students. Branch[27] states that ADDIE is a product development model applied to build performance-based learning that is child-centered, innovative, authentic, and inspirational. The ADDIE model was chosen because it provides a systematic framework in developing interactive Augmented Reality (AR) based educational media that aims to strengthen the attitude and soft skills of vocational school graduate student profiles. The five ADDIE stages are shown in Figure 1.

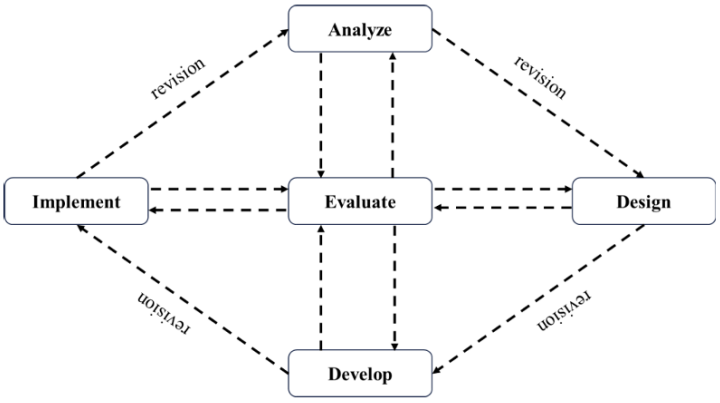

FIGURE 1. Stages of ADDIE Model Devlopment

In the Analyze stage, the researchers identified the core problems and needs in vocational schools related to the lack of systematic development of students' attitudes and soft skills. Data was obtained through classroom

observations, teacher interviews, and literature reviews. The Design stage involved developing the conceptual framework of the AR-based interactive media, including storyboards, content structure, and integration of interactive features based on the eight dimensions of the Student Graduate Profile. At this stage, research instruments such as expert validation sheets, student and teacher response questionnaires, and observation forms were also designed. In the Development stage, the initial prototype of the AR-based media was created and refined according to the design specifications, producing an interactive learning product that could be accessed through mobile devices.

The Implementation stage was carried out in two phases. A small-scale trial was first conducted involving 10 students and 3 teachers to evaluate readability, usability, and practicality of the AR media. This was followed by a broader field test with vocational school students who had been engaged in technology-supported learning practices. Data collection at this stage included students' and teachers' responses to the practicality of the media, as well as pre- and post-tests to measure its effectiveness in strengthening students' attitudes and soft skills. The Evaluation stage consisted of both formative and summative evaluations. Formative evaluation was conducted at each stage of development to identify areas for improvement, while summative evaluation was conducted after the implementation stage through a Focus Group Discussion (FGD) with four experts to assess the overall feasibility and effectiveness of the AR-based media. Expert validation results were analyzed using Aiken's V[28] formula, which measures the content validity of items based on expert ratings. The scores obtained were then compared with the validity categories[29,30] presented in Table 1, where values above 0.81 indicate high validity, 0.41–0.80 moderate validity, and below 0.40 low validity [30].

$$V = \sum \frac{s}{n\,(c-1)}$$

Information:
S = r-lo
r = the rating given by experts
lo = the lowest possible rating (1)
n = the total number of experts
c = the highest possible rating (5)

TABLE 1. Feasibility Test Success Criteria

Value	Validity
> 0.81	High
0.41 – 0.80	Moderate
< 0.40	Low

RESULTS AND DISCUSSION

The findings of this study are presented in accordance with the five stages of the ADDIE development model, which collectively demonstrate the process of designing and evaluating AR-based interactive media for strengthening the Student Graduate Profile of vocational school students.

Analyze

In the Analyze stage, information was obtained from classroom observations, teacher and student interviews, and a review of relevant literature. The findings consistently indicated that learning in vocational schools was still dominated by cognitive aspects, while the reinforcement of students' attitudes and soft skills remained suboptimal. Both teachers and students expressed the need for technology-based interactive media that could support these competencies more explicitly. Based on this analysis, it was concluded that Augmented Reality (AR) based interactive learning media was required, as it can be accessed by students anytime and anywhere, and has the potential to strengthen their attitudes and soft skills. This conclusion aligns with previous studies which emphasize that AR provides immersive and flexible learning experiences that are particularly effective for fostering non-cognitive competencies in vocational contexts[10,11].

Design

In the Design stage, the development of AR-based interactive learning media was carried out through four systematic steps. First, the researchers designed the Student Graduate Profile materials, in which the eight essential dimensions were structured and packaged into instructional content that was simple and accessible for students to understand (Figure 2). Second, the researchers developed video scenarios that illustrated the Student Graduate Profile, resulting in eight short videos that depicted positive attitudes and soft skills expected from students in vocational education (Figure 3). Third, the team created Augmented Reality (AR) object assets,

producing eight 3D objects that symbolized each of the graduate profile dimensions (Figure 4). Finally, the researchers designed the prototype of the AR-based interactive media, integrating the materials, videos, and 3D assets into a cohesive application ready for development (Figure 5). This design process ensured that the instructional content, video narratives, and AR objects were pedagogically coherent, visually engaging, and technologically feasible, thereby providing a strong foundation for reinforcing students' attitudes and soft skills in authentic learning contexts.

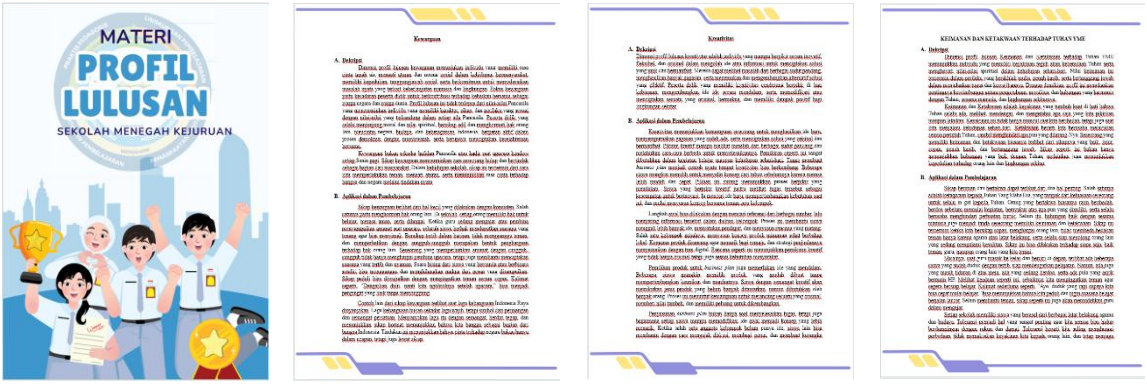

FIGURE 2. Graduate Profile Material Design

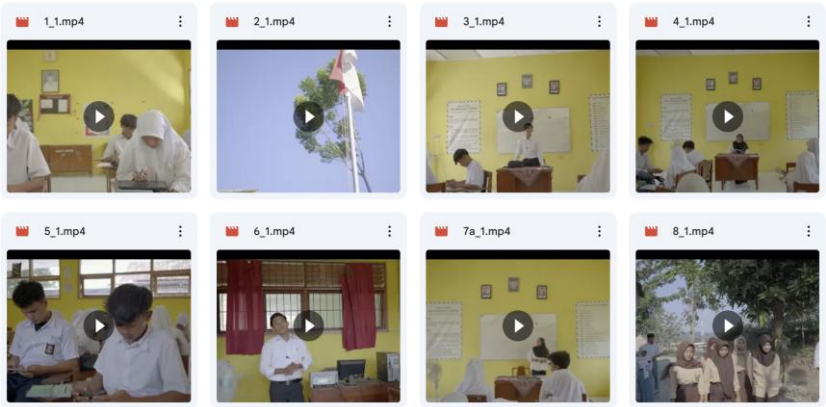

FIGURE 3. Short Graduate Profile Video

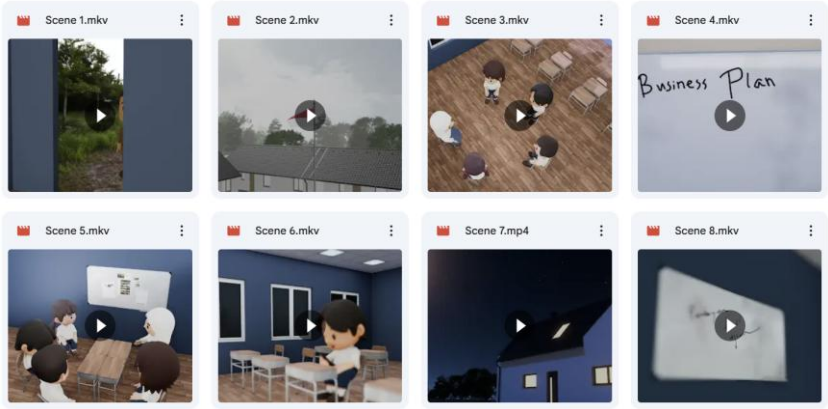

FIGURE 4. Graduate Profile AR Object Asset

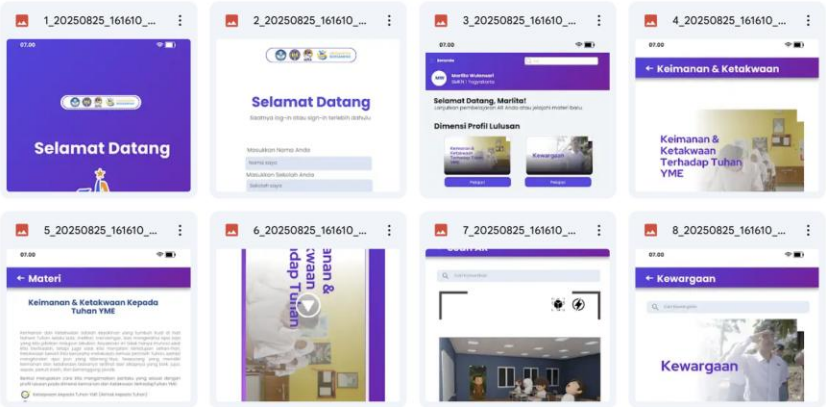

FIGURE 5. AR-Based Interactive Graduate Profile Media Prototype

Development

In the Development stage, the prototype design that had been previously produced was further processed into a functional AR-based interactive learning media aimed at strengthening students' attitudes and soft skills as outlined in the Student Graduate Profile. The resulting AR media, illustrated in Figure 6, included an initial login page followed by a main interface displaying the eight elements of the graduate profile. Each element could be accessed by students through multiple learning features, including complete instructional materials, short video scenarios that depict appropriate attitudes and soft skills in school settings, and an AR scanner feature that presents 3D objects representing the dimensions of the Student Graduate Profile. A comprehensive display of these features is presented in Figure 7.

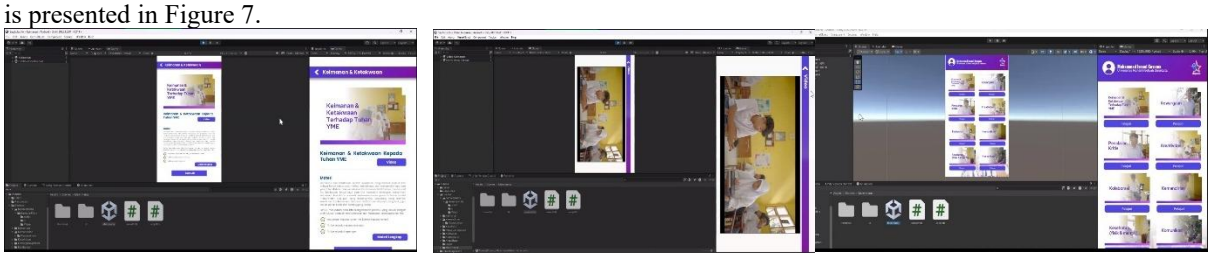

FIGURE 6. AR-Based Interactive Media Development

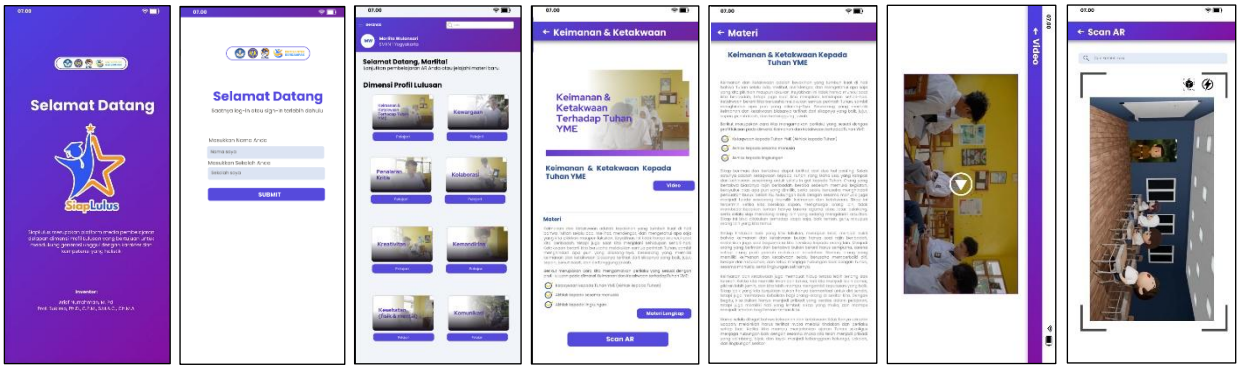

FIGURE 7. AR-Based Interactive Media Features

At this stage, face validity was carried out by four experts in the fields of instructional design, vocational education, and educational technology. The assessment focused on the clarity of the interface, user-friendliness, and the attractiveness of the overall media design. The experts agreed that the AR-based interactive media met the required standards of feasibility and provided positive feedback regarding its visual appeal and potential usability. Based on this face validation, it was concluded that the developed AR media was appropriate and feasible to proceed to the implementation stage for classroom testing with vocational students.

Implementation

The developed media was then trialed on a limited basis with students and teachers to test the readability of the material in the AR learning media that had been developed. Implementation was carried out on a limited basis at SMK Tamansiswa 1 Imogiri with 10 students and 3 teachers as respondents, to see the readability, usability, and initial practicality of the AR features. The results showed that students found the media easy to

operate and interesting. Students also explored eight dimensions of the Student Graduate Profile through AR media, including studying the material, watching video scenarios, and interacting with 3D AR objects. Based on the results of observations made, students were enthusiastic when using AR media and understood the material that had been developed. Teachers assessed that the media was easy to integrate into learning, and AR media encouraged students to reflect on their attitudes and soft skills more explicitly, so that non-cognitive competencies were more easily observed during the learning process.

Evaluation

Based on the implementation results that have been carried out, the next stage is an evaluation to see the feasibility of the materials and media that have been developed. Testing was carried out by experts through a Forum Group Discussion by looking at Aiken's V value. The results of the test from four experts showed that the graduate profile material was assessed as eligible with a v-value of 0.81-0.94 and AR-based learning media was also assessed as eligible with a v-value of 0.81-0.94. The results of the calculation of the feasibility test of materials and media are presented in Table 2 and Table 3.

TABLE 2. Graduate Profile Material Eligibility Test Results

Item	V-Value	Criteria	Item	V-Value	Criteria
1	0.88	Eligibility	6	0.81	Eligibility
2	0.88	Eligibility	7	0.94	Eligibility
3	0.94	Eligibility	8	0.88	Eligibility
4	0.94	Eligibility	9	0.88	Eligibility
5	0.88	Eligibility	10	0.94	Eligibility

Source: Processed By Researchers (2025)

TABLE 3. Results of the Feasibility Test of AR-Based Interactive Media

Item	V-Value	Criteria
Media Readability	0.88	Eligibility
Media Display	0.88	Eligibility
Ease of Use/Practicality	0.94	Eligibility
Media Quality	0.94	Eligibility
Layout	0.88	Eligibility
Topography of Media Content	0.81	Eligibility
Content Accuracy	0.88	Eligibility
Relevance	0.94	Eligibility
Interactivity	0.88	Eligibility
Attractiveness	0.94	Eligibility
Language Clarity	0.88	Eligibility
Technical Performance	0.88	Eligibility

Source: Processed By Researchers (2025)

The results of this study confirm that AR-based interactive educational media is feasible, practical, and effective in strengthening vocational students' attitudes and soft skills as outlined in the Eight-Dimension Graduate Profile. The high validation score (Aiken's V > 0.8) demonstrates that the developed product meets the required standards of content and design, while the positive responses from both teachers and students indicate that the media is highly practical and easy to integrate into classroom practice. Most importantly, the significant improvement in students' attitudes and soft skills after implementation highlights the effectiveness of AR-based learning in fostering competencies beyond the cognitive domain.

These findings are in line with previous studies showing that AR enhances motivation, engagement, and collaborative learning. Marshall [11] and Masurkar et al[31] reported that AR creates immersive learning experiences that encourage deeper interaction and understanding. In the vocational context, Luca[32] emphasized that AR supports the development of collaborative and reflective practices, while Siposova & Hlava[14] showed that AR provides authentic practice environments for skill mastery. By extending these outcomes to attitudes and soft skills, this study contributes to filling the research gap noted by Srivastava and Kuri[13], who argued that non-cognitive competencies are often neglected in technical education.

The improvement observed in students' communication, collaboration, responsibility, and adaptability further supports earlier claims by Huzooree et al[20] that such soft skills are indispensable for employability in the

21st-century workforce. Likewise, the explicit strengthening of professional attitudes such as discipline and integrity resonates with Bisschoff & Massyn[21], who found that employers consistently prioritize attitudes as key determinants of workplace readiness and career advancement. In this sense, AR-based media functions not only as a cognitive tool but also as a character-building instrument that operationalizes the non-technical aspects of vocational education.

Importantly, the integration of the Eight-Dimension Graduate Profile into the AR media provides empirical evidence that technology-based innovations can support national education policy directions. The dimensions of faith and piety, citizenship, critical reasoning, creativity, collaboration, independence, health, and communication were not merely presented as abstract constructs but were embedded in authentic scenarios, video narratives, and AR objects. This approach aligns with OECD[2] and WEF[3] frameworks, which stress the importance of holistic competencies that combine technical expertise with moral, social, and interpersonal capacities. By translating policy-level aspirations into practical instructional media, this study demonstrates that vocational schools can systematically foster graduate profiles that are intellectually capable, morally grounded, and socially responsible.

Theoretically, this research expands the application of AR beyond its commonly reported benefits in technical and cognitive learning domains[12,33] to encompass affective and interpersonal development. Practically, it provides teachers with an innovative model that integrates immersive technology with graduate profile dimensions, thus bridging the persistent gap between vocational training and the demands of the labor market. However, challenges remain regarding scalability, teacher readiness, and infrastructure, as also noted by studies on AR adoption in vocational training[34]. Future research should therefore explore broader implementation across different vocational disciplines and investigate the long-term impact of AR-based learning on workplace readiness[35].

Overall, this study affirms that AR-based interactive media represents a powerful pedagogical innovation for vocational schools. It offers a concrete pathway for operationalizing the Eight-Dimension Graduate Profile, ensuring that graduates are not only technically competent but also equipped with the attitudes and soft skills necessary to thrive in an increasingly dynamic and competitive labor market.

CONCLUSION

This study confirms that AR-based interactive media is a feasible, practical, and effective innovation for vocational education. The product achieved high validity (Aiken's V > 0.8), was positively received by both teachers and students, and significantly improved students' attitudes and soft skills, particularly in communication, collaboration, responsibility, and adaptability. By embedding the Eight-Dimension Graduate Profile into authentic and engaging AR scenarios, the intervention not only supported technical learning but also fostered non-cognitive competencies that are essential for workplace readiness in the 21st century. Beyond its empirical findings, this research contributes theoretically by extending the application of AR into affective and interpersonal domains, and practically by offering vocational schools a replicable model for integrating technology with holistic graduate development. The approach aligns with national policy priorities and international frameworks (OECD, UNESCO) that emphasize the balance of technical, cognitive, and non-cognitive skills. Future research should examine long-term impacts and broader implementation across vocational fields to maximize AR's potential in shaping graduates who are technically proficient, ethically grounded, and socially responsible.

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Mapping the Impact of VOEs' Existence in Supporting Asta Cita

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Abstract. To achieve national development goals (Asta Cita), the government has implemented various policies, including village community development for empowerment and economic independence. One concrete effort undertaken by the government is to regulate the establishment of village-owned enterprises (VOEs) based on local contexts and to provide funding and regulatory support for their operation. However, in reality, still face numerous business challenges, and their role in supporting Asta Cita remains largely uncharted. Therefore, this study aims to map the impact of VOEs in supporting Asta Cita. This research is a descriptive qualitative study with research subjects selected through purposive sampling, where respondents were chosen based on the criteria of VOEs whose directors won the VOEs Ambassador Award in the 2025 DIY BUMKAL/BUMKALMA competition, namely VOEs Binangun Jati Unggul, VOEs Mekaring Pono Potorono, and VOEs Amarta. Research data collection used interviews, observation, and documentation techniques. Research informants were VOEs directors, Village Governments, and the community. Data validity used technical triangulation. The data obtained were analyzed using Miles & Hubberman interactive analysis techniques. The results of the study indicate that the existence of VOEs has been able to support Asta Cita 3, 4, and 6. The impact of VOEs' existence in supporting Asta Cita is reflected in increased employment, human resource development, and development from below for poverty eradication. The results of the study can be used as a database to improve VOEs' performance, making it more effective and contributing more optimally to the achievement of Asta Cita.

INTRODUCTION

Asta Cita is a program launched by the Prabowo-Gibran government, which is a form of struggle to realize the Joint Vision of Advanced Indonesia Towards Golden Indonesia 2045. Asta Cita, which consists of eight missions, has one of the priorities for village development, namely the sixth Asta Cita - building from the village and from the bottom up for economic equality and poverty eradication. Based on data from the Central Statistics Agency (BPS), there are 83,971 villages/sub-districts in Indonesia in 2023 [1]. This large number of villages can certainly be a potential for Indonesia if managed well.

Villages have business entities called Village-Owned Enterprises (VOEs), which can serve as catalysts for achieving this sixth Asta Cita. VOEs are relatively new compared to other businesses established in rural areas. Their establishment aims to assist village governments in creating prosperity and reducing poverty.

VOES is a very brilliant idea from the government, because so far the Village Government has been struggling to combat poverty, but does not have the tools or strategies to realize it [2]; [3]). The establishment of VOEs is required not only to generate profits to increase Village Original Income but also to translate and help implement government programs in creating rural economic growth, so that it can reduce poverty through various business activities carried out by VOEs.

Although VOEs has grown rapidly since the enactment of Village Law No. 6 of 2014 [4], various challenges remain in its implementation, such as low managerial capacity, a lack of business innovation, and limited access to markets and capital. Furthermore, there are still a few studies that specifically highlight the role of VOEs in supporting Asta Cita.

In reality, existing VOEs businesses have not developed as intended by the Government; in fact, many VOEs remain absent within rural communities. Although numerous VOEs have been established, many have stagnated or ceased operations [5]. Research on several VOEs reveals multiple challenges, particularly the selection of business ventures that do not align with local human resource capabilities. For example, some VOEs start trading ventures without competent managers or sufficient consideration of community needs [6].

This research investigates how VOEs can support Asta Cita, a topic that has received limited attention compared to the more commonly discussed economic and institutional aspects. By analyzing the impact of VOEs' existence, this study seeks to offer both academic and practical contributions and provide strategic recommendations that support innovative, inclusive, and welfare-oriented development for village communities.

The central government's funding and regulatory support further establish the urgency of this research. Ultimately, the study aims to identify future VOEs development priorities in relation to supporting Asta Cita.

LITERATURE REVIEW

A. VOEs

Village-owned enterprises (VOEs) are village business institutions managed by the community and village government in an effort to strengthen the village economy and build social communities that are formed based on village needs, and as regulated in laws and regulations [7]. VOEs was established, among other things, in order to increase Village Original Income.

There are 7 main characteristics that differentiate VOES from commercial economic institutions in general, namely: 1) This business entity is owned by the village and managed jointly; 2) Business capital comes from the village (51%) and from the community (49%) through capital participation (shares or shares); 3) Its operations use a business philosophy rooted in local culture (local wisdom); 4) The business fields run are based on potential and market information results; 5) The profits obtained are intended to improve the welfare of members (capital participants) and the community through village policies (village policy); 2 6) Facilitated by the government, provincial government, district government, and village government; 7) The implementation of operations is controlled jointly (village government, BPD, and members) [8]).

The establishment of VOEs is based on the Village initiative which takes into account: (a) the initiative of the Village government and/or the Village community; (b) the potential for Village economic ventures; (c) natural resources in the Village; (d) human resources capable of managing VOEs and; (e) capital participation from the Village government in the form of financing and Village assets which are handed over to be managed as part of the VOEs business [9].

Characteristics of village communities that need to receive the main services of VOEs: (a) village communities that in fulfilling their living needs in the form of food, clothing and shelter, most of them have a livelihood in the agricultural sector and carry out economic business activities that are informal in nature; (b) village communities whose income is relatively low, and it is difficult to set aside part of their income for capital for further business development, (c) village communities that in terms of being unable to fulfill their own living needs, so that many fall into the hands of entrepreneurs who have stronger capital, and most importantly, (d) village communities whose business activities tend to be worsened by a marketing system that provides 21 opportunities for capital owners to be able to suppress prices, so that they tend to squeeze and enjoy most of the results of the work of village communities (Ministry of National Education, Center for the Study of Development System Dynamics, 2007 [8]).

B. Asta Cita

Asta Cita are the eight main missions of the Prabowo-Gibran administration, serving as a foundation for achieving the vision of "Together Towards a Golden Indonesia 2045." Asta Cita consists of:

1. Strengthening the Ideology of Pancasila, Democracy, and Human Rights
2. Strengthening National Defense and Security
3. Quality Job Creation and Entrepreneurship Development
4. Human Resource Development and Gender Equality
5. Downstreaming and Industrialization for Economic Added Value
6. Village Development for Economic Equality
7. Political, Legal, and Bureaucratic Reform and Eradication of Corruption and Drugs
8. Environmental Harmony, Culture, and Religious Tolerance [10].

The implementation of Asta Cita in various sectors is expected to create inclusive, sustainable, and equitable development for all Indonesians. This research focuses on mapping the impact of the existence of VOEs in supporting Asta Cita..

RESEARCH METHOD

This study is qualitative and descriptive. The data used came from the in-depth interviews conducted with informants which selected using purposive sampling technique. Informants were selected based on VOEs whose directors won the VOEs ambassador award in the 2025 DIY BUMKAL/BUMKALMA competition, winning first through third place. These VOEs were VOEs Binangun Jati Unggul in Kulonprogo Regency, DIY, VOEs Mekaring Pono Potorono in Bantul Regency, DIY, and VOEs Amarta in Sleman Regency, DIY. The informants were VOEs leader, figure in the village government, and local community. The data also identified through observation and documentation. The data were analyzed using Miles & Hubberman's interactive analysis technique which includes data collection, data reduction, data presentation, and verification [11].

Data were obtained through in-depth interviews with VOEs directors, village government officials, and local communities to understand how VOEs operate and support Asta Cita. Furthermore, this research involved direct observation of VOEs operational activities to gain a more comprehensive understanding. To support the analysis,

secondary data was collected from various sources, such as VOEs' annual reports, government policy documents, and relevant previous research.

Data validity was achieved through technical triangulation, which involved comparing the results of interviews, observations, and documentation to obtain more accurate and reliable research results. This method is expected to provide in-depth insights into the impact of the existence of VOEs in supporting Asta Cita..

RESULT AND DISCUSSION

TABLE 1. The Impact of VOEs' Existence in Supporting Asta Cita

Asta Cita	Deskripsi		
	VOEs Binangun Jati Unggul	VOEs Mekaring Pono Potorono	VOEs Amarta
Asta Cita 3 Increase quality employment opportunities, encourage entrepreneurship, develop creative industries, and continue infrastructure development.	▪ Absorb local labor to become VOEs employees. ▪ Provide decent wages for employees. ▪ Develop all VOEs businesses collaboratively and innovatively.	▪ VOEs creates employment opportunities for local residents in the MSME and tourism sectors. ▪ Recruits people with disabilities as employees, especially in the parking and light operations sectors. ▪ Opens opportunities for residents to become VOEs employees, MSME operators, or service providers in the tourism sector. ▪ Involves all levels of society in productive economic activities. Employees, partners, and MSME operators come from various social backgrounds, and job opportunities are widely open to all residents. ▪ VOEs develops villages from the periphery by building economic infrastructure such as village markets and culinary parks. ▪ Creates social spaces such as playgrounds and tourist attractions that strengthen community life.	▪ Involves residents from various backgrounds, including farmers, housewives, and youth, in VOEs business units. ▪ Residents who previously lacked a steady income can work as waste collectors or processors. ▪ Farmers are supported through partnerships that sell local rice. ▪ Creates jobs in environmentally friendly sectors that do not require higher education, such as compost production, maggot cultivation, swimming pool maintenance, and village culinary management. ▪ VOEs involves many residents from various levels, not just capital owners. Everyone can participate and earn income.
Asta Cita 4 Strengthening human resource development, science, technology, education, health, sports achievements, gender equality, and strengthening the roles of women, youth, and persons with disabilities.	▪ Increase the capacity of village human resources through training that is relevant to the local context	▪ Organizing entrepreneurship and cultural training for the community, ▪ Strengthening VOES human resources by providing tourism service training to employees.	▪ Provide training to employees ▪ Provide training and outreach on proper waste management for village communities ▪ Collaborate with universities and the government to provide entrepreneurship and waste management training.
Asta Cita 6 Developing from the village level and from the bottom up for economic equality and poverty eradication.	▪ Creating a superior village product, namely packaged rice with the "Jati Unggul" brand. ▪ Purchasing higher-quality unhusked rice. ▪ Providing capital loans to the community through VOEs.	▪ Strengthening regions and villages through strengthening village institutional capacity, improving community economics, environmental management, and human development through education and training. ▪ Contributing through the development of village markets, lake tourism,	▪ Conduct village innovations based on local potential, community empowerment, and environmental sustainability. ▪ VOEs provides financial and social benefits in the form of a healthy environment, capital support, and village economic empowerment.

	agricultural education (Edupark), and waste management. ▪ Villages are able to manage their own businesses without complete dependence on external parties, reflecting concrete steps towards village independence. ▪ The active role of residents is very prominent in the implementation and management of economic activities. ▪ Setting aside 2.5% of its profits for social activities, such as providing assistance to orphans, the poor, and the underprivileged.	▪ Contribute through the development of village business units such as culinary parks, swimming pools, and waste management systems. All of this contributes not only to the economy but also to better public services and the environment.

VOEs Binangun Jati Unggul, Mekaring Pono Potorono, and Amarta have a strategic role in supporting the achievement of Asta Cita 3, which focuses on increasing quality employment, strengthening entrepreneurship, developing creative industries, and developing village infrastructure. Through diverse business units, VOEs Binangun Jati Unggul encourages the opening of new job opportunities and improving community skills. Generic skills development is necessary to enter and survive in the workforce [15]. VOEs Mekaring Pono Potorono contributes to developing village entrepreneurship by supporting micro, small, and medium enterprises (MSMEs) to be more competitive. Village entrepreneurship is receiving increased attention from policymakers due to the significant impact of liberalization on the rural economy [16;17]. This shift creates opportunities for diverse economic activities, although these opportunities are accompanied by substantial challenges [16]. Meanwhile, VOEs Amarta plays a role in developing the creative industry sector based on local potential and contributing to the development of infrastructure supporting the village economy. The synergy of the roles of these three VOEs not only strengthens village economic independence but also becomes a driving force in realizing a prosperous, independent, and competitive society in line with the direction of national development. Currently, villages in Indonesia are required to generate high-quality and sustainable economic growth to strengthen and contribute to the real economic sector in the villages [18].

This three VOEs are also essential to achieving Asta Cita 4, which emphasizes strengthening human resource development, science, technology, education, health, sports, gender equality, and strengthening the roles of women, youth, and people with disabilities. This strategic role is realized through various concrete steps, including providing employee training to improve work capacity, both in managerial, technical, and service aspects, so that village human resources become more professional, adaptive, and ready to compete in facing the challenges of the modern economy. VOEs play a critical role in empowering rural communities by facilitating their participation in economic activities [12].

In addition, the three VOEs also actively organize training and outreach to the community covering various fields, such as financial literacy, entrepreneurship, digital technology utilization, health, and environmental awareness. Through this program, the community not only gains new knowledge but also becomes directly involved in building village independence through improving skills, changing mindsets, and expanding business opportunities.Training activities enhance individual and team performance, and also support positive outcomes such as improved attitudes, motivation, and empowerment [13].

Furthermore, the commitment to social inclusion is also demonstrated by opening employment opportunities for people with disabilities, so that VOEs functions as a forum that upholds the values of equality and diversity. Fostering a more inclusive and equitable work environment is likely to enhance the organization's overall performance and productivity [14]. This practice of recruiting employees with disabilities not only provides equal participation space but also creates an inclusive work environment, strengthens social solidarity, and fosters the confidence of people with disabilities to contribute to village development. By integrating training, outreach, and social inclusion, VOEs Binangun Jati Unggul, Mekaring Pono Potorono, and Amarta are concrete evidence of how village economic institutions can play a broader role than just driving the economy, namely as centers for human resource development, strengthening social values, and creating justice and equality for all village communities. Through these efforts, all three VOEs contribute significantly to building independent, competitive, and sustainable villages in line with the direction of national development.

Apart from the two impacts above, the three VOEs also have a strategic impact in supporting the achievement of Asta Cita 6, which focuses on village-based and grassroots development for economic equality and poverty

eradication. These three VOEs are committed to creating superior village products that can increase local competitiveness and become a source of sustainable income for the community, such as processed agricultural products, typical culinary products, and local crafts. Local products can be delivered through shorter supply chains and are produced with sustainable practices [19;20]. Not stopping at product management, they also encourage village innovation based on local potential by utilizing simple to digital technology to expand markets and strengthen village identity. Local goods represent a local value, are part of the identity of a certain community or area, and are primarily associated with a particular community through historical legacy and custom [21;22].

These efforts run in tandem with community empowerment programs, where villagers are given access to training, mentoring, and opportunities to be directly involved in business management, thereby creating a sense of ownership and shared responsibility in advancing the village. The three VOEs also emphasize the importance of environmental sustainability, for example, through waste management into value-added products, utilization of environmentally friendly energy, or conservation of natural resources to support economic activities. The synergy between the creation of superior products, innovation based on local potential, community empowerment, and environmental sustainability makes VOEs Binangun Jati Unggul, Mekaring Pono Potorono, and Amarta a driving force for economic equality as well as a bulwark against poverty at the village level. With this approach, village development is not only oriented towards economic growth, but also ensures the welfare of the community in a fair, inclusive, and sustainable manner, in line with the spirit of building from the village for a more independent and just Indonesia.

CONCLUSION

Research on three Village-Owned Enterprises (VOEs) produced comprehensive findings on the impact of VOEs' existence in supporting Asta Cita, especially Asta Cita 3, 4, and 6. The three VOEs studied (VOEs Binangun Jati Unggul, VOEs Mekaring Pono Potorono, and VOEs Amarta) showed different operational characteristics but had similarities in social orientation and community empowerment in supporting Asta Cita. The existence of VOEs reflected in their operations is very relevant to Asta Cita as the Government's Vision and Mission in the context of village development. If VOEs can optimize their business operations, villages in Indonesia will be more empowered and accelerate the process of Indonesian development. Recommendations that can be given are strengthening VOEs through various local human resource capacity building programs in the form of training, socialization, and workshops. In addition, VOEs needs to be provided with intensive cross-sectoral mentoring, including academics, business actors, communities, local governments, financing institutions, and also the media, so that they always innovate to be able to produce superior local products that have economic potential and are published to the wider community to support their existence. The more VOEs exist, the more they can support the achievement of Asta Cita and national development.

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READING GRIMM'S FAIRY TALES IN INDONESIA: RECEPTIONS FROM THE PERSPECTIVE OF LOCAL WISDOM

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Abstract. This research analyzes the reception process of the Brothers Grimm's fairy tales (Kinder- und Hausmärchen) by Indonesian readers through the lens of local wisdom. The widespread popularity of these tales in Indonesia, evidenced by various translations, highlights a significant cultural dialogue between world literary heritage and local values. This study argues that this reception is not neutral; rather, it's profoundly influenced by the readers' cultural and linguistic backgrounds, especially Nusantara's local wisdom. This qualitative-comparative research utilizes data from 15 selected Grimm's fairy tales, including *Der Froschkönig, Rapunzel, Hansel und Gretel, Rotkäppchen, Schneewittchen, Aschenputtel, Daumesdick, Von dem Fischer und Seiner Frau, Schneewittchen, Jorinde und Joringel, Hans ins Glück, Der goldene Vogel, Der alte Sultan, Bremerstadtmusikanten and Rumpelstilzchen.* These tales are compared with their Indonesian translations published by Gramedia, Elex Media Komputindo, and Kakatua. Literary reception analysis is used as the theoretical framework to explore how local wisdom influences the understanding and interpretation of the moral messages within these stories. The findings reveal that the translated Grimm's fairy tales undergo a process of cultural domestication. Elements considered incompatible with local norms and values, such as excessive violence or children's rebellion against their parents, tend to be softened or eliminated. Conversely, values that align with local wisdom, such as honesty, patience, respect for elders, and the principle of nrimo ing pandum, are reinforced through more explicit language and clear moral messages. In conclusion, the reception of Grimm's fairy tales in Indonesia mirrors a process of acculturation where world literature adapts to Nusantara's local wisdom. This study has important implications for developing translation strategies that are responsive to cultural contexts and for revitalizing the role of foreign literature in shaping a literary identity rooted in local wisdom.

Keywords: Grimm fairy tales, Indonesian fairy tales, local wisdom, cross-cultural reading, literary reception

INTRODUCTION

Fairy tales are a form of literature that possesses universal value and has spread widely across various parts of the world. Besides being universal, fairy tales are also literary works with a simple form (Joles, 1965: 231). The Brothers Grimm's fairy tales, collected in Kinder- und Hausmärchen, have become a universal world literary heritage. These tales have spanned over two centuries and have been translated into more than 100 languages (Kiani, 2023).

The main role of the Brothers Grimm was to lay the groundwork for the exploration of national folk stories

in many other countries (Zipes, 2002). Therefore, the tales collected by the Brothers Grimm have spread widely throughout the world.The Brothers Grimm's tales have not only undergone a translation process into various languages globally, but have also been translated according to the local context in different countries, including Indonesia. Some of the Grimm tales that have been translated and circulated in Indonesia include Cinderella (*Aschenputtel*), Snow White (*Schneewittchen*), Hansel and Gretel (*Hansel und Gretel*), Lucky Hans (*Hans ins Glück*), and so forth.

In Indonesia, the Brothers Grimm's tales not only undergo a process of translation into Indonesian, but also experience a dynamic dialogue between the original text, the receiving culture, and local wisdom, which ultimately shapes the reception of Indonesian readers. In other words, the translation process of the Grimm tales in Indonesia is influenced by Indonesian culture in the form of local wisdom, which then affects the translation results.

The process and result of translating Grimm's tales into Indonesian is a form of reception of those Grimm tales. Reception occurs because elements of Indonesian culture are incorporated into the translation process of the Grimm tales in Indonesia. These cultural elements are in the form of local wisdom poured into the translation results. This process causes the Grimm tales to undergo an actualization process where the changes reflect a negotiation between the universal values of the tales and the cultural system in Indonesia. This actualization gives the Grimm tales a different look because they are influenced by the Indonesian cultural system in the form of local wisdom.

This research offers novelty compared to previous studies by incorporating local wisdom in shaping the results of social reception. In the context of reception, local wisdom becomes a Vorwissen (prior knowledge) that influences Indonesian readers when they read the Grimm tales originating from Germany. This prior knowledge constitutes the horizon of expectation held by Indonesian readers of the Grimm tales. Based on the reception theory which states that a work of literature becomes more existent the more it is read (Jauss, 1970; 1969) , the Grimm tales will become more existent because they are read and translated into various languages, including Indonesian. In addition to being translated, the Grimm tales are also received and actualized by readers in Indonesia, adjusting to the local culture in Indonesia.

Although many German fairy tales are translated into Indonesian, there has been no comprehensive research analyzing the actualization of the Grimm tales caused by local wisdom as prior knowledge (*Vorwissen*). Previous research on Grimm tales was still dominated by narrative structure analysis, and had not yet led to the socio-cultural factors of the readers influencing their reception results. Previous research also had not explored how universal values in the Grimm tales are reconstructed through Indonesian cultural principles. This research is important to enrich studies on Grimm tales in Indonesia, which pays more attention to the dynamics of cross-cultural literary reception. The findings in this research can also serve as a basis for the development of translation strategies that are responsive to local wisdom, and revitalize the role of foreign fairy tales, especially the Grimm tales, in shaping a literary identity based on local wisdom.

LITERATURE REVIEW

Research on fairy tale adaptations, especially Grimm's fairy tales, has been carried out by several scholars. Hill (2015), for example, compared the characters in *Kinder- und Hausmärchen* with their adaptations in modern fairy tales. Oki (2024) conducted a study on the adaptation of *Snow White* in a film directed by Tarsem Singh. Wei (2018) analyzed the adaptation of Grimm's fairy tales into musical opera performances. On the other hand, some researchers have examined Grimm's fairy tales from the perspective of their thematic content. Budidarma et al. (2023), Yusuf (2021), Arby et al. (2022), and Montante et al. (2023) explored Grimm's fairy tales from a feminist perspective. The educational elements in Grimm's fairy tales were studied by Vučković (2018), while aspects of justice were examined by Sharma (2020).

The worldwide dissemination of Grimm's fairy tales cannot be separated from the role of translators. Therefore, many studies have also been conducted on the translations of the Brothers Grimm's fairy tales. Zürkovä (2012) analyzed the translation of three Grimm fairy tales based on the cultural context of Czech society. Kiani (2023) investigated how and why Grimm's fairy tales were edited in English translations to be modified as children's literature. Schroeder (2018) examined the cultural aspects of the translation of Grimm's fairy tales into English. The findings show that translations are shaped by the cultural backgrounds of both translators and target readers. Consequently, every new translation of Grimm's fairy tales enhances the readers' understanding of the source text and its culture as well as their own cultural context.

In the Indonesian context, studies on the Brothers Grimm have been carried out by Siregar et al. (2023), who compared characterization and plot in the fairy tale *Aschenputtel* with the Indonesian tale "Bawang Merah dan Putih." Firdausi and Pendit (2022) examined the translation methods used by translators in rendering the Grimm Brothers' *The Seven Ravens* into Indonesian.

Research on fairy tales from the perspective of reception theory was conducted by Futtera (2020). This study discussed the reception of Musäus's fairy tales from Bohemia (*Libussa* and *Rübezahl*) in Bohemia, with a

particular focus on (cultural) translation strategies within an intercultural context. Further research on fairy tales (*Märchen*) was carried out by Hotzel (2013) in his dissertation *Die Märchenrezeption in DDR-Märchen*. The study found that reflections on fairy tales in meta-fairy tales were used to disguise political statements. In some cases, fairy tales functioned as metaphors, offering alternative interpretations of reality made possible by the fantastic elements inherent in the genre.

RESEARCH METHOD

This research is a descriptive qualitative and comparative method study to obtain an overview of how the German fairy tales collected by the Brothers Grimm are received and interpreted by readers in Indonesia. The comparative method is used to compare the Grimm tales in German and how the Grimm tales are translated in Indonesian.

The data sources and objects of this research are 15 Grimm tales collected in Kinder- und Hausmärchen, and the Indonesian translations of the Grimm tales, published by 3 publishers: Gramedia (2 books), Elex Media Komputindo, and Kakatua. The research steps are: reading the 15 Grimm tales, both the original and Indonesian versions, to find their local wisdom. The next step is comparing the Grimm tales in German and Indonesian, finding the similarities and differences in the selected tales as the object of study, and discovering how the Indonesian translations of the Grimm tales attempt to incorporate elements of local wisdom. The final step is concluding the research findings, which is to reveal the form of cross-cultural dialogue between world culture and Nusantara local wisdom.

RESULTS AND DISCUSSION

Local Wisdom in the Grimm Tales in Indonesia

Local wisdom is present as a guide in human life that is closely linked to daily activities. Local wisdom plays a role in regulating and maintaining relationships among humans and the relationship between humans and nature. As a social guideline, local wisdom is present through moral and ethical guidance. Meanwhile, in the context of the human-nature relationship, local wisdom is present as ecological guidance in preserving and regulating the utilization of local resources (Mahasya and Raysa, 2025).

The Grimm tales translated into Indonesian contain moral values that are very useful for children as readers of these tales. These moral values are in the form of local wisdom inherent in the tales according to the characteristics of each region. Grimm in German also contains local wisdom from regions in Germany, while when the Grimm tales are translated into Indonesian, the local wisdom existing in Indonesia will certainly influence the translation of those tales. If there is local wisdom that may be less compatible with Indonesian local wisdom, adjustments will be made.

Local wisdom in the Grimm tales can be classified into two groups based on the intensity of its appearance: dominant local wisdom and non-dominant local wisdom. The distribution map of local wisdom found in the Grimm tales can be seen in the following diagram.

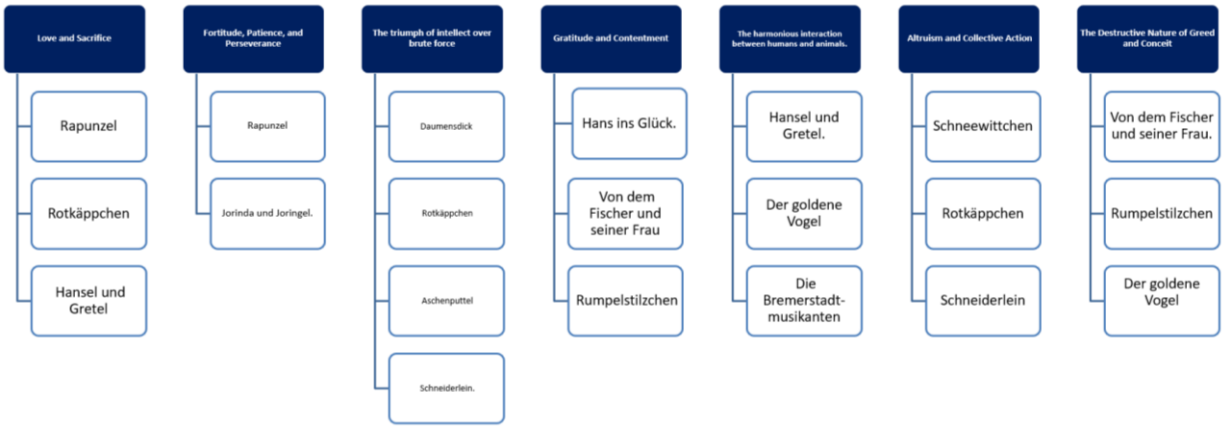

Diagram 1. Map of Local Wisdom Distribution

The research results show that local wisdom in the Grimm tales can be classified into two groups based on the intensity of its appearance: dominant local wisdom and non-dominant local wisdom. The dominant forms of local wisdom found in the Grimm tales are: (1) cleverness defeats strength, (2) harmonious interaction between

humans and animals, (3) good defeats evil, (4) greed leads to destruction, (5) being grateful and feeling sufficient, (6) parental affection, (7) a promise is a debt, (8) being thankful for the help of others, (9) helping those in distress, (10) sincere dedication will bear sweet fruit, (11) caution against deception, and (12) devotion to parents. The non-dominant forms of local wisdom found in the Grimm tales are (1) affection between siblings, (2) optimism, (3) envy causes misery, (4) politeness, (5) honesty, (6) spousal love and sacrifice, (7) perseverance/patience, (8) trust.

The forms of local wisdom found in the Grimm tales, both the original and Indonesian versions, can be grouped into five categories: family values, moral values, social values, and cognitive values. Family values include affection, loyalty, and appreciation for one's partner, while moral values include honesty, politeness, and avoiding greed. Religious/spiritual values include belief in God and gratitude, while social values include mutual cooperation (gotong-royong), helping others, and harmonious interaction. Cognitive values found in the Grimm tales include cleverness and the ability of reason to defeat physical strength.

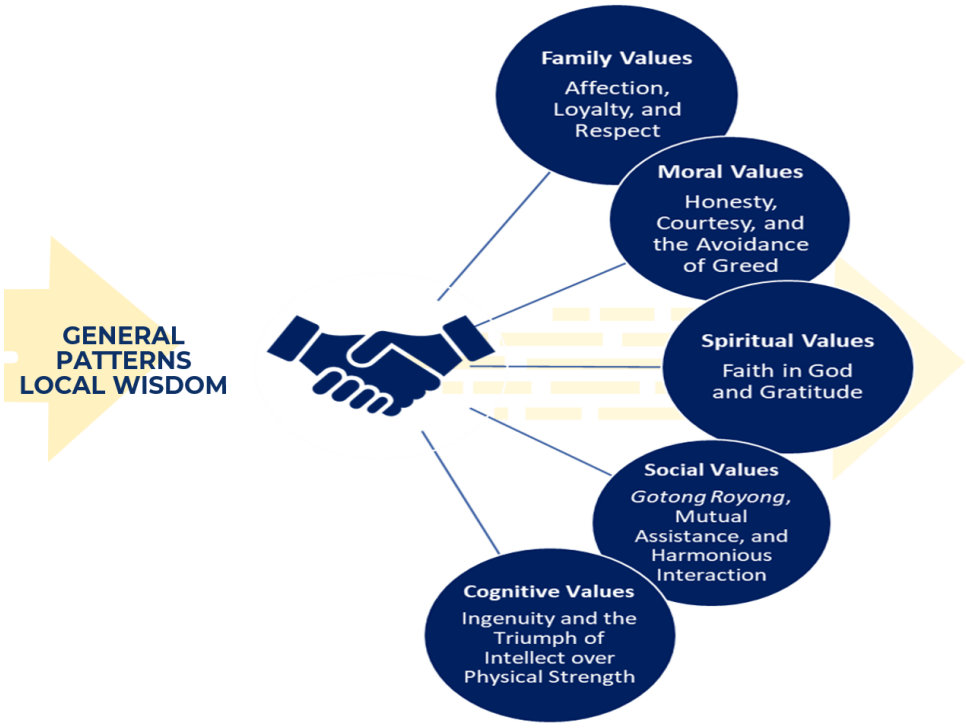

Diagram 2. General Pattern of Local Wisdom

These local wisdom values are found spread across the 15 Grimm tales that are the object of the study. For example, cleverness defeats physical strength is found in the tales "*Hansel und Gretel*", "*Daumensdick*", "*Rotkäppchen*", "*Aschenputtel*" and "*Die Bremen Stadtmusikanten*". Furthermore, harmonious interaction between humans and animals is found in the tales "Hansel und Gretel", "Von dem Fischer und seiner Frau", "Aschenputtel", "Der goldene Vogel", and *"Der alte Sultan"*. Another local wisdom is that greed leads to destruction, which can be found in the tales *Von dem Fischer und seiner Frau, Rumpelstilzchen, and Der goldene Vogel*.

One of the local wisdoms that appears in the Grimm tales is cleverness. Cleverness is the main asset for those who lack strength, wealth, or social status. Characters like Hansel and Gretel, Tom, Aschenputtel/ Cinderella, and the four animals in "*Die Bremerstadtmusikanten/ The Bremen Town Musicians"* do not rely on physical strength to overcome bigger and stronger enemies. Instead, they use reason and strategy. Cleverness is not just a trait inherent in certain characters, but becomes a fundamental tool for survival for the weak and vulnerable characters..

Another local wisdom is that greed results in misery. In the world of the Grimm tales, greed is depicted as one of the most dangerous human traits, because one never feels satisfied. Characters dominated by greed always want to have more power, wealth, or advantage, although they have already achieved what they wanted. As a result, greed actually leads them to destruction. This can be seen in several tales such as "*Von dem Fischer und Seiner Frau*", "Rumpelstillchen", and "Der goldene Vogel". The characters in these three stories fall into misfortune due to the urge of greed, losing everything they had.

A clear example is found in the tale "*Von dem Fischer und Seiner Frau*", where greed is depicted through the figure of the fisherman's wife who is never satisfied with what she has. Initially, they only lived in an uninhabitable house. After the fisherman releases the magical fish, his wife asks for a comfortable small house. However, that pleasure only lasts for a short while, because soon after she asks for a bigger house. It does not stop there, she continues to feel dissatisfied. This can be seen from the translation of the tale "*Von dem Fischer und seiner Frau*" published by Elexmedia as follows

> *Semuanya berjalan baik selama seminggu atau dua minggu namun kemudian sang istri berkata lagi, "Suamiku, ruangan di rumah ini tidak cukup lagi bagi kita, halaman dan kebunnya terlalu kecil. Aku ingin memiliki istana batu yang besar untuk tempat kita tinggal. Pergilah dan temui ikan itu lagi. Katakan padanya untuk memberi kita istana*." (Grimm dan Grimm, 2011: 67).
>
> Everything went well for a week or two, but then the wife said again, 'Husband, the rooms in this house are no longer enough for us, the yard and garden are too small. I want to have a big stone palace for us to live in. Go and meet the fish again. Tell him to give us a palace.'"
> (Grimm und Grimm, 2011: 67).

The quote shows the basic nature of greed, which is never feeling sufficient and always asking for something bigger than before. The fisherman's wife never stops at the point of "enough". In fact, if viewed from the perspective of an ordinary person, a big house is more than enough to support a comfortable life.

Another local wisdom is a promise is a debt. The local wisdom expression "a promise is a debt" implies that anyone who has made a promise must keep it because a promise is not just words, but an obligation attached to a person's honor. In the Grimm tales, this value often becomes the core of the conflict. Characters who make a promise will be tested for their loyalty and consistency, while failure to fulfill a promise always implies a loss of honor, happiness, or even safety.

In the tale "*Der Froschkonig or Raja Katak*", for example, a promise becomes the starting point for a change in the character's fate. The princess who loses her golden ball in the pond promises a frog that she will love and allow the frog to eat from her golden plate and sleep in her bed, provided the golden ball is returned. Initially, the princess only made the promise to get her valuable item back, without a sincere intention to keep it. However, when the frog comes to collect the promise, the princess feels morally bound, especially since the promise has been told to her father, the king. In the Elexmedia version translation, Grimm writes:

> "*Ada seekor katak buruk" katanya, "dan ia ada di balik pintu. Katak itu mengambilkan bolaku dari mata air pagi ini. Aku mengatakan bahwa ia bisa tinggal denganku di sini karena kukira ia tak akan mungkin keluar dari mata air itu. Tapi kini ia ada di balik pintu dan ingin masuk." Lalu raja berkata kepada sang putri, "Karena kau telah berjanji kau harus menepatinya. Pergilah dan biarkan ia masuk*." (Grimm dan Grimm, 2011: 83).
>
> "There is an ugly frog," she said, "and he is behind the door. The frog fetched my ball from the spring this morning. I told him he could stay with me here because I thought he couldn't possibly come out of the spring. But now he is behind the door and wants to come in." Then the king said to the princess, "Since you have promised, you must keep it. Go and let him in."

The quote clearly shows how a promise is positioned as something that cannot be ignored. The princess, who initially considered her promise only a trick to get her golden ball back, finally faces the reality that the words spoken have moral consequences. The presence of the king as an authority figure further emphasizes this obligation. The King emphasizes the importance of keeping a promise, regardless of who the promise was made to, even if only to a frog. This message re-emphasizes that a person's dignity is not measured by who receives the promise, but by the faithfulness in keeping the spoken commitment.

The local wisdom found in the Grimm tales proves that there is a spread of local wisdom values in the Grimm tales. In all the Grimm tales that are the object of the research, universal values are found. The values in those tales such as keeping promises, cleverness, loyalty, affection, and obedience to parents are not only relevant to the cultural context of Germany where the tales originated, but can also be found and understood in various other cultures in the world, especially in Indonesia. These tales are able to cross the boundaries of space and time and still provide meaning for readers from different cultural backgrounds.

Reception of Grimm Tales in Indonesia from the Perspective of Local Wisdom

To see how local wisdom influences the results of reception in the form of translating the Grimm tales in Indonesia, a comparison is made between the Grimm tale's original (German) version and the Indonesian version. The comparison is made by looking at the intrinsic elements of the tales and also the elements of local wisdom. After the comparison, the changes become apparent. The changes that occur due to the factor of local wisdom can be seen in the Diagram 3.

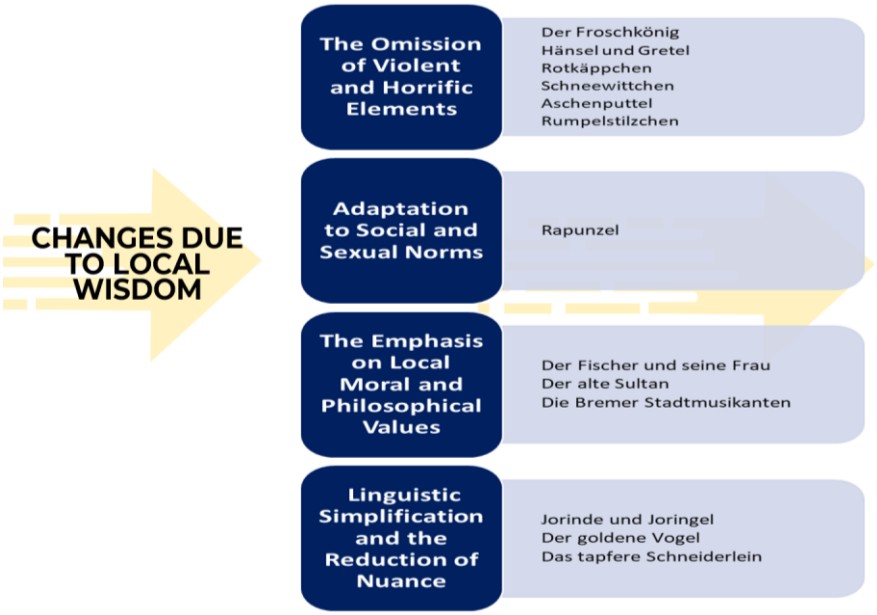

Diagram 3. Changes due to Local Wisdom

The Grimm tales undergo several changes when translated into Indonesian. In general, the changes can be grouped into four: the elimination of violence and horror elements, the adjustment of social and sexual norms, the emphasis on moral values and local philosophy, and the simplification of language and nuance. The pattern of change is clearly visible when these Grimm tales are translated into Indonesian. Simply put, the changes are from initially containing violence and horror, they are changed to gentleness. Sexually taboo elements are also eliminated, Javanese philosophies such as simplicity and nrimo ing pandum are also more highlighted, and the language is made simpler, not as detailed as in the original language..

These changes and adjustments of the Grimm tales from the original version to the Indonesian translation constitute the reception of the Grimm tales in Indonesia. The changes or adjustments are caused by the influence of Vorwissen/prior experience possessed by Grimm readers in Indonesia. The prior experience of Grimm readers in Indonesia, which is influenced by Indonesian local wisdom, causes the reception results in the form of the translation of Grimm tales in Indonesia to undergo changes.

One change that occurs, for example, is in the tale Rapunzel. This tale features the story of a pregnant wife who craves Rapunzel/lettuce from the witch Frau Gothel's garden, so her husband steals it. As a consequence of being caught stealing in the witch's garden, the child to be born must be handed over to the Witch. Because the readers of fairy tales in Indonesia are children, the Rapunzel tale also undergoes adjustments by eliminating scenes considered cruel or inappropriate, so that it is more aligned with the didactic function and the delivery of clear moral messages. In the Indonesian version of the Rapunzel tale, the relationship between Rapunzel and the prince is depicted romantically and platonically without indication of intimacy or night visits. The element of pregnancy, which is the trigger for the plot in the original version, is completely removed, while the violence scene is softened, for example, by changing the prince's blindness due to falling into thorn bushes to merely a slight injury. The plot is also simplified by omitting the episode of Rapunzel's exile in the desert and the existence of twins. The focus of the narrative is shifted to the theme of loyalty and true love as a source of happiness, which aligns with moral values in the Indonesian oral literature tradition, such as goodness, patience, and devotion to parents

Another example of a tale that undergoes changes is the tale "*Rotkäppchen*". In the original Grimm version, "*Rotkäppchen"* tells of a little girl who always wears a red hood given by her grandmother. Her mother warns her not to talk to strangers and to stay on the path when going to visit her grandmother. However, along the way, she meets a cunning wolf. The wolf manages to deceive Rotkäppchen, causing her to stray from the path, then precedes her to the grandmother's house. The wolf swallows the grandmother, disguises itself as the grandmother, and finally swallows Rotkäppchen too. The story ends with a hunter who arrives, cuts open the wolf's belly, and saves the grandmother and Rotkäppchen. This tale emphasizes obedience to parental advice and the danger of talking to strangers.

In the Indonesian version, "*Si Tudung Merah*" is depicted with a softer nuance. Some gruesome details, such as the scene where the wolf swallows Rotkäppchen and the grandmother, are often softened or eliminated. In some versions, the wolf only locks up the grandmother, or Rotkäppchen can escape with her cleverness. The hunter character remains present, but the depiction of the scene where the wolf's belly is cut open is usually

removed to adjust to the sensitivity of Indonesian children. The same moral message is maintained, which is the importance of obedience to parental advice and caution towards strangers. However, the translation strategy employed prioritizes the principles of character education and local wisdom which emphasize gentleness and protection for children.

Another tale whose changes are interesting to observe is the tale *"Von der Fischer und seiner Frau"*. In the original Grimm version, the story "*Von dem Fischer und seiner Frau*" recounts a poor fisherman who catches a magical fish. The fish is actually a cursed prince, so when released, he offers to grant the fisherman's wish. The fisherman's wife, Ilsebill, encourages her husband to keep asking for more things: from a hut to a large house, then to being a queen, then a pope, and finally wanting to become God. This greed angers the fish, which finally returns them to their original state, living in a dilapidated hut by the sea. The story of Von der Fischer und seine Frau is a satire or a criticism of insatiable greed.

The changes in the tale „*Von dem Fischer und seiner Frau"* in the Indonesian version show an adjustment to the cultural context and moral education values in Indonesia. The harsh nuance of the original version, which portrays greed as a great sin even to the point of wanting to become God, is softened to be more suitable for children. The story is interpreted through the lens of the Javanese philosophy *nrimo ing pandum* (sincere acceptance of what is given). This value emphasizes the importance of gratitude, simplicity, and life satisfaction, so the focus of the story shifts from a critique of individual greed to a collective teaching about the acceptance of destiny. The moral highlighted is not just a prohibition of ambition, but an invitation not to be greedy and to define true happiness as the ability to accept sincerely.

From the changes that occur, it can be concluded that this adaptation of the tale reflects the function of children's literature in Indonesia as a means of character education, while also demonstrating how foreign tale translations are adjusted to local cultural values. These changes show how translators and publishers adapt based on local wisdom and the function of fairy tales in Indonesia as a means of entertainment and moral education. By emphasizing the values of innocence and affection, the story is more readily accepted by Indonesian children who are raised in a collectivist culture and are protected from violence.

As happens in the tale "*Rotkäppchen*", the same moral message is maintained, which is the importance of obedience to parental advice and caution towards strangers. However, the translation strategy employed prioritizes the principles of character education and local wisdom which emphasize gentleness and protection for children. This change reflects the function of children's literature in Indonesia, which more prioritizes the delivery of moral values without explicitly displaying violence. This shift shows how local wisdom influences the translation process. The story, which originally functioned as a harsh warning about the direct consequences of disobedience, is transformed into a softer and more universal educational tool, teaching the values of caution, affection, and the danger of strangers, without needing to display explicit scenes of violence.

In the "*Schneewittche*"n tale, the focus of the story shifts from a beauty competition to the theme of domestic oppression, in line with the common motif of Nusantara folk tales. The values of goodness and patience become the core moral values being tested, while evil is depicted through everyday cruelty in household life. The main message of this adaptation affirms that goodness will ultimately triumph, aligning with the moral tradition of Indonesian tales.

Meanwhile, the reception of the "*Rumpelstilzchen*" tale in Indonesia shows a process of value domestication, where the aspect of violence is removed and replaced with a softer ending. This change is made to align with the main function of children's literature in Indonesia, which is to educate, entertain, and instill moral values. The local wisdom value reflected is the emphasis on maternal affection, cleverness in dealing with problems, and the avoidance of extreme punishment.

CONCLUSION

The local wisdom found in the Grimm tales, both the original German version and the Indonesian version, is divided into five groups: family values, moral values, social values, and cognitive values. Family values include affection, loyalty, and appreciation for one's partner, while moral values include honesty, politeness, and avoiding greed. Religious/spiritual values include belief in God and gratitude, while social values include mutual cooperation (gotong-royong), helping others, and harmonious interaction. Cognitive values found in the Grimm tales include cleverness and the ability of reason to defeat physical strength

After comparing the Grimm tales in the original German version and the Indonesian version, the differences in local wisdom present in the two versions can be identified. From this comparison, it is evident which values are maintained and which values are changed in accordance with the local wisdom present in Indonesia. Some tales undergo adjustment, for example, violence is changed to gentleness of character. The values of goodness and patience become the core moral values being tested, and goodness will ultimately triumph, aligning with the moral tradition of Indonesian tales. This change demonstrates the function of children's literature in Indonesia as a means of instilling moral values and character education, not as a medium for presenting the

harsh realities of life. This change is also made to align with the main function of children's literature in Indonesia, which is to educate, entertain, and instill moral values.

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Support Service Needs and Gaps for Students with Multiple Disabilities in Indonesian Special Senior High Schools

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Abstract. This study investigates support service needs and gaps for students with multiple disabilities in Indonesian special senior high schools by analyzing teacher and parent perspectives. Data were collected through surveys from 14 teachers and 31 parents across diverse regions. The instrument focused on three clusters of support services routine communication, interprofessional collaboration, and transition planning while also capturing insights into co-planning and educational discussions. Descriptive statistics were applied to analyze the responses. The results reveal that both teachers (77.8%) and parents (74.2%) consistently reported the presence of routine communication, and parents emphasized educational discussions (74.2%) as an important practice. Teachers strongly highlighted interprofessional collaboration (77.8%) and transition planning (77.8%), yet parents did not consistently identify these services, indicating a gap in awareness and involvement. Parental participation in co-planning was moderate (55.6% from teachers and 64.5% from parents), suggesting that while parents are informed, their role in decision-making remains limited. These findings underline the coexistence of established support services and persisting gaps in parental involvement. Strengthening authentic school–family partnerships, enhancing transparency in collaborative practices, and increasing parental participation in transition planning are necessary to ensure inclusive and family-centered education for students with multiple disabilities.

Keywords: Support Services; Home–School Communication; Parent Engagement; Interprofessional Collaboration; Transition

INTRODUCTION

Students with multiple disabilities are a group of learners who experience more than one type of impairment simultaneously, such as communication difficulties combined with limitations in mobility, cognition, or sensory functioning[1]. The complexity of these conditions requires educational approaches that differ from those provided to other students with special needs, as they face dual challenges that affect their access to the curriculum and the development of adaptive skills[2]. Without adequate support, students with multiple disabilities are at risk of being marginalized from meaningful learning opportunities and unable to fully develop their potential[3]. International studies show that structured support services contribute significantly to enhancing quality of life and social participation for these students[4]. Therefore, support services are essential not only to facilitate learning at school but also to prepare students for life after graduation and their adaptation to community living.

Indonesian special senior high schools (SMALB) play a crucial role in preparing students with multiple disabilities for adulthood, independence, and active participation in society[5]. At this educational stage, support needs become more complex compared to primary levels, as students are expected to acquire not only academic skills but also vocational, social, and functional competencies[2]. Support services in special senior high schools include a variety of provisions, ranging from academic guidance and life skills training to access to resources relevant to students' needs[6]. Without structured services, students with multiple disabilities may face difficulties in both school learning and post-school adaptation[7]. Thus, support services in special senior high schools must be regarded as a central component of special education that prepares students for a more independent future.

Support services in special senior high schools generally encompass three interrelated dimensions: school–home collaboration, routine communication between teachers and parents, and school transition programs. In this study, support services are understood as systematic efforts by schools to provide educational, social, and vocational interventions tailored to the needs of students with multiple disabilities, involving teachers, parents, and other professionals. School–home collaboration is vital to ensure alignment of interventions and strategies, so that students experience consistency in both school and home environments[8]. Routine communication serves as a channel for exchanging information on students' academic, social, and behavioral development and has been

shown to enhance parental engagement in education[9]. Transition programs, meanwhile, are essential for preparing students for post-school life, including vocational skills, independent daily living, and social participation[10]. Together, these dimensions form the foundation of comprehensive support services in special senior high schools.

Despite the presence of support services in special senior high schools, several challenges persist. Communication between teachers and parents is often not fully two-way, leaving parents positioned more as recipients of information than as equal partners in decision-making[11]. Parental involvement in educational planning remains limited, as they are sometimes asked merely to give consent rather than to co-develop strategies[12]. Interprofessional collaboration, while important, is often hindered by limited resources, a shortage of specialists, and weak cross-disciplinary coordination[13]. Transition programs that should prepare students for adulthood are also not always well integrated into daily school practices[10]. These conditions indicate that although support services exist, their quality must be strengthened to truly address the complex needs of students with multiple disabilities.

Globally, research has highlighted the importance of school–home communication, parental involvement, interprofessional collaboration, and transition planning for students with multiple disabilities [10,14]. However, in Indonesia, studies addressing support services at the secondary level remain limited. Most existing research has focused on primary education or inclusive education in general, leaving little insight into support services in secondary special schools[15]. Yet, this stage is critical for preparing students to transition into the workforce, higher education, or independent living. This research gap underscores the need to map support service needs in special senior high schools for students with multiple disabilities.

Based on this gap, the present study aims to describe support service needs in special senior high schools for students with multiple disabilities. The study focuses on three key dimensions—school–home collaboration, routine teacher–parent communication, and school transition programs[8–10] while also examining parental involvement in co-planning, as previous studies have identified potential gaps between teacher and parent perspectives. By mapping these dimensions, this research seeks to provide a comprehensive overview of current support service practices and to identify areas requiring further improvement.

Theoretically, this study is expected to enrich the literature on special education, particularly concerning support services for students with multiple disabilities at the secondary school level. International scholarship has emphasized the importance of family–professional partnerships in improving educational outcomes[16] and highlighted the role of transition planning in expanding post-school opportunities for students with special needs (Trainor et al., 2020). Contributions from the Indonesian context remain limited; therefore, the results of this study will add to the global discourse on support services. Practically, the findings are expected to provide concrete input for teachers, parents, and policymakers in developing more integrated support services in special senior high schools. Teachers may use the findings to design more effective strategies for communication and collaboration, while parents may gain awareness of the importance of active involvement in their child's education [17]. Policymakers can also use the evidence to formulate policies that strengthen transition services and collaborative interventions. Ultimately, this study aims to ensure that students with multiple disabilities receive adequate support to achieve independence and meaningful participation in society.

LITERATURE REVIEW

School–home collaboration has long been regarded as a foundation of special education. Blue-Banning, Summers, Frankland, Nelson, and Beegle identified key dimensions of family–professional partnerships, including respect, communication, and mutual commitment[18]. Through a meta-synthesis, Wilder confirmed that parental involvement is positively associated with children's academic achievement, although the strength of this relationship varies across social and cultural contexts[19]. These studies indicate that equitable collaboration between schools and families can enhance the effectiveness of support services, including for students with multiple disabilities.

Effective communication between teachers and parents is a prerequisite for successful collaboration. Yotyodying and Wild found that structured school–family communication was closely linked to parental engagement both at home and in school[20]. Similarly, Azad et al, , through the Partners in School program, demonstrated that communication-focused interventions can optimize teacher–student relationships[21]. These findings underscore that routine, clear, and two-way communication strengthens parental involvement in supporting children's learning.

School transition has also been a central focus of international studies. Test et al., formulated evidence-based practices for transition among students with disabilities, emphasizing integrated work experiences and individualized planning[22]. Rowe et al., further highlighted that transition predictors can be operationalized through expert consensus, offering a concrete reference for educational policy[23]. These findings suggest that systematic transition programs are essential for preparing students for post-school life.

More recent studies have reinforced these insights. Mazzotti et al, reaffirmed the significance of transition predictors for long-term post-school success[24]. Carter, Austin, and Trainor found that school-based work experiences, parental expectations, and communication skills significantly influence employment opportunities for youth with severe disabilities[25]. West, Sima, Wehman, Chan, and Luecking added that mitigating factors within transition programs can reduce risks of failure in employment[10]. Collectively, the literature consistently demonstrates that family involvement, school support, and relevant work experiences are key factors in transition outcomes.

In addition to programmatic predictors, parental expectations play a critical role. Doren, Gau, and Lindstrom identified a significant relationship between parental expectations and post-school outcomes for students with disabilities, underscoring that families act not merely as passive supporters but as active agents of successful transitions[26]. This aligns with earlier studies emphasizing the role of parents in fostering children's motivation and aspirations.

Overall, the international literature provides strong evidence that school–home collaboration, teacher–parent communication, and school transition programs are essential dimensions of support services. However, research in Indonesia remains limited, particularly at the level of special senior high schools. Thus, this study seeks to address the gap in national literature while contributing to the global discourse on best practices in support services for students with multiple disabilities.

RESEARCH METHOD

This study employed a descriptive quantitative survey design to map the profile of support services for children with multiple disabilities in secondary special schools. A survey design is considered appropriate because it allows researchers to systematically describe existing practices and capture the perceptions of teachers and parents without manipulating variables[27].

Participants

Respondents consisted of nine teachers and thirty-one parents from several provinces in Indonesia. A purposive sampling technique was applied, considering their direct involvement in providing educational services for children with multiple disabilities. Teachers were selected based on their teaching experience in secondary special schools, while parents were chosen based on their active role in supporting their child's education at home. The use of purposive sampling is recommended in educational research to ensure participants are information-rich and relevant to the research objectives[28].

Instrument

The survey instrument was developed based on a literature review and designed using a four-point Likert scale (1 = never, 2 = sometimes, 3 = often, 4 = always). It covered three main clusters: (1) home–school communication, (2) parental involvement and interprofessional collaboration, and (3) transition planning. The questionnaire included both closed-ended items and open comments to capture additional insights. Content validity was established through expert judgment from two senior lecturers in special education, who reviewed the clarity, relevance, and alignment of items with research objectives. Expert judgment is a widely accepted method for establishing content validity in educational and psychological measurement[29,30].

Procedure

Data were collected between July and August 2025 through online (Google Forms) and printed questionnaires, allowing for the participation of respondents from diverse geographic and socioeconomic backgrounds. Prior to distribution, participants received a clear explanation of the research objectives and provided informed consent. Ethical principles in survey research emphasize voluntary participation, informed consent, and confidentiality of responses[31]. Anonymity was maintained throughout the process to increase reliability and reduce response bias.

Data Analysis

Data were analyzed descriptively using percentage calculations. Each item response was summarized to identify the distribution and tendencies of teacher and parent perspectives in each cluster of support services. Descriptive statistics are frequently used in educational surveys to present data in a clear and interpretable manner[32]. The results are presented in tables, figures, and narrative explanations to provide a comprehensive overview of support service profiles in secondary special schools.

RESULTS AND DISCUSSION

Result

The results of this study are presented in two parts: first, the demographic profile of the respondents, and second, the findings related to support services in secondary special schools. Presenting respondent characteristics at the outset is important to provide context and to clarify the background of teachers and parents who participated in the survey.

Demographic profile

This section first describes the demographic profile of the respondents, consisting of 14 teachers and 31 parents, before presenting the main findings on support services

Table 1. Demographic profile of teacher respondents

Variable	Sub-category	Frequency (n)	Percentage (%)
Region/Province	Maluku	3	21.4
	West Sulawesi	1	7.1
	East Java	1	7.1
	DKI Jakarta	1	7.1
	South Sumatra	1	7.1
	Central Java	1	7.1
	DI Yogyakarta	1	7.1
	West Nusa Tenggara	1	7.1
	West Java	1	7.1
	West Sumatra	1	7.1
	Bangka Belitung Islands	1	7.1
	North Kalimantan	1	7.1
Teaching experience	6–10 years	5	35.7
	More than 15 years	5	35.7
	1–5 years	4	28.6
Disability types handled	Autism and intellectual disability	7	50.0
	Cerebral Palsy and intellectual disability	2	14.3
	Hearing impairment and intellectual disability	2	14.3
	MDVI (Multiple Disabilities with Visual Impairment)	1	7.1
	Other multiple types	2	14.3

The teacher respondents (n = 14) came from twelve provinces across Indonesia, reflecting a wide geographical distribution. In terms of teaching experience, most had between six and fifteen years of service, while a smaller number reported fewer than five years or more than fifteen years. The majority of teachers worked with students who had autism with intellectual disability, followed by those handling cerebral palsy with intellectual disability, hearing impairment with intellectual disability, and multiple disabilities with visual impairment. A small proportion of teachers reported other multiple disability combinations.

Table 2. Demographic profile of parent respondents

Variable	Sub-category	Frequency (n)	Percentage (%)
Region/Province	East Java	11	35.5
	West Sumatra	8	25.8
	East Kalimantan	7	22.6
	Bali	3	9.7
	Bengkulu	1	3.2
	DI Yogyakarta	1	3.2
Education level	Senior High School (SMA/SMK)	14	45.2
	Bachelor's degree or higher	10	32.3
	Diploma	3	9.7
	Junior High School (SMP)	2	6.5
	Primary School (SD)	1	3.2
	No schooling	1	3.2
Occupation	Housewife	13	41.9
	Entrepreneur/self-employed	8	25.8
	Employee (public/private sector)	4	12.9

Variable	Sub-category	Frequency (n)	Percentage (%)
Disability types of child	Teacher	2	6.5
	Kindergarten teacher	1	3.2
	Farmer/laborer/retired/private worker	3	9.7
	Autism and intellectual disability	7	22.6
	Cerebral Palsy and intellectual disability	4	12.9
	MDVI (Multiple Disabilities with Visual Impairment)	2	6.5
	Other multiple types	18	58.0

The parent respondents (n = 31) came from various regions in Indonesia. Their children exhibited a range of multiple disabilities, the most common being autism with intellectual disability, cerebral palsy with intellectual disability, and multiple disabilities with visual impairment. Other parents' responses were grouped into the *"Other Multiple Disabilities"* category. Respondents were distributed across grade levels X–XII. In terms of background, most parents had completed secondary or higher education, and more than half were employed.

Findings on support services

The survey results revealed several important aspects of support services for students with multiple disabilities in special senior high schools. Teachers and parents generally agreed that routine communication between school and families was already established, while other forms of support—such as interprofessional collaboration, transition planning, and co-planning with parents—varied in practice and perception.

1. Routine communication

   Most teachers (77.8%) and parents (74.2%) reported that routine communication was conducted consistently. This communication took the form of progress reports, communication books, and digital platforms such as WhatsApp. Teachers typically shared updates on daily assignments and student behavior, while parents provided feedback on their child's development at home. This finding indicates that communication has become a common practice across schools, although the quality and depth differed by context.

2. Interprofessional collaboration

   A high proportion of teachers (77.8%) reported engaging in interprofessional collaboration. This collaboration involved classroom teachers, vocational teachers, therapists, counselors, and other professionals. For example, when supporting students with communication difficulties, teachers worked together with speech therapists to design strategies using communication boards or Augmentative and Alternative Communication (AAC) tools. This reflects a shared awareness that educating children with multiple disabilities requires a cross-disciplinary approach.

3. Transition planning

   According to teacher reports, 77.8% of schools had implemented transition planning activities aimed at preparing students for adult life. These included vocational training, daily living skills, and workplace exposure. Practical examples included student practice in school-based bakery units or vocational workshops under teacher supervision. However, parents did not consistently confirm involvement in such activities, highlighting a gap in family participation in transition planning.

4. Co-planning with parents

   Only 55.6% of teachers and 64.5% of parents perceived parental involvement in co-planning as optimal. Although opportunities for participation existed, parents often played a passive role in decision-making. For example, Individualized Education Program (IEP) meetings were usually based on teacher-prepared plans, with parents asked mainly for approval rather than co-development of strategies. This suggests that co-planning remains limited and requires improvement to build stronger school–family partnerships.

5. Educational discussions

   From the parents' perspective, 74.2% reported being regularly invited to discussions about their child's education. These meetings were held either monthly or through informal communication with teachers. A common example was meetings between homeroom teachers and parents to review children's adaptive progress in social skills, such as greeting peers or using eating utensils independently.

To provide a clearer comparison between teacher and parent perspectives, the results are summarized in Table 3, which highlights similarities and differences across the four key aspects of support services. As shown in Table 3, both teachers and parents reported high levels of routine communication, while parental involvement in co-planning appeared less optimal. Teachers also emphasized interprofessional collaboration and transition

planning, aspects that parents did not consistently acknowledge. To visualize these findings more clearly, the percentages are presented in Figure 1 below.

Table 3. Comparison of teacher and parent perspectives on support services for students with multiple disabilities in special senior high schools

Aspect	Teachers (%)	Parents (%)
Routine communication	77.8	74.2
Co-planning with parents	55.6	64.5
Interprofessional collaboration	77.8	–
Transition planning	77.8	–

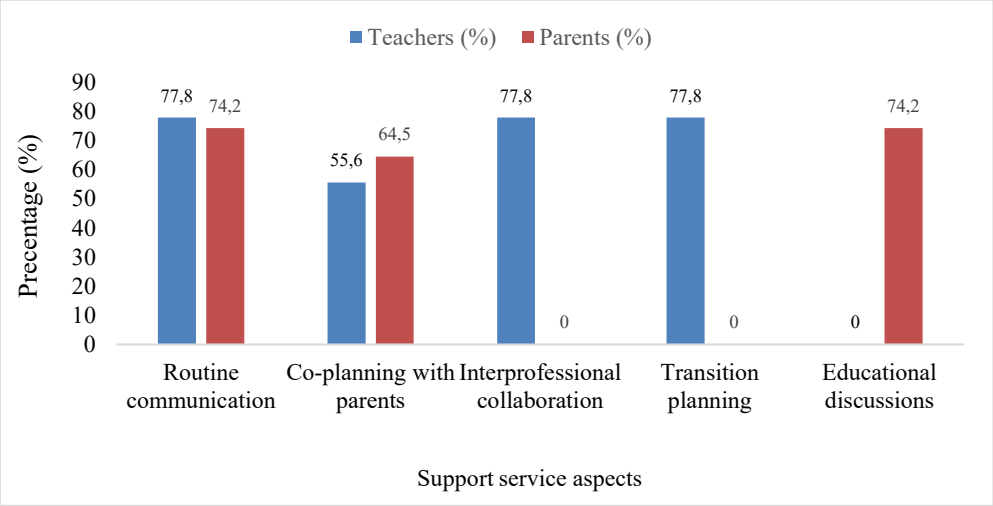

Figure 1. *Percentage of teachers and parents reporting communication, co-planning, collaboration, and transition planning*

Discussion

The present study provides important insights into the strengths and gaps of support services for students with multiple disabilities in Indonesian special senior high schools. Both teachers and parents consistently reported that routine communication was established, with more than three-quarters acknowledging the use of communication books, reports, and digital platforms. This is consistent with recent findings emphasizing that consistent communication fosters authentic parental involvement and improved outcomes when families are treated as active participants [13,33]. Parents in this study also highlighted the role of educational discussions, suggesting that schools do not only transmit information but also offer space for dialogue, although the depth of such discussions remains limited.

In addition, teachers strongly reported engaging in interprofessional collaboration, working with therapists, counselors, and vocational trainers. Similar patterns have been found internationally, where effective cross-professional collaboration significantly enhances the quality of services for children with complex needs[34,35]. Yet, the absence of corresponding reports from parents points to a gap in awareness or involvement, suggesting that collaboration may occur more internally among professionals than in partnership with families. This finding underscores the importance of transparent practices that visibly include parents as partners in collaborative processes.

Another significant theme is transition planning. While most teachers indicated that transition activities, such as vocational training and life skills practice, were integrated into school services, parents did not consistently recognize these efforts. This mirrors evidence from transition research showing that schools often plan transition services without sufficiently engaging families in setting long-term goals[36–38]. Without intentional family involvement, transition planning risks being implemented as a school-driven practice rather than a shared strategy to prepare students for adulthood.

Finally, the issue of co-planning reflects broader challenges in building authentic school–family partnerships. Although over half of teachers and nearly two-thirds of parents acknowledged some level of participation, involvement remained limited and often resembled consultation rather than true co-decision making. This reflects global observations that partnerships in special education frequently stop at information sharing[39]. To move forward, schools must reframe co-planning as a collaborative process where families contribute actively to designing individualized supports and transition goals.

Taken together, these findings demonstrate that Indonesian special senior high schools have established important foundations in communication and professional collaboration, but significant gaps persist in ensuring that parents are fully engaged in planning and transition processes. Addressing these gaps requires strengthening interprofessional practices that visiblyinclude families, fostering structured and inclusive communication, and creating genuine opportunities for co-planning. As recent literature confirms, sustainable improvements in outcomes for students with multiple disabilities can only be achieved through integrated professional collaboration and authentic family engagement[13,34].

CONCLUSION

This study examined support service needs and gaps for students with multiple disabilities in Indonesian special senior high schools by incorporating teacher and parent perspectives. The findings demonstrate that while essential services such as routine communication, interprofessional collaboration, and transition planning are in place, significant gaps remain in parental involvement, particularly in co-planning and recognition of transition activities. Teachers frequently reported structured collaboration and transition practices, but parents did not consistently acknowledge these, suggesting that schools may not fully engage families as equal partners.

Overall, the study highlights the dual reality of established practices and persisting gaps. Strengthening authentic school–family partnerships, enhancing transparency in collaborative practices, and creating more opportunities for parents to participate actively in planning are necessary steps to improve support services. Addressing these needs and bridging the gaps is crucial to ensure inclusive and family-centered education for students with multiple disabilities in Indonesia.

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Meaningrhizome: A Novel Framework for Community-Based Alternative Education in Indonesian Migrant Worker Communities

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Abstract. This research introduces the meaningrhizome framework, a novel conceptual approach for understanding community-based alternative education in Indonesian migrant worker communities. Through twelve months of ethnographic fieldwork across three villages in Central Java experiencing high rates of international labor migration, we demonstrate how communities organically develop distributed, networked educational systems. These systems integrate rhizomatic organizational structures with meaningful learning principles, grounded in Indonesian gotong royong (mutual cooperation) philosophy. The framework extends rhizomatic learning theory beyond digital contexts to face-to-face community settings, demonstrates how meaningful learning can be sustained through distributed social networks, and illuminates how indigenous cultural principles can serve as organizing frameworks for educational systems. Our findings reveal impressive community capacity for educational innovation through network actor configurations, rhizomatic structural patterns, local wisdom foundations, meaningful learning dimensions, and sustainability mechanisms. While recognizing significant challenges including educational quality concerns, sustainability constraints, and gender inequities, this research positions migration-affected communities not as passive victims but as active problem-solvers developing educational alternatives worthy of recognition and strategic support.

INTRODUCTION

Indonesia stands as one of the world's largest labour-exporting nations, with approximately 4.5 million documented migrant workers deployed across Asia, the Middle East, and beyond. This massive outflow of labour, predominantly from rural areas, has generated substantial economic benefits through remittances, which contribute significantly to household incomes and local development in migrant-sending communities. However, beneath these economic gains lies a profound social transformation that has received insufficient scholarly attention: the emergence of what can be termed "social orphanhood" among children left behind by migrating parents.

Social orphanhood refers to a condition in which children, despite having living parents, experience prolonged separation and attenuated parental care due to labour migration. Unlike traditional orphanhood, these children exist in a liminal space where parental presence is simultaneously absent and present—physically distant yet connected through remittances, phone calls, and occasional visits. In villages across Java, Lombok, and other migrant-sending regions, it is not uncommon to find communities where 40-60% of children are raised by grandparents, relatives, or neighbours, while one or both parents work abroad. This demographic reality has created what scholars describe as "transnational care chains," where care responsibilities are redistributed across generations and geographical boundaries, often with profound implications for children's educational experiences and developmental outcomes.

The educational consequences of this massive social restructuring have been documented in various contexts. Research has consistently shown that children of migrant workers face multiple vulnerabilities: disrupted learning patterns, reduced parental academic support, emotional and behavioral challenges, and in some cases, higher dropout rates. Yet paradoxically, these same children often have access to greater economic resources through remittances than their peers from non-migrant families. This creates a complex educational landscape where economic advantage does not automatically translate into educational success, suggesting that factors beyond financial capital—particularly social and cultural capital embedded in community networks—play crucial roles in shaping educational trajectories.

Despite growing scholarly interest in migration and education, existing theoretical frameworks have proven inadequate for capturing the full complexity of educational adaptation in migrant-sending communities. The dominant paradigm in migration studies has largely focused on either the individual household decision-making processes or the macro-level economic impacts of remittances. When educational outcomes are examined, they are typically analyzed through deficit lenses that emphasize what children lack due to parental absence, rather than recognizing the adaptive capacities and innovative educational arrangements that communities develop in

response to migration. This deficit orientation obscures the agency of communities and fails to acknowledge the rich informal learning ecologies that often emerge organically in these contexts.

This article addresses these theoretical and empirical gaps by introducing and elaborating the concept of "meaningrhizome" as a novel framework for understanding community-based alternative education in Indonesian migrant worker communities. Drawing on twelve months of ethnographic fieldwork across three villages in Central Java, we demonstrate how communities facing widespread parental migration have organically developed decentralized, network-based educational systems that integrate meaningful learning principles with rhizomatic organizational structures, all grounded in local cultural frameworks of collective responsibility. Rather than viewing these communities through a deficit lens, we argue that they represent sites of educational innovation where necessity has catalyzed the emergence of alternative pedagogical arrangements that challenge conventional assumptions about what constitutes effective education.

LITERATURE REVIEW

Migration and Educational Outcomes

The relationship between parental migration and children's educational outcomes has been a subject of intensive scholarly inquiry over the past two decades, yielding findings that are both substantial and contradictory. Early research, predominantly conducted in Latin American contexts, emphasized the negative consequences of parental absence on children's academic performance and school engagement. These studies documented how migration-induced family separation correlates with increased behavioral problems, diminished academic motivation, and higher dropout rates, particularly when mothers migrate and when separation occurs during critical developmental periods.

However, subsequent research has complicated this predominantly negative narrative by highlighting the potential positive effects of migration through remittance channels. Studies from diverse contexts including the Philippines, China, and Morocco have demonstrated that remittances can improve educational access by enabling families to afford school fees, learning materials, and private tutoring, while also reducing the need for child labor. This economic mechanism suggests that migration, despite its emotional costs, may paradoxically enhance educational opportunities for some children.

Rhizomatic Learning Theory

Rhizomatic learning theory, derived from the philosophical work of Deleuze and Guattari, offers a radical reconceptualization of how learning occurs and how educational systems might be organized. In their seminal work A Thousand Plateaus, Deleuze and Guattari contrasted the rhizome—a horizontal, subterranean root system with multiple, non-hierarchical entry and exit points—with the arborescent tree structure characterized by vertical hierarchy, central roots, and linear branching. This botanical metaphor became the foundation for reimagining knowledge not as a structured, hierarchical system emanating from foundational truths, but as a network of connections that can be entered at any point and that grows through proliferating linkages rather than vertical accumulation.

Meaningful Learning and Community Knowledge

Meaningful learning theory, developed primarily by David Ausubel and elaborated by Joseph Novak, provides a cognitive framework for understanding how new knowledge becomes integrated into learners' existing conceptual structures. Ausubel distinguished meaningful learning from rote learning, arguing that meaningful learning occurs when new information is substantively related to what the learner already knows and when the learner chooses to incorporate new knowledge into their cognitive structure in a non-arbitrary, non-verbatim manner.

Gotong Royong Philosophy

Gotong royong, often translated as "mutual cooperation" or "collective responsibility," represents a foundational cultural principle in Indonesian society with deep historical roots in Javanese and broader Austronesian social organization. The concept refers to communal practices where community members voluntarily contribute labor, resources, and support for collective projects and mutual welfare without expectation of immediate individual compensation. Traditionally manifested in activities such as collective rice harvesting, community infrastructure maintenance, and assistance for families experiencing hardship, gotong royong

embodies values of social solidarity, reciprocity, and communal obligation that transcend individualistic self-interest.

THEORETICAL FRAMEWORK: THE MEANINGRHIZOME CONCEPT

The meaningrhizome framework represents a conceptual synthesis designed to illuminate how communities facing large-scale parental migration organize alternative educational systems that are simultaneously adaptive, culturally grounded, and pedagogically effective. The term itself is intentionally hybrid, combining "meaningful" (from meaningful learning theory) and "rhizome" (from rhizomatic learning theory) to signal the integration of cognitive-psychological insights about knowledge construction with organizational-structural insights about networked, non-hierarchical systems.

Component 1: Network Actor Configurations

The first component of the meaningrhizome framework concerns the configuration of actors who collectively constitute the educational support network in migration-affected communities. Drawing on actor-network theory's insight that agency is distributed across heterogeneous assemblages, this component identifies the diverse human and non-human actors that participate in children's learning and the relational patterns that connect them. The primary human actors typically include migrant parents, substitute caregivers (grandparents, aunts, uncles, older siblings, neighbors), formal educators, peer groups, and community elders.

Component 2: Rhizomatic Structural Patterns

The second component addresses the organizational structure of community-based educational systems, drawing explicitly on rhizomatic principles to characterize how learning opportunities, knowledge flows, and educational activities are organized. A key structural feature is multiplicity of pathways to learning. Rather than all children following identical curricular sequences, rhizomatic systems accommodate diverse learning trajectories based on individual circumstances, available opportunities, and specific needs.

Component 3: Local Wisdom Foundations

The third component emphasizes that community-based educational systems are fundamentally grounded in specific local knowledge systems, cultural values, and traditional practices. In Indonesian contexts, gotong royong principles provide cultural templates and moral frameworks that make distributed educational responsibility feel natural and normative. Local wisdom provides organizing principles for how educational activities are structured and who participates in them.

Component 4: Meaningful Learning Dimensions

The fourth component focuses on the cognitive and experiential processes through which learning becomes meaningful for children in migration-affected communities. The first dimension concerns experiential relevance—the degree to which educational content connects to children's lived experiences of migration and its consequences. When educational activities build upon this experiential knowledge, learning becomes more meaningful because it resonates with children's actual lives.

Component 5: Sustainability Mechanisms

The fifth component addresses how community-based educational systems sustain themselves over time despite resource constraints. The first mechanism involves reciprocal obligation networks grounded in gotong royong principles. In systems based on mutual aid, participants contribute to collective educational efforts with expectations of reciprocal support. This creates interdependent relationships where different participants contribute different resources.

RESEARCH METHOD

Research Design

This research employs ethnographic methodology to investigate how communities experiencing high rates of parental labor migration organize alternative educational support systems. The research was designed as a comparative ethnographic study across three village sites in Central Java, Indonesia, selected purposively to represent communities with high migration rates but varying in demographic, economic, and educational characteristics. The extended duration of fieldwork (twelve months continuously) reflects our commitment to developing nuanced, contextualized understanding.

Research Sites and Participants

The three research sites were selected through multi-stage purposive sampling. Desa Makmur is a relatively prosperous agricultural community of approximately 3,200 residents with established patterns of international migration primarily to Malaysia and Saudi Arabia. Desa Sejahtera is a smaller village of about 1,800 residents where international migration has intensified more recently. Desa Harmoni is a peri-urban community of approximately 2,800 residents experiencing both international and internal migration. In total, 45 participants were recruited across categories including children, substitute caregivers, migrant parents, teachers, and community leaders.

Data Collection

Data collection occurred over twelve months from March 2022 through February 2023. The primary method was participant observation involving sustained immersion in daily community life. Detailed fieldnotes accumulated to approximately 2,400 pages. Semi-structured interviews complemented observation, with 87 formal interviews conducted. Additional data sources included document collection, informal conversations, and visual documentation.

Data Analysis

Data analysis followed Miles, Huberman, and Saldaña's iterative approach involving data reduction, display, and conclusion drawing. Analysis began during data collection with ongoing coding and memo-writing. The first step involved preliminary coding using both deductive codes from theoretical frameworks and inductive codes from data. The second step involved pattern coding to identify abstract patterns and themes. Data displays including matrices and network diagrams facilitated systematic comparison. Verification strategies included triangulation, negative case analysis, and participant feedback.

RESULTS AND DISCUSSION

Community Educational Networks

The most striking finding was the organic emergence of complex, multi-layered educational networks operating alongside formal schooling. These networks exhibited rhizomatic characteristics: multiple entry points, distributed authority, non-hierarchical relationships, and adaptive reconfiguration. In Desa Makmur, residents called this the jaringan asuh bersama (collective care network). One grandmother caring for three grandchildren described: "Every afternoon, children gather at Pak Hadi's house. Maybe ten, fifteen children come there. They do homework together, older ones help younger ones. It's like the whole village becomes their school."

Institutional Innovations

Beyond informal networks, all three sites developed more structured institutional innovations. We identified three distinct models: the Rumah Belajar Komunitas (Community Learning House) in Desa Makmur, a semi-formal space operating five afternoons weekly serving 35 children; the Kelompok Belajar Rotasi (Rotating Study Group) in Desa Sejahtera, where activities moved among households on scheduled rotation; and the Sekolah Komunitas Anak Migran (Migrant Children's Community School) in Desa Harmoni, a legally registered institution enrolling 50 children with part-time teachers.

Transnational Parenting Integration

A distinctive feature was active integration of physically distant parents through communication technologies. Daily video calls enabling remote homework supervision and educational monitoring were normative. One domestic worker in Hong Kong described her routine: "Every evening at 7 PM I video call my children. First we talk, then I ask to see their homework. If I can help, I explain. When I cannot help, I tell them to ask grandmother or go to the Rotating Study Group." However, effectiveness varied significantly based on parents' educational backgrounds, work conditions, and children's ages.

Cultural Innovation and Preservation

Community educational initiatives consciously integrated cultural transmission with academic instruction. Traditional arts, crafts, and performance forms were deliberately kept alive. An 82-year-old retired farmer teaching agricultural practices reflected: "I never went to school beyond third grade. But I know the land, I know the plants, I know the wisdom my grandfather taught me. If we don't teach it, it will disappear. So even though I am old and uneducated by modern standards, I have something valuable to contribute." Cultural education provided children with strong cultural identities and rootedness despite parental absence.

Reciprocal Care Networks

Sustainability depended on reciprocal care networks grounded in gotong royong principles. In Desa Makmur, an explicit pakta bersama (collective pact) articulated mutual responsibilities: parents working abroad contribute remittances to community education funds, community members provide direct care and educational support, and everyone both contributes and benefits. However, challenges included perceptions of inequitable burden distribution, particularly among elderly women providing disproportionate care labor, and free-rider problems where some families benefited without contributing proportionately.

DISCUSSION

This research makes several significant theoretical contributions. First, the meaningrhizome framework extends rhizomatic learning theory beyond digital contexts to face-to-face, resource-constrained community settings, suggesting rhizomatic organization can emerge from social necessity and cultural practices. Second, it demonstrates how meaningful learning can be sustained through distributed social networks rather than requiring intensive nuclear family support. Third, it shows how indigenous cultural principles can serve as organizational frameworks for entire educational systems, not merely as curriculum content.

Practically, this research challenges conventional approaches by suggesting interventions should begin by identifying and understanding what communities are already doing before designing new programs. External interventions risk displacing effective community practices. More appropriate support includes modest flexible funding, capacity building, legal recognition pathways, and coordination with formal schools—all while preserving community ownership and control.

However, honest assessment requires acknowledging significant limitations. Community-based systems may struggle to provide educational quality comparable to well-functioning formal schools. Sustainability remains precarious, dependent on voluntary participation and modest resources. Equity concerns exist, particularly regarding gendered labor burdens on elderly women. There are tensions between community embeddedness and critical education necessary for questioning potentially problematic local norms.

CONCLUSION

This research introduces the meaningrhizome framework as a novel conceptual approach for understanding community-based alternative education in contexts of large-scale parental migration. Through ethnographic fieldwork across three Indonesian villages, we demonstrated how communities organically develop distributed, networked educational systems integrating rhizomatic structures with meaningful learning principles, grounded in gotong royong philosophy. The framework makes significant theoretical contributions by extending rhizomatic learning theory, demonstrating distributed meaningful learning, and illuminating indigenous cultural principles as organizational frameworks.

Practically, findings challenge deficit perspectives, revealing impressive community capacity for educational innovation. Educational interventions should prioritize strengthening existing community initiatives through strategic support rather than imposing external programs. However, we critically examined significant limitations including quality concerns, sustainability challenges, and equity issues. While community-based systems

represent valuable alternatives deserving support, they cannot fully substitute for parental presence or for addressing structural economic inequalities driving migration.

As global migration intensifies affecting an estimated 200 million children worldwide, understanding how communities successfully organize alternative educational support becomes an urgent matter of educational justice, requiring recognition of community wisdom, support for community capacity, and ultimately addressing structural conditions necessitating such adaptations.

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IMPROVING ADMINISTRATIVE SERVICE QUALITY THROUGH ARCHIVAL SYSTEM REFORM AT THE DIRECTORATE OF RESEARCH AND COMMUNITY SERVICE YOGYAKARTA STATE UNIVERSITY

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Abstract. This study aims to analyze and implement archival system reform to improve administrative service quality at the Directorate of Research and Community Service (DRCS), Yogyakarta State University. The problems encountered include difficulties in document retrieval, unsystematic archive management, and low administrative service efficiency. The research methodology employed a qualitative approach with observation, interviews, and document analysis techniques. The findings indicate that archival system reform through the implementation of a structured classification system, archive digitization, and human resource training has successfully increased document retrieval efficiency by 70%, reduced administrative service time from an average of 5 days to 2 days, and improved service user satisfaction by 85%. The archival system reform has proven to be significantly effective in enhancing administrative service quality and work productivity at DRCS YSU.

Keywords: archival system, service quality, administration, digitization, efficiency

INTRODUCTION

The archival system constitutes a crucial component in the administrative management of higher education institutions. The Directorate of Research and Community Service (DRCS) at Yogyakarta State University, as a unit managing various research and community service activities, faces challenges in managing increasingly complex documents and archives. The continuously increasing volume of documents in line with the escalation of research and community service activities necessitates an effective and efficient management system.

Based on preliminary observations, several problems were identified in the archival system at DRCS YSU, including: (1) difficulties in document retrieval due to inadequately structured storage systems, (2) accumulation of physical documents requiring substantial storage space, (3) risks of damage and loss of important documents, (4) delays in administrative service processes impacting service user satisfaction, and (5) insufficient human resource competency in modern archive management.

Law Number 43 of 2009 concerning Archives emphasizes the importance of proper archive management as part of the national information system. Well-managed archives serve as sources of information and accountable evidence. In the higher education context, an effective archival system supports good governance and enhances service quality for the academic community.

This study focuses on archival system reform efforts at DRCS YSU with the objective of improving administrative service quality. The reform was conducted comprehensively, encompassing aspects of classification systems, archive digitization, infrastructure, and human resource competency development for archive management.

METHODS

Research Approach and Type

This study employs a qualitative approach with action research methodology. This approach was selected because the research aims to solve practical problems in archival management through direct implementation of improvements. The research was conducted in four stages: (1) planning, (2) action implementation, (3) observation and evaluation, and (4) reflection.

Research Location and Timeline

The research was conducted at the Directorate of Research and Community Service, Yogyakarta State University, located at Karangmalang Campus, Yogyakarta. The research was carried out over six months, from March to August 2025

Research Subjects and Objects

The research subjects included 15 administrative staff members at DRCS YSU, unit leaders, and service users (lecturers and researchers). The research objects were the archival system and administrative service quality at DRCS YSU.

Data Collection Techniques

The data collection techniques employed include:

- Participant observation to examine the archival system condition and administrative service processes
- In-depth interviews with administrative staff, unit leaders, and service users
- Documentation in the form of archival data, standard operating procedures, and documents related to archival management
- Service user satisfaction questionnaires distributed before and after the reform

Data Analysis Techniques

Qualitative data were analyzed using the Miles and Huberman model, comprising data reduction, data display, and conclusion drawing. Quantitative data from satisfaction questionnaires were analyzed using descriptive statistics to compare conditions before and after the reform. Success indicators include: (1) document retrieval time efficiency, (2) administrative service time speed, and (3) service user satisfaction level.

RESULTS AND DISCUSSION

Initial Archival System Condition

The analysis of initial conditions revealed that the archival system at DRCS YSU still faced various problems. The archive classification system had not been properly standardized, resulting in each section implementing different storage methods. Document storage was still dominated by physical formats with limited and inadequate storage space. This condition caused difficulties in document retrieval, with an average retrieval time of 15-30 minutes per document.

From the human resource aspect, interview results indicated that administrative staff lacked adequate understanding of modern archival management. Training related to archives had not been conducted systematically. This condition resulted in low administrative service efficiency, with an average service completion time of 5 working days. Initial satisfaction questionnaire results showed that user

satisfaction only reached 65%, with primary complaints related to slow service processes and difficulty accessing information.

Implementation of Archival System Reform

The archival system reform was conducted comprehensively through several main strategies:

Aspect	Reform Strategy	Implementation
Classification System	Development of function and activity-based classification system	Creation of classification codes, classification guidelines, and training for all staff
Archive Digitization	Scanning of priority documents and development of research and community service information systems, as well as digital archiving input in the correspondence system.	Digitization of Archives Scanning of priority documents and development of information systems for research and community service, as well as input of digital archiving into the correspondence system. Digitization of research and community service documents (proposals, contracts, reports) into simppm.uny.ac.id, and correspondence documents into siagen.uny.ac.id.
Infrastructure	Storage space arrangement and procurement of facilities and infrastructure	Procurement of filing cabinets, mobile file racks, computers, scanners, and storage servers
Human Resources	Competency enhancement through training and mentoring	Training in archival management, digitization, and information system usage for 15 staff members
SOP	Development and socialization of archival management standard operating procedures	Preparation of DRPM archiving SOP

Results of Archival System Reform

The implementation of archival system reform demonstrated significant results in improving administrative service quality. The following are the measured impacts of the reform:

Indicator	Before Reform	After Reform
Document Retrieval Time	15-30 minutes	2-5 minutes
Administrative Service Time	5 days	2 days
User Satisfaction Level	65%	85%
Storage Space Efficiency	4 full rooms	2 rooms
Digitized Documents	0%	60%

Discussion

The research findings indicate that archival system reform provides a significantly positive impact on administrative service quality at DRCS YSU. The improvement in document retrieval time efficiency from 15-30 minutes to 2-5 minutes (a 70% increase) demonstrates that a structured classification system and archive digitization are highly effective in accelerating information access. This aligns with research by Winarko (2019), which states that a proper classification system can increase information retrieval speed by up to 75%.

The reduction in administrative service time from 5 days to 2 days (a 60% improvement) indicates that an effective archival system contributes directly to work process efficiency. Ease of document access enables administrative staff to complete work more quickly without being hindered by time-consuming document searches. Basuki (2020) in his research also found that archive digitization can reduce administrative process time by 50-70%.

The increase in service user satisfaction from 65% to 85% demonstrates that archival system improvement has a positive impact on service quality perception. Service users experienced ease of information access, service speed, and increased professionalism in administrative services. This is consistent with SERVQUAL service quality theory, which states that responsiveness and reliability are important dimensions in service quality.

The implementation of 60% archive digitization has provided dual benefits: storage space efficiency and document security. The reduction in physical storage space from 4 rooms to 2 rooms provides operational cost savings and enables office space optimization. Additionally, digital archives are safer from risks of physical damage, loss, and disasters.

Human resource training proved to be a key success factor in reform implementation. The enhancement of staff competency in modern archival management ensures the sustainability of the established system. Post-training interview results showed improvement in staff understanding and skills in digital archive management, document classification, and archival information system usage.

Challenges encountered in reform implementation included resistance to change from some staff who were accustomed to the old system, budget constraints for infrastructure procurement, and time required for large-scale archive digitization processes. However, with a gradual approach and intensive mentoring, these challenges were overcome.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the research findings and discussion, it can be concluded that:

1. The initial archival system condition at DRCS YSU still faced various problems including an unstandardized classification system, dominance of physical storage, limited human resource competency, and low administrative service efficiency.
2. The archival system reform strategy was conducted comprehensively, including classification system development, archive digitization, infrastructure enhancement, human resource competency development, and standard operating procedure formulation.
3. The archival system reform proved to significantly improve administrative service quality with achievements of 70% increase in document retrieval efficiency, 60% reduction in administrative service time, 20% increase in user satisfaction, and 50% improvement in storage space efficiency.

Recommendations

Based on the research findings, several recommendations are proposed as follows:

1. Continue the archive digitization process gradually until reaching 100% to maximize document efficiency and security.
2. Conduct periodic evaluation and updates of the archival information system to keep pace with technological developments and organizational needs.
3. Organize continuous training for human resources to maintain and enhance competency in archival management.
4. Integrate the archival information system with other information systems at YSU to improve efficiency and synergy across units.

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Development of Science Learning Modules to Stimulate Scientific Thinking Skills in Early Childhood

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Abstract. The present study was conducted to (1) design and develop a Science Learning Module for Early Childhood aimed at enhancing scientific thinking skills, (2) evaluate the feasibility of the developed module, and (3) examine its practicality. The developed module provides structured guidance in identifying science content across five domains: life science, physical science, earth science, space science, and environmental science. It is enriched with visual illustrations, simplified explanations, and examples of integration into lesson plans to facilitate instructional use by teachers. Validation results demonstrated a media score of 92% and a material score of 91%, both of which fall into the "Highly Feasible" category, thereby confirming the module's eligibility for implementation following several revisions. At the time of submission, the practicality testing phase was still in progress.

INTRODUCTION

Early childhood education (ECE) plays a pivotal role in establishing the foundations of children's cognitive, psychomotor, affective, and life skills development, enabling them to adapt and remain competitive in an increasingly challenging era[1,2]. At this stage, stimulation should be directed toward encouraging children to solve problems scientifically through direct, hands-on experiences[3,4]. Such stimulation is crucial, as the experiences provided during early childhood serve as the basis for subsequent educational stages. Therefore, the ECE curriculum must incorporate programs that are aligned with the developmental needs and characteristics of young learners, encompassing objectives, content, instructional methods, and assessment strategies

One of the essential components of the early childhood education (ECE) curriculum is science learning. Through science-related activities, children are able to develop critical thinking abilities and scientific skills by exploring objects, events, and phenomena in their surroundings. However, in practice, science learning in ECE still encounters several challenges. Some teachers feel uncomfortable teaching science due to limited understanding of scientific concepts and pedagogical approaches. As a result, science learning is often disconnected from the curriculum and, in many cases, is rarely introduced to young children. In addition, the teaching methods that are commonly employed remain largely conventional, such as lectures and worksheet-based tasks, which fail to provide interactive and enjoyable learning experiences[2,5,6].

Previous studies have shown that 67% of early childhood education (ECE) teachers have implemented science learning; however, a gap remains between classroom practices and a deeper understanding of scientific concepts[7]. On the other hand, another study revealed that 92.31% of children demonstrated better comprehension of scientific concepts through simple experimental methods, such as color experiments. These findings indicate that when teachers provide appropriate science learning experiences, children are capable of achieving higher levels of understanding[8]. Nevertheless, limitations in the availability of tools, materials, and instructional media for science learning in ECE continue to pose significant challenges to its effective implementation[9].

Ideally, science learning should be carried out using a scientific approach that encompasses the stages of observing, questioning, making predictions and hypotheses, drawing conclusions, and communicating findings[10]. This approach not only introduces children to scientific concepts but also fosters curiosity and critical thinking skills from an early age[6]. To achieve this, teachers require learning resources that can serve as a guide in designing and implementing science activities that are developmentally appropriate for young children.

Based on these conditions, this study aims to develop a science learning material's module that can serve as a practical guide for early childhood education (ECE) teachers in implementing high-quality science instruction. The module is designed to facilitate teachers in providing interactive, engaging, and curriculum-aligned learning experiences, thereby stimulating the development of scientific thinking skills in young children. Furthermore, this study evaluates the feasibility of the developed module, with the expectation that it will contribute significantly to improving the quality of science learning in ECE settings.

LITERATURE REVIEW

Science Learning Materials in Early Childhood Education

Science is a body of knowledge, a method of inquiry, and a way of thinking that examines natural phenomena to uncover their underlying principles while simultaneously fostering problem-solving skills applicable to everyday life[4,11,12]. In the context of early childhood education (ECE), science is understood as a combination of process skills (how children learn) and content knowledge (what children learn))[13,14]. The core of science learning lies in the scientific process, relevant content, and concepts that are meaningfully connected to children's real-life experiences[28].

Science materials in early childhood education (ECE) must be concrete, observable, and aligned with children's developmental stages[2,30]. These materials include: (1) earth and space sciences, such as weather, seasons, and planets; (2) life sciences, such as plants, animals, and their relationships with the environment; and (3) environmental and conservation issues[11,15,16]. Science activities are also designed to develop fundamental skills such as observing, comparing, measuring, classifying, and communicating[10,17,18]. Simple experiments using objects and phenomena from children's immediate surroundings can enhance their attitudes and curiosity toward the natural world[19].

The implementation of science learning in early childhood education (ECE) is carried out through three main stages: planning, implementation, and closure[20]. Within this process, teachers are expected to foster nine scientific attitudes in children, including curiosity, originality, cooperation, perseverance, independent thinking, responsibility, and self-discipline[21]. Moreover, science learning contributes to the holistic development of children, encompassing physical, intellectual, social, emotional, spiritual, and language growth[19].

The recommended approaches are the scientific approach and discovery-inquiry, which enable children to explore concepts through play and hands-on experiences, thereby making learning more enjoyable[22–24]. Teachers are also encouraged to relate science learning to children's daily lives to ensure that concepts are more easily understood[19].

Early Childhood Education Curriculum

The curriculum functions as a guideline for planning, implementing, and evaluating learning. It is not merely a written plan, but also an instrument that regulates the learning environment and classroom activities[25]. In this context, the curriculum is understood not only as a planning document but also as a series of interconnected processes that are closely linked to other systems of activity within the educational environment[26].

At the early childhood education (ECE) level, the curriculum is designed to support children's development and potential through enjoyable learning experiences while preparing them for subsequent levels of education[23]. Currently, ECE in Indonesia implements the *Merdeka Curriculum*, which aims to make the learning process more relevant, in-depth, and meaningful[27]. This curriculum emphasizes the development of essential competencies, project-based learning, and the alignment of instruction with children's developmental stages and interests[28]. The ECE curriculum can be understood as a collective system of activities that involves multiple stakeholders, supported by various tools and learning resources (artifacts), and oriented toward achieving developmental goals. The transformation of the ECE curriculum highlights the importance of understanding the interrelationship between motives, objectives, and instruments at the institutional level, thereby ensuring that learning focuses on children's holistic development rather than merely individual behaviors[26].

Educators are granted the flexibility to design and manage the curriculum in accordance with the characteristics of their institutions and the needs of their students. Children are also encouraged to choose activities based on their interests and talents[27]. Previous studies have demonstrated that the *Merdeka Curriculum* promotes critical and independent thinking among children[29]. This aligns with Ki Hajar Dewantara's philosophy regarding students' right to freedom, encompassing freedom of thought, spirit, and body[27]. Furthermore, the curriculum is structured to foster the four essential 21st-century competencies—communication, creativity, collaboration, and critical thinking[29,30]—thus offering significant potential to enhance the quality of learning, particularly in science education within early childhood settings.

RESEARCH METHOD

This research is a development study aimed at producing a science learning material's module to stimulate scientific thinking skills in early childhood. The development model employed is the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation[31].

The Analysis stage initiates the research process and involves identifying needs through focus group discussions (FGD), Google Form–based questionnaires, and a literature review. The research subjects were early childhood education (ECE) teachers. This stage was designed to explore teachers' competencies in selecting and

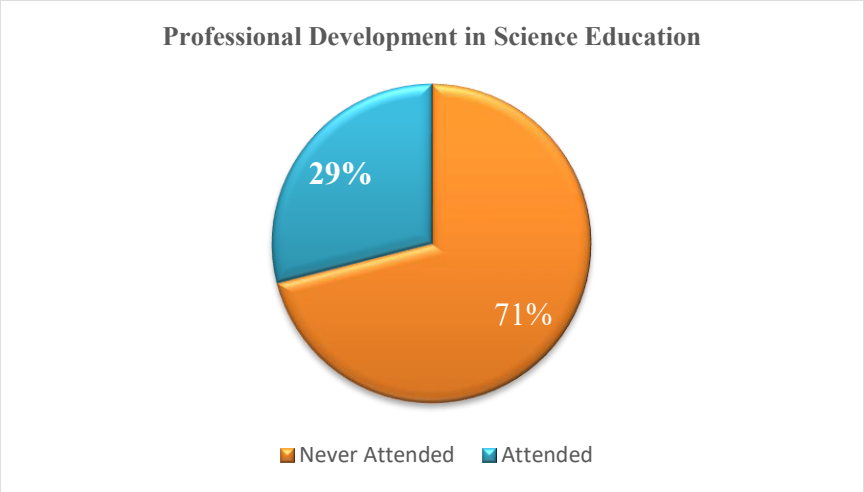
determining science learning materials, as well as their needs regarding types of activities, teaching methods, and instructional media for science learning. The Design stage consists of activities aimed at developing the framework of the science learning module. The module structure comprises an introduction, science concepts, types of science materials, examples of science content integrated into lesson plans, and a closing section. The design phase encompassed research activities aimed at developing a science material module framework, structured to include an introduction, fundamental science concepts, types of science materials, examples of science materials integrated into lesson plans (RPP), and a conclusion.

The development phase focused on producing the initial draft of the module, which was subsequently subjected to content and appearance validation. During this stage, feasibility assessment instruments were also developed, covering both media-related aspects (design and layout) and content quality (self-instruction, self-contained, stand-alone, adaptive, and user-friendly criteria). Validation comprised two dimensions: content and visual presentation. The content was reviewed and validated by two science subject-matter experts, while the media aspect was evaluated by one instructional media specialist. Upon receiving approval from both the content and media experts, the module underwent user validation through readability testing, involving 20 early childhood education (ECE) teachers. The data were analyzed quantitatively using a five-point Likert scale and qualitatively through feedback and suggestions provided by the participants.

The module, having been deemed feasible by content experts, media specialists, and end-users, was subsequently implemented in early childhood education (ECE) settings. The implementation was conducted in two stages: a limited field trial involving two ECE teachers, followed by a wider field trial involving five ECE teachers. Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed narratively to provide input for module revision. The results of the implementation were utilized to conduct evaluation and final revisions, resulting in a module that is valid, feasible, and ready for use in science learning within ECE settings.

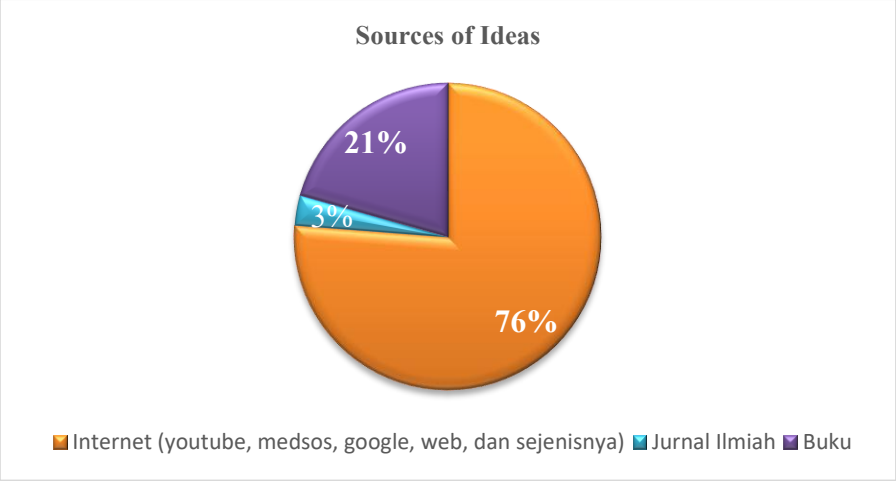
RESULTS AND DISCUSSION

This developmental research commenced in 2024 with a field analysis and an examination of the characteristics of early childhood education (ECE) teachers' professional competencies. The data collection employed several techniques, including focus group discussions (FGDs), questionnaire distribution through Google Forms, and a literature review addressing the relevant issues. The findings of this preliminary study were then synthesized into a conceptual model, which served as the foundation for the module development. The results further revealed that the majority of teachers had never received training in science education, as reflected in the following data.



The diagram illustrates that 71% of teachers have never participated in science training. This condition has led to a lack of confidence among teachers in delivering science instruction, primarily due to their limited understanding of scientific concepts and appropriate teaching methodologies. This finding corroborates the results of Izzudin (2019), who reported that the majority of early childhood education (ECE) teachers felt uncomfortable providing science learning[2].

These data also indicate that, although teachers have not received formal training in science education, they nevertheless continue to implement science learning by seeking ideas from various sources, as outlined below.



The diagram reveals that the majority of teachers (76%) seek ideas for science learning materials from social media platforms and YouTube. Only 21% of teachers rely on books, and a mere 2% consult scientific journals. This indicates the limited availability of books or scholarly articles that specifically address science education in early childhood contexts. These findings reinforce the study of Syaodih (2020), which highlighted that one of the main barriers to implementing science instruction in early childhood education is the scarcity of tools, materials, and appropriate learning media[9].

The results served as the foundation for developing the module. The developed science exploration module was subsequently validated in terms of content by two experts, who assessed its feasibility for use by early childhood education (ECE) teachers. The evaluation was conducted using an instrument consisting of 15 indicators covering aspects such as objectives, content presentation, clarity, illustrations, and relevance to the ECE learning context. A five-point Likert scale was employed, with 1 indicating "not appropriate" and 5 indicating "highly appropriate."

The validation results demonstrated that the module achieved an average score of 91.33%, which falls within the “highly feasible” category. This indicates that the module content is well aligned with the needs of ECE teachers in providing interactive science learning that is developmentally appropriate for young children. The highest score was obtained for the indicator assessing the alignment of the module’s objectives with scientific advancements, highlighting the strong theoretical and practical relevance of the developed module.

The module content illustrates that science should be presented in a concrete, observable manner, and aligned with children’s developmental stages[29,30]. The types of science materials developed in this module reinforce previous studies[10,17,18], encompassing: (1) earth and space sciences, such as weather, seasons, and planets; (2) life sciences, including plants, animals, and their interrelationships with the environment; and (3) issues related to environmental preservation and sustainability[11,15,16]. The materials also integrate everyday topics relevant to children’s experiences. This approach is consistent with the findings of Izudin and Hidayati, who emphasized that science learning should aim to foster the foundations of cognitive, psychomotor, affective, and life skills development, thereby enabling children to adapt and compete in an increasingly challenging era[1,2].

Nevertheless, several aspects still require revision, including the addition of illustrations and examples to enhance engagement and comprehensibility, the reorganization of learning themes to facilitate teachers in selecting and applying the materials, and the incorporation of step-by-step guidelines for selecting and elaborating science content based on deep learning, complemented with sample lesson plans. Accordingly, the module was deemed feasible with revisions, and the subsequent stage will focus on refining the module prior to field testing.

Media validation was conducted by a media expert to assess the quality of the visual appearance and design of the developed science exploration module. The evaluation encompassed five key aspects: module size, layout, typography, illustrations, and design consistency. The assessment instrument consisted of 30 indicators rated on a five-point scale, where 1 indicated “not appropriate” and 5 indicated “highly appropriate.”

The validation results demonstrated that the media aspects of the module achieved a score of 92%, falling into the “highly feasible” category. The highest ratings were obtained for the indicators related to module size, color selection and visual contrast, as well as typographic consistency. These results suggest that the module design meets professional standards and is well aligned with the requirements of instructional media.

Several indicators required minor revisions, including adjustments to the layout of the cover and module content to achieve better proportionality, updates to the illustrations to ensure greater communicative value and realism, and more consistent labeling of chapter titles. Overall, the module was considered feasible with revisions, with improvements primarily focused on refining illustrations and layout prior to the field trial stage.

From the content perspective, the highest scores were obtained for the alignment of the module objectives with teacher competencies and the relevance of the material to scientific developments. This finding is consistent with Wijaya and Dewi (2021), who emphasized that science learning in early childhood should be concrete and contextual, enabling children to grasp abstract concepts through direct, hands-on experiences[32]. Similarly, Alawiyah et al. (2024) highlighted the importance of adopting a scientific approach in early childhood science learning to foster the development of children's scientific thinking skills[33].

Nevertheless, several aspects require revision, such as the inclusion of additional life science topics (e.g., animal and plant habitats), earth science topics (e.g., day and night cycles and natural disasters), as well as the refinement of lesson plans (RPP) in the domain of physical science. Suryawati and Akkas (2021) argue that science content in early childhood education should ideally encompass three major domains (physical, life, and earth sciences), delivered through play-based activities[34]. In addition, learning assessment needs to be aligned with instructional objectives so that it functions formatively and emphasizes the learning process rather than merely the final outcomes.

From the media perspective, the module design has fulfilled the principles of readability and aesthetics, receiving high scores on color contrast, layout, and typography. This finding supports Arifin et al. (2023), who emphasized the importance of coherent visual design in enhancing comprehension[35]. Several minor revisions are still required, such as adjusting illustrations for greater proportionality, ensuring font size consistency, adding author profiles, page headers, and a back-cover blurb. The importance of engaging visuals is further reinforced by Kress and Van Leeuwen (2006), who argued that visual elements strengthen conceptual understanding and enhance user motivation[36].

Overall, the validation results indicate that this module holds significant potential to enhance the quality of science education in early childhood settings. The module not only provides practical guidance for teachers but also supports the implementation of the *Merdeka Curriculum*, which emphasizes exploration and meaningful learning. The next stage will involve a field trial to examine the effectiveness of the module in fostering scientific thinking skills among young children.

CONCLUSION

This study produced a science exploration module for early childhood education, designed to support teachers in implementing interactive science instruction that is developmentally appropriate. Validation results indicated that the content aspect achieved a score of 91.33% and the media aspect 92%, both of which fall within the "highly feasible" category. The module development was grounded in preliminary findings showing that 71% of teachers had never received science training. Consequently, 76% of teachers relied on online sources, (such as YouTube, social media, Google, and other websites), for science material ideas, while only 21% drew on books. This reliance on digital sources reflects the limited availability of books that specifically address science content for early childhood education.

The validation results demonstrated that the module contains content relevant to teachers' needs and features an attractive design that meets instructional media standards. Nonetheless, several minor revisions are required, including the addition of illustrations, refinement of layout, clarification of learning themes, and incorporation of step-by-step guidelines for selecting and elaborating science content based on deep learning. Overall, the module was deemed feasible with revisions, and the subsequent stage will involve field testing to evaluate its effectiveness in enhancing young children's scientific thinking skills while simultaneously strengthening teachers' competencies in science instruction.

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The Role of Counseling Teachers in Student Learning Difficulties

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Abstract. Guidance and counseling is the essential part of the educational process. As part of education, guidance, and counseling, teachers are essential in developing students' learning processes and helping with learning difficulties. This research method uses qualitative methods. Methods of data collection using interviews. The research location is Sarbini Grabag Islamic Middle School, Magelang Regency. The instrument used in this study is an interview guide. This study's data sources are Guidance and Counseling Teachers, Principals, and Homeroom Teachers. Analysis of the data used in this study involves data collection, data reduction, data presentation, and conclusion. Test the validity of the data in this study using source triangulation. The results of this study are (1) need assessment to analyze student learning difficulties, using the Student Needs Analysis (AKPD) instrument, (2) program preparation follows the AKPD results. Specifically for learning difficulties, Guidance and Counseling Teachers incorporate into the guidance and counseling program, namely guidance and counseling services in the personal field, information services, individual counseling and home visits, (3) guidance and counseling services to overcome student learning difficulties, namely information services, individual counseling and home visits in collaboration with homeroom teachers, and (4) evaluation of the counseling program is carried out using short and long term assessments. This study concludes that Guidance and Counseling Teachers have carried out the role of Guidance and Counseling Teachers in carrying out guidance and counseling services for students with learning difficulties following the flow of guidance and counseling services.

Keywords: guidance and counseling, student, learning difficulties, counselling teacher

INTRODUCTION

Education is a place to develop abilities, skills, habits, and attitudes expected to make a person better. Education is not only in schools. Learning can be done anytime and anywhere, not limited by space and time. The 21st century has brought about radical societal transformations in social and personal values and social structures. While these changes challenge society, educational and school systems strive to keep up by making appropriate arrangements in their curricula, pedagogical methodologies, and human resources (Saklz, 2019). Based on Permendikbud No. 81A of 2013, that learning is a way how to make what is taught can be mastered by students, in principle learning activities are educational processes that provide opportunities for students to develop their potential into abilities that are increasingly increasing in attitude, knowledge, and skills needed by him to live and socialize, nation, and contribute to human welfare.

Learning difficulty is when students cannot complete the learning process as it should. Learning difficulty is when students cannot learn appropriately due to threats, obstacles, or distractions in learning. Von Aster (Bartelet et al., 2014) differentiated a poor performance cluster and three dyscalculia clusters. The latter clusters consisted of children who scored more than one standard deviation below the mean test score of the average population on at least one subtest. Each student has different learning abilities. Students can capture learning at different speeds. Students are fast in capturing learning, and some are slow.

Students who are slow in capturing learning may experience difficulties in learning. Learning difficulties are students' difficulties in receiving or absorbing lessons at school. Our primary concern as teachers, for example, may be increasing students' higher-level understanding of concepts in some domain and in- creasing their ability to generalize those concepts to new situations where they are relevant, but achieving those goals rests on students having acquired the basic vocabulary of terms and labels in that domain (Bjork, 2015). Learning difficulty is a condition in which competence or achievement is not following predetermined standard criteria. Low academic

achievement has been identified as the most critical predictor of educational dropout (Battin-Pearson et al., 2000; Korhonen, 2014)

Guidance and Counseling teachers are essential in helping students overcome learning difficulties. Teachers are professional educators with the main task of educating, teaching, guiding, directing, training, assessing, and evaluating students in early childhood education through formal, primary, and secondary education. Teachers must pay special attention and treatment to students who have learning difficulties compared to students who do not experience learning difficulties. The provision of guidance within other curricular domains within the school system is becoming increasingly relevant for career learning and development (Barnes, Bassot, & Chant, 2011; Hearne, 2017)

Talking about education cannot be separated from the role of the teacher in it, especially the Guidance and Counseling Teacher. Guidance and Counseling Teachers are professionals who receive special education in tertiary institutions and devote all their time to guidance services. This Guidance and Counseling teacher provides guidance services to students so that students can optimize their potential and become consultants for school staff. Other concerns raised by stakeholders focused on how the infrastructure for training competent school counselors would be developed and maintained and how supervision would be funded and provided (Pattison et al., 2009). Professional development was identified as a need for counselors and staff (Pattison et al., 2009).

Guidance and Counseling Teachers as educators are required to be responsible for student development and must pay attention to the abilities of individual students so that they can help students develop optimally and recognize students who have learning difficulties. This approach involves collaboration between guidance counselors, school management, teachers, and resource staff, with the guidance counselor having overall responsibility for guidance planning and delivery of the service in the school (DES, 2009, 2012; Hearne, 2015). Teachers must have creativity in learning by adjusting the needs of students in learning. Learning difficulty is the distance between expected academic achievement and academic achievement obtained. They further state that individuals who experience learning difficulties are normal in intelligence but show one or more critical deficiencies in the learning process, whether in perception, memory, attention, or motor function. Saa (Hussain, 2019) performed a study to find the best classifier to predict students' performance in higher education using social and personal input features.

School guidance and counseling services look better than in the previous era. Recognition towards guidance and counseling services as a profession has increasingly crystallized, especially from the government and other professional circles. Implementation of guidance and counseling has a significant role in achieving educational goals. With guidance and counseling services, an educational institution is hoped to form good student character and embody constructive educational values. In addition, counseling guidance is also a place to pour out all the complaints that may be complicated for an individual to experience. Counseling in an educational context also shows some connection to improvements in learning, achievement, behavior, and attendance at school (Ofsted, 2004; Rupani, Haughey, & Cooper, 2012; Rupani, 2014)

The role of the Guidance and Counseling Teacher in schools is significant to help students solve various problems, especially learning difficulties. Students need a calm mood to learn and achieve good results so that these situations and conditions can be realized; the role and participation of guidance and counseling staff are needed to help students overcome difficulties in learning. Although daily interaction with caring adults who serve as advisors, teachers, and coaches provides supervision and guidance, there is an inherent need to successfully navigate peer relationships because of this constant communal life (Pavletic, 2016). Nelson, Kendall, and Shields (Pavletic, 2016) closely link the development of healthy peer relationships with nurturing adult care in determining school success and well-being.

RESEARCH METHOD

The approach used by researchers in this research is descriptive qualitative research. The researcher chose a qualitative descriptive research design because the researcher wanted to describe the conditions observed in the field more precisely, transparently, and in-depth. So the role of researchers as a tool is to obtain the data needed for research.

In carrying out this research, the research location was the Sarbini Islamic Middle School, Grabag District, Magelang Regency. In carrying out this research, the subjects in the study were Guidance and Counseling Teachers, Principals, and Classroom Guardians. In this study, there are two data, namely primary data and secondary data. Primary data was taken from Guidance and Counseling Teachers, while secondary data was obtained from homeroom teachers and school principals.

The instruments used in this study were Interview Guidelines which consisted of Interview Guidelines for Guidance and Counseling Teachers, Interview Guidelines for Principals, and Interview Guidelines for Classroom Teachers. In this study, data collection was carried out by interview techniques. Interviews were conducted with Guidance and Counseling Teachers, homeroom teachers, and school principals

Data analysis in this study refers to four steps, namely, 1) data collection, 2) data reduction, 3) data presentation, and 4) conclusion. Data validity or trust in research results can be obtained using source triangulation techniques.

The triangulation technique used is Source Triangulation. Triangulation of sources to test the credibility of data about the role of Guidance and Counseling Teachers related to learning difficulties. The way to do this is to check the data obtained through several sources, namely primary and secondary data.

RESULTS AND DISCUSSION

Need Assessment Relating to Student Learning Difficulties

Based on the results of interviews with Guidance and Counseling Teachers at Sarbini Islamic Middle School, it is clear that the need assessment carried out by Guidance and Counseling Teachers at Sarbini Islamic Middle School uses Student Needs Analysis (AKPD). After determining the need assessment of the needs of the students, the Guidance and Counseling Teacher makes the Guidance and Counseling Program according to the needs of the students.

The results of interviews with Guidance and Counseling Teachers show that specifically for learning difficulties, in carrying out a need assessment using the AKPD. This is because there are already existing AKPDs that lead to learning difficulties in the field of study. The results of the interviews with the Guidance and Counseling Teachers were corroborated by the results of interviews with the homeroom teacher and the principal, that the Guidance and Counseling Teachers often provide the results of a need assessment regarding learning difficulties and make joint plans regarding the provision of services and assistance for students who experience learning difficulties.

Guidance and Counseling Teachers have a significant role in assisting students in achieving optimal development in four areas: personal, social, academic, and career. The selection criteria are very different if the goal is for peer counselors to help others in the school (open model). With this goal, students are chosen because they "have their act together" and possess a humanistic outlook and well-developed listening skills (Blain, 1985). In carrying out the role of the Guidance and Counseling Teacher at Sarbini Islamic Middle School, the Guidance and Counseling Teacher uses need assessment as a medium or tool to analyze problems of student learning difficulties. Need assessment is the primary and first work of the counseling teacher in making the BK Program, so need assessment is the primary key to developing the BK Program. In choosing guidance staff, the administration and, in particular, the assistant head teacher in charge of guidance had sought staff members whose theoretical approach to their work (Antonouris, 1976; (Siann, 2016).

Guidance and Counseling Program for Students with Learning Difficulties

The results of interviews with Guidance and Counseling Teachers show that the implementation of the guidance and counseling program at Sarbini Islamic Middle School, Guidance and Counseling Teachers develop programs according to the results of the need assessment. The guidance and counseling program in Sarbini Islamic Middle School is an annual, semester, and monthly program. The guidance and counseling program includes activities such as information services, orientation services, group counseling services, individual counseling services, group counseling services, classical guidance services, and home visits.

The guidance and counseling program for learning difficulties at Sarbini Islamic Middle School is included. The program is included in the semester program. The results of interviews with the homeroom teacher and the school principal show that every semester, the Guidance and Counseling Teacher reports the guidance and counseling program to the homeroom teacher and the school principal and explains the steps in implementing guidance and counseling services.

In carrying out the guidance and counseling program related to student learning difficulties; the Guidance and Counseling Teacher works closely with various school parties and outside school. The school counseling profession is engaged in a discourse transforming what school counselors do (Lewis, 2006). Professional school counselors, counselor educators, and other stakeholders are in the process of revising the stories that guide the school counseling profession (American School Counselor Association [ASCA], 2003, 2004; Campbell & Dahir, 1997; Galassi & Akos, 2004; Gysbers & Henderson, 2000; House & Martin, 1998; Littrell & Peterson, 2004; Lewis, 2006). On the school side, Guidance and Counseling Teachers work with the principal as a leader or who makes policies, Homeroom Teachers, Subject Teachers, and all components in the school, while for collaboration with parties outside the school, the teacher works with parents to equally control students. Career teachers, guidance practitioners, and counselors have to create a productive equilibrium between a constructivist approach (in which they co-create a career narrative together with their students) and a 'traditional' teacher role that provides students with the information they need in order to thrive and survive in a 'risk society (Hughes, 2017).

Guidance and Counseling Services for Students with Learning Difficulties

Based on the results of interviews with Guidance and Counseling Teachers, the implementation of guidance and counseling services in overcoming learning difficulties, namely Guidance and Counseling Teachers use information services, classical guidance, group guidance, and group counseling. In addition, Guidance and Counseling Teachers collaborate with the homeroom teacher to carry out the services above. The results of interviews with the homeroom teacher indicated that some students experienced difficulties because they did not understand the material provided. Thus, the Guidance and Counseling Teacher recommends meeting directly with the Subject Teacher through the homeroom teacher.

The results of the interview with the school principal indicated that the school also supports the activities of the Guidance and Counseling Teachers to carry out guidance and counseling services to overcome learning difficulties. School counselors are responsible for supporting the needs of all students in three primary domain areas: academic, personal–social, and career (ASCA, 2003; Wood, 2010). The principal also provides particular time for providing guidance and counseling services in collaboration with the Subject Teacher for students who do not yet understand the material provided by the Subject Teacher. Counseling is an effective intervention for a range of psychological problems experienced by adolescents, as several recent meta-analyses have indicated (Harrison, 2019). For example, McLaughlin, Holliday, Clarke, and Ilie (Harrison, 2019) report that counseling effectively addresses depression, anxiety, trauma, and conduct problems.

Evaluation of Guidance and Counseling Programs

The results of interviews with Guidance and Counseling Teachers show that the evaluation of the Guidance and Counseling Teacher Program carried out by Guidance and Counseling Teachers is done by assessing the process of implementing guidance and counseling services. Assessment of the guidance and counseling services process aims to determine the effectiveness and efficiency of implementing activities carried out from the results of the assessment of guidance and counseling service activities included in the program implementation report. The Guidance and Counseling Teachers at Sarbini Islamic Middle School were evaluated to obtain feedback on the effectiveness of guidance services and the level of success of guidance and counseling activities. This evaluation includes long-term assessment and short-term assessment, especially for learning difficulties in the evaluation involving the homeroom teacher, subject teacher, and school principal.

The Guidance and Counseling teacher at Sarbini Islamic Middle School has an essential role in overcoming the problem of student learning difficulties. Guidance and Counseling teachers play an active role in solving student problems and overcoming student learning difficulties. When staffing in schools is inadequate, higher caseloads result, stretching school counselors thin and diverting attention away from mental health, considering the multiple responsibilities that school counselors have (Brener, 2018). Services provided by Guidance and Counseling Teachers in collaboration with other teachers, such as subject teachers and homeroom teachers, to support the implementation of the Guidance and Counseling Program. The rapidity with which the emerging knowledge age makes it mandatory for today's school counselor education students to be aware of the changing relationships between education and work (Hoyt, 1997).

CONCLUSION

Guidance and Counseling Teachers have carried out role of Guidance and Counseling Teachers in carrying out guidance and counseling services for students with learning difficulties according to the flow of guidance and counseling services. Implementing guidance and counseling services for students with learning difficulties has carried out a need assessment, development of counseling programs, guidance, counseling services, and collaboration with parties in schools.

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DIGITIZATION OF UNY'S MPI COLLECTIONS AND SERVICE DEVELOPMENT TO ACHIEVE VALUE-ADDED DOWNSTREAMING OF STATE UNIVERSITIES

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Abstract. This research aims to improve the service quality and attractiveness of the Indonesian Education Museum (MPI) at UNY through the digitization of collections based on Augmented Reality technology. The background of this research is the low interest in visiting, especially from groups, and the limitations of conventional collection presentations.

The research used a development method with the ADDIE model, which includes analysis, design, development, implementation, and evaluation.

The results revealed two main innovations: (1) the Satulat MPI visit flow (pickup, conditioning, assistance, overview, welcome dance, and outdoor garden) which increases visitor comfort and positive impressions, and (2) the digitization of collections of five Yogyakarta educational figures (Ki Hajar Dewantara, Kh Ahmad Dahlan, Dr. Wahidin Sudirohusodo, Sri Sultan Hamengkubuwono IX, Ki Ageng Suryomentaraman) using visual and audio barcode-based AR. The trial showed an average visitor satisfaction level above 4.2 (scale of 1–5), with elementary school students (4.7) and junior high school students (4.6) receiving the highest scores. Teachers (4.5) rated AR as highly beneficial as a contextual learning medium. AR has been shown to increase historical understanding, emotional engagement, and learning motivation among visitors. **Keywords:** Digitalization, Satulat MPI, Education Figures.

INTRODUCTION

A museum is an institution that functions to protect, develop, utilize collections, and communicate the general conference of ICOM (International Council of Museums) according to Government Regulation No. 66 of 2015. A museum is a permanent, non-profit institution serving society and its development, open to the public, which collects, preserves, researches, communicates, and exhibits the cultural heritage and its environment, both tangible and intangible, for the purposes of study, education, and enjoyment.

Etymologically, the word museum comes from the Latin "museum" ("musea"). Originally from the Greek "mouseion," which refers to a temple dedicated to the Muses (the nine goddesses of art in Greek mythology), it was a building for education and the arts, specifically an institute for philosophy and research at the library in Alexandria founded by Ptolemy I Soter in 280 BC.

Museums manage material evidence of cultural and/or natural materials and their environment that have significance for history, science, education, religion, culture, technology, and/or tourism, to be communicated and displayed to the general public through permanent, temporary, and traveling exhibitions. Most museums offer programs and activities that appeal to all audiences, including adults, children, families, and all professional levels. Public programs include lectures or training sessions with faculty, experts, films, music or dance performances, and technology demonstrations [1]

Museums, with all their collections, offer a wealth of knowledge and history from their respective collections. Therefore, in fulfilling the purpose of creating and establishing a museum, the museum's duties and functions are: (1) a place for collecting and safeguarding cultural and natural heritage, (2) a place for documentation and scientific research, (3) conservation and preservation, (4) a medium for disseminating and distributing knowledge to the public, (5) a place for introducing and appreciating art, (6) a visualization of cultural and natural heritage,

(7) a medium for introducing cultures between regions and nations, (8) a reflection of the growth of human civilization, and (9) a fostering sense of piety and gratitude to God Almighty.

The role of a museum is to exhibit objects or collections based on scientific principles by providing clear images. Furthermore, museums are also used for entertainment and education.

Learning will be successful if the learning resources are also good. Museums can also serve as a good learning resource.

As technology advances, we should utilize it effectively. By utilizing technology, learning resources will be richer and more effective than in the past. We can leverage this technology by digitizing some of the museum collections.

The Indonesian Education Museum is located in Yogyakarta, specifically at Yogyakarta State University. The presence of the Indonesian Education Museum at UNY is crucial for helping the younger generation understand the struggles of education champions to facilitate access to education for all Indonesians. This museum also serves as a reminder that the rapid development and ease of access to education today are due to the intervention of these heroes who have served. This museum not only fosters public understanding of the history of education in Indonesia but also fosters a sense of nationalism for our beloved nation, Indonesia.

Currently, the collections at the Indonesian Education Museum have not been digitized and are still conventional. Therefore, digitization of the Indonesian Education Museum's collections is necessary to increase visitor appeal and develop services at the UNY MPI.

The planned technology to be used is AR (Augmented Reality), a technology that combines digital elements (such as images, sound, or data) into the real world interactively. AR allows users to view and interact with virtual elements that appear over the physical environment through specific devices, such as smartphones, tablets, or AR glasses.

By utilizing this technology, it is hoped that the Indonesian Education Museum can increase its appeal and thus attract more visitors.

Problem Formulation

1. How is the museum a learning resource?
2. How can the Indonesian Education Museum increase its appeal?
3. How can AR technology be utilized for the Indonesian Education Museum's collections?

Research Objectives

1. Understanding the museum as a learning resource
2. Understanding how to increase its appeal to the Indonesian Education Museum
3. Understanding how to utilize AR technology for its collections

LITERATURE REVIEW

A. Museums

Museums are one of the elements that preserve cultural heritage, connecting humanity from the past to the present. This cultural heritage is evidence of human civilization that has gone through a social process [2]Museums are cultural institutions that play a vital role in preserving and presenting a nation's historical heritage to present and future generations [3].

According to ICOM (International Council of Museums), a museum is a not-for-profit organization engaged in critical dialogue on the past and the future, thus requiring a link that can connect the two [4]

A museum is an organization that exists to preserve, develop, and utilize collections that reflect the museum's character, such as artifacts from the past that are expected to convey its history. Museums function to store cultural heritage, both artifacts and non-artifacts, which can be utilized by the general public and academic researchers for historical research [5]

A museum is an institution established in response to government policies on the preservation of cultural objects and human history. Museum collections constitute the nation's cultural heritage and contain information about history and culture.

Museums and culture are inseparably linked, as they always go hand in hand. One institution that can serve as a forum for learning about history. A museum is an institution for storing, securing, and utilizing material objects, as well as the natural environment, to support the protection and preservation of the nation's cultural wealth [6]

Today, museums serve as a resource for educators to conduct learning. They serve as learning centers and recreational venues. Museums are utilized as a learning medium while also providing tourism. These learning media, utilizing varied and recreational facilities, make museums a learning medium and an educational tourist attraction [7] Furthermore, museums are used as a means of cultural preservation and a learning medium [8].

Generally, museums are places to exhibit historical objects, but they can also serve as venues for cultural events such as performances, storytelling, theater, and exhibitions about other cultures [9]. Museums are places to store, maintain, protect, and utilize evidence of human, natural, and environmental culture to support efforts to protect and preserve the nation's cultural heritage [10].

Several studies on museums conclude that museums are places to store or exhibit items related to culture and history. Currently, museums are also a place for learning for various groups, both Children and adults. Therefore, it serves as a means of cultural resilience through art appreciation for early childhood.

B. Indonesian Education Museum

The Indonesian Education Museum is a museum located on the UNY campus. This museum showcases the history of education throughout the years. Among the outstanding collections held by the Indonesian Institute of Sciences (MPI) are portraits of learning from the past, still using slate.

The Indonesian Education Museum's collection is divided into several galleries depicting the history of education in Indonesia.

C. AR Technology

The majority of museum visitors visit museums solely as tourist attractions, while very few are motivated to increase their knowledge. This phenomenon occurs because the current generation grows up with technological advances. This can be seen in the tendency of young people to spend a lot of time with computers, video games, and gadgets [11]

Changes to museums that focus more on digitizing their collections are necessary to keep pace with the times. In this digital era of technological advancement, especially among the younger generation who are accustomed to technology, museums have a significant opportunity to integrate This technology is integrated into learning programs. Museums can adopt media such as virtual reality, augmented reality, and smartphone apps to enhance the history learning experience [12]

Utilizing augmented reality will increase relevance to the younger generation, while still upholding its primary purpose as a center for learning and cultural heritage. In both formal and informal contexts, the role of museums as a medium for history learning is increasingly important. The use of museums as learning experiences and fostering interest in studying history[13]

RESEARCH METHOD

This research is developmental research. Research aimed at creating a product. Developmental research describes the procedures taken by researchers or developers in discovering, creating, or developing a product. The development model used is the ADDIE development model, a learning development model based on effectiveness and efficiency. Its interactive process allows this model to produce evaluation results for each phase, which data can guide learning development to the next phase [14]. The stages of ADDIE model development are Analysis, Design, Development, Implementation, and Evaluation.

Figure 7. ADDIE model development design

RESULTS AND DISCUSSION

Museum development is crucial to increase visitor appeal. One way to achieve this is by improving service quality, a proven effective approach [15]As a center for historical education and a recreational learning environment, the experience provided must be impressive, incorporating high-quality service [16]. Service quality is a series of

specific forms that can help meet consumer needs and desires [17]. Similarly, [18]argue that good service quality is crucial for visitor satisfaction. Improving service quality is essential for visitor satisfaction [19]. Therefore, the educational museum will undertake development focused on museum visitor services.

This process begins with an analysis of visitor data from the past six months, with the following data:

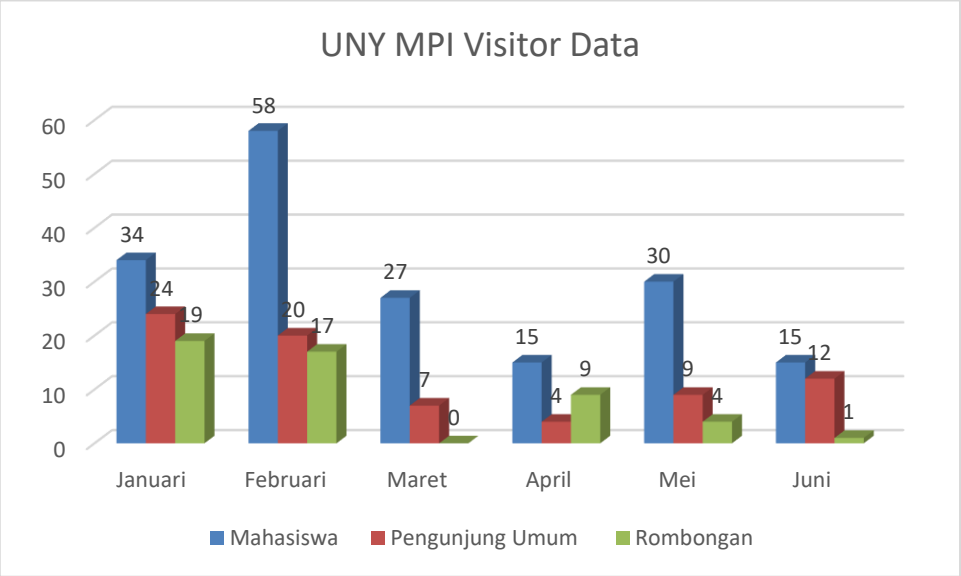


Figure 8. Graph of MPI UNY visitors

The graph above shows three categories of visitors: students, general visitors, and groups. In January, there were 34 students, 24 general visitors, and 19 groups. In February, there were 58 students, 20 general visitors, and 17 groups. In March, there were 27 students, 7 general visitors, and 0 groups. In April, there were 15 students, 4 people, and 9 groups. In May, there were 10 students, 19 general visitors, and 4 groups. In June, there were 15 students, 12 general visitors, and 1 group. The graph above shows a downward trend in group visitor numbers over the past few months.

The Indonesian Education Museum's strategy to increase visitor appeal is to create a visitor flow for groups and digitize the museum's collections, particularly the latest MPI collection, which features five prominent figures from Yogyakarta's education sector.

(1) MPI Guest Visit Flow

The design includes pick-up, conditioning, accompaniment, a briefing, a welcome dance, and an outdoor garden. These six service steps are called Satulat MPI. Sat means 6 and Lat stands for service. The development of Satulat MPI was discussed with all MPI staff, especially educators. The implementation of Satulat MPI flow was carried out through a trial run during MPI visits. An evaluation process was conducted after the trial run to assess whether it had run well.

Satulat MPI is one of the visit flows for the Indonesian Education Museum, encompassing the process from pick-up to drop-off and return to the bus.

Figure 9. MPI Satulat Design

1. Reception

A visit to the Indonesian Education Museum begins with a reception for guests or groups in front of the UNY Rectorate. Guests are warmly welcomed by an educator serving as a receptionist. This reception is designed to be orderly and comfortable, providing a positive first impression for visitors.

2. Conditioning Participants

Upon arrival at the UNY Rectorate, educators ensured participants were ready for the visit. This conditioning included a brief briefing on the museum rules. Group assignments were also conducted at this stage. The relaxed yet orderly atmosphere ensured participants were relaxed and enthusiastic about the visit. A group photo was then taken in front of the UNY tower and the Rectorate, providing participants and guests with memories of their time at UNY.

3. Guidance

After receiving the briefing, participants are asked to tour the museum with a designated educator. They will observe various collections and artifacts depicting the history of education in Indonesia throughout history. The guide will provide interactive explanations in each gallery, from traditional education and the colonial era to modern and digital education. Indonesian Education Museum.

4. Overview

Next, participants were directed to the audiovisual room to enjoy and listen to the UNY Overview. The presentation began with a profile video of the UNY MPI and was followed by an explanation of UNY's history.

5. Welcome Dance

On this occasion, guests were also welcomed in a more lively and cultural atmosphere. The welcome included the signature dances of MPI UNY, namely the sabak, grip, or penggatis dance. These dances were performed by educators who not only entertained but also introduced the cultural values integral to national education.

6. Outdoor Garden

As the final step, invited guests or visiting guests continue their journey to the museum's outdoor garden, an open area where MPI provides a playroom and relaxation area. Guests can enjoy the food served and take photos and videos in the outdoor garden. Afterward, guests or visiting participants are escorted to the bus and farewell.

In an effort to improve service at the Indonesian Education Museum, the visitor flow is being improved, starting with the arrival and arrival, setting up, accompaniment, overview, welcome dance, and the outdoor garden. While guiding visitors through each gallery at the Education Museum, educators provide explanations using

interpersonal skills. Interpersonal skills are the ability to interact and communicate effectively with others. This ensures visitors enjoy each gallery experience at the Indonesian Education Museum. A study by [20] found that guide skills such as professional competence, interpersonal skills, organizational skills, empathy, and problem-solving positively influenced the decision to visit.

In the outdoor garden, participants were served typical Yogyakarta snacks such as clorot, mata kebo, tahu bakso, corobika, and drinks. This is one strategy to attract visitors, similar to what [21] stated that museums need outlets selling specialty foods and souvenirs to maximize service while appealing to visitors' desires and needs.

An innovation implemented at the Indonesian Education Museum (MPI) is a key factor in visitors' decision to visit the Indonesian Education Museum (MPI). Good service quality significantly influences visitors' decision to visit the museum. This is similar to what [22] found that infrastructure innovation and service quality significantly influence three tourism destinations.

The Indonesian Education Museum's visit flow is systematic and enjoyable, starting with a friendly welcome, orderly attendance, and exploration of the museum's galleries. This is followed by a brief overview of UNY, a welcome dance performance representing the museum's unique characteristics, the Sabak dance. Furthermore, interactive activities in the outdoor garden allow participants to take photos and videos.

(2) Digitization of the collection of 5 Yogyakarta education figures

The collection of 5 Yogyakarta education figures is located on the second floor of the Indonesian Education Museum. This collection includes leprosy photographs of the figures, brief biographies, and books. The 5 education figures are Sri Sultan HB IX, Ki Ageng Suryomentaraman, Ki Hajar Dewantara, KH Ahmad Dahlan, and Dr. Wahidin Soediro Hoesodo.

Ki Hajar Dewantara, born in Yogyakarta on May 2, 1889, with the name RM Suwardi Suryaningrat, was an educational figure, journalist, and national hero who founded the Taman Siswa School in 1922 with the Among System as the basis of education. His ideas included the Tripusat Pendidikan (family, school, society), the Trikon concept (continuity, convergence, concentricity), and the educational motto "Ing Ngarsa Sung Tuladha, Ing Madya Mangun Karsa, Tut Wuri Handayani" which has remained the motto of national education to this day. In addition to opposing discriminatory colonial policies, he also served as Minister of Education and Culture after independence and was awarded the title of National Hero. His ideas remain the foundation of the Indonesian education system, and his birthday is commemorated as National Education Day.

Dr. Wahidin Sudirohusodo (1852–1917) was a pioneer in the birth of Budi Utomo in 1908 which marked the Indonesian National Awakening. Born in Mlati, Sleman, to a Javanese aristocratic family and descendant of Makassar nobility, he successfully studied at ELS and then the Javanese Medical School (STOVIA), becoming the first village child to be accepted there. His concern grew from an awareness of the suffering of the colonized people, so he initiated the importance of education as a path to independence. He encouraged the collection of "student funds" to help intelligent indigenous youth continue their education, while also instilling a spirit of national unity. In addition to education, Wahidin also championed the health and welfare of the people, making him a key figure in raising awareness of Indonesian nationalism.

Sri Sultan Hamengkubuwono IX (1912–1988), born Raden Mas Dorodjatun, was the 9th Sultan of Yogyakarta and is known as a key figure in the struggle for independence and the development of Indonesia. Since the beginning of the proclamation, he fully supported the Republic of Indonesia by providing protection, logistical assistance, and diplomatic roles, especially when Yogyakarta was the capital of the struggle during the Dutch Military Aggression. In addition to his political activities, the Sultan also contributed greatly to the development of education, health, and infrastructure, including the establishment of Gadjah Mada University. He is remembered as a wise leader, siding with the people, preserving culture, and receiving high state awards for his services, making him a leader whose legacy lives on in the history of the Indonesian nation.

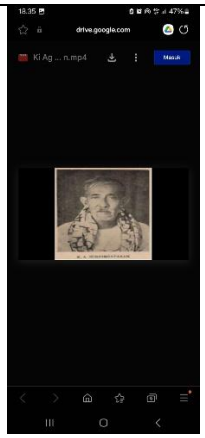
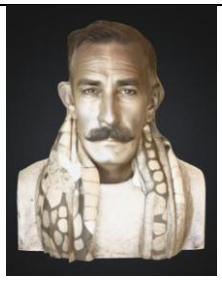
Ki Ageng Suryomentaram (1892–1962), son of Sri Sultan Hamengkubuwono VII, was a Javanese spiritual figure who abandoned his royal status in search of the meaning of life. He taught the values of simplicity, harmony, and self-understanding through moral teachings such as aja dumeh and the concept of the “6-Sa” (sakepenake, sabutuhe, saperlune, sacukupe, samesthine, sabenere) as the key to happiness. For him, happiness and hardship are temporary (mulur mungkret), so humans must be able to understand themselves in order to understand others. He also reminded humans to avoid the “hell on earth” of envy, arrogance, disappointment, and worry, which will only hinder true happiness. His thoughts remain relevant today as a philosophy of life that emphasizes inner awareness, simplicity, and humanity.

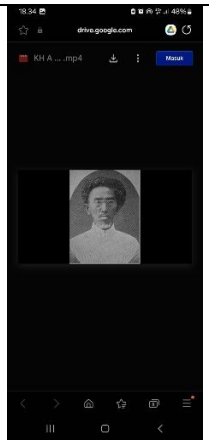
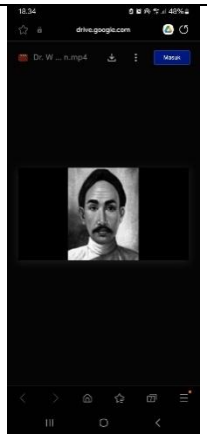
KH. Ahmad Dahlan (Muhammad Darwis), born in Yogyakarta on August 1, 1868, was an Islamic reformer and founder of Muhammadiyah, who played a crucial role during the national awakening. Through Muhammadiyah, he modernized religion, education, social, and cultural affairs by combining the traditional Islamic boarding school system with Western education, and established schools, hospitals, orphanages, and various social facilities. His movement was rooted in the spirit of the Quran, particularly the practice of Surah Al-Ma'un, which emphasizes concern for the underprivileged. With his sincerity, exemplary conduct, and consistency in his words and actions, KH. Ahmad Dahlan succeeded in establishing a modern Islamic organization oriented

towards da'wah, humanity, and community service. His ideas remain relevant in fostering the welfare of the people today.

With the collection of these five figures, the use of barcode-based augmented reality (AR) technology is an innovation that provides an interactive and meaningful learning experience at the Indonesian Education Museum. This barcode not only displays visual representations of the five figures but also includes audio narration, allowing visitors to obtain comprehensive historical information in a more lively and contextual way. Research (Cliffe, 2024) confirms that historical objects enriched with sound can provide a new experience in understanding history. The barcode format is as follows.

Table 1. The results of Augmented Reality are in the form of barcodes in visual and audio form based on smartphones.

Character	Barcode	Results	
Sri Sulta HB IX			
Ki Ageng SUryomentaraman			
Ki Hajar Dewantara			

KH Ahmad Dahlan	KH Ahmad Dahlan KH Ahmad Dahlan		
Dr. Wahidin Soediro Hoesodo.	Dr. Wahidin Soediro Hoesodo Dr. Wahidin Soediro Hoesodo		

Augmented Reality (AR) technology uses barcodes representing five educational figures, complemented by visual and audio formats, and includes a syntax that can encompass four stages. The stages are:

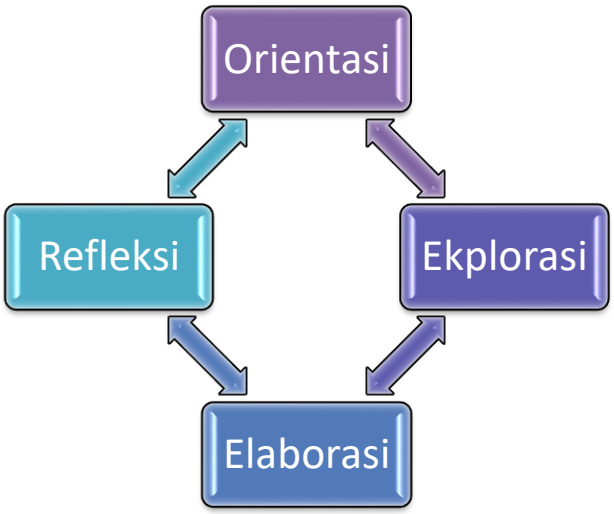


Figure 10. AR syntax flow for five figures

1. Orientation: an introduction to barcode users

The museum guide explains the purpose of the five educational figures, and visitors are given a brief explanation of how to use the device using a smartphone or tablet to scan the barcode.

2. Exploration: the barcode scanning process that results in the AR visualization of the figure appearing

Visitors are directed to scan the barcode on each figure using the provided device.

3. Elaboration: visitors listen to the historical narrative of the figure.

Each figure is accompanied by a short historical audio narrative (origins, struggles, and widows). The guide encourages visitors to listen.

4. Reflection: Visitors can share their understanding with the guide. The guide expresses appreciation and provides a summary of the figure's struggles as an example.

This structure suggests that the simultaneous use of visuals and audio supports deeper understanding through the dual coding theory mechanism, where verbal and nonverbal information are processed in parallel to enhance storage and recall (Paivio, 1971). Physical objects enriched with virtual audio can create new experiences in museum history curation [23]. [24]also revealed that AR applications in museums significantly increase learning motivation and the effectiveness of visitor experiences. The use of AR in museum educational content is designed to improve visitor understanding by inserting concrete visual and audio-based information, as stated in the abstraction hierarchy theory that bridges concrete experience and abstract understanding [25].

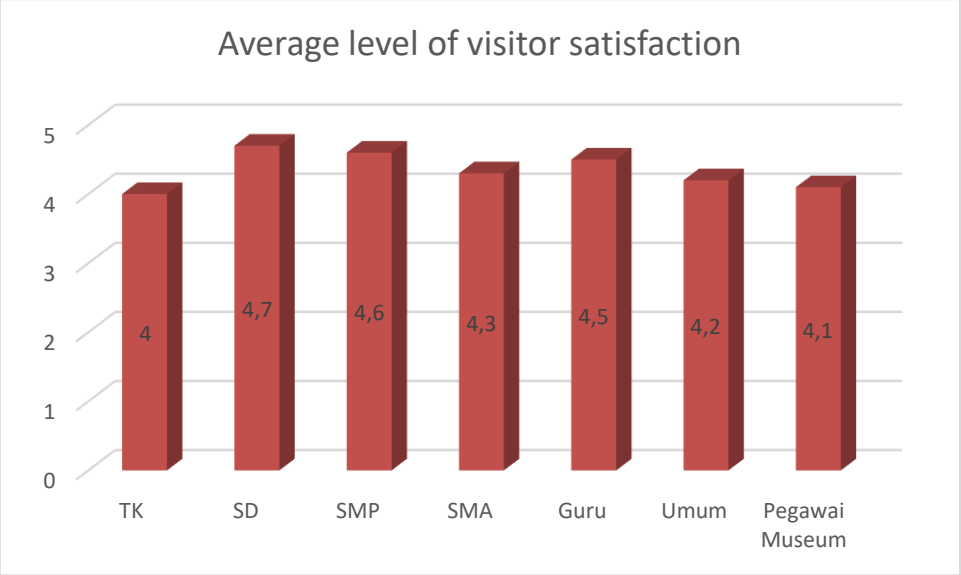


Figure 11.Visitor satisfaction graph

Based on the data obtained, visitor satisfaction with the use of audio and visual barcode-based Augmented Reality (AR) shows a very positive trend. Elementary and junior high school students had the highest satisfaction levels (4.7 and 4.6), respectively, as they felt helped in understanding history through interactive media. Kindergarten students showed moderate satisfaction (4.0), although their age limitations prevented their understanding from being optimal. High school students considered AR an interesting innovation (4.3), but some considered the content simplistic. Teachers (4.5) appreciated AR as a contextual learning medium, while general visitors (4.2) found it easier to understand history through interactive visualizations. Museum staff (4.1) considered AR effective as an educational tool, although they still required assistance. Overall, AR has been proven to enhance the history learning experience by presenting a more vivid and interactive narrative.

Results of a trial of barcode-based Augmented Reality (AR) with a collection of five figures showed high levels of satisfaction across various museum visitor categories. Elementary and junior high school students were the most satisfied, as the visual and audio content in AR increased learning motivation and facilitated comprehension. Meanwhile, high school visitors were also satisfied, although they tended to desire more in-depth information about the figures displayed. Teachers considered AR useful as a contextual and interactive learning tool, thus adding value to students' learning experiences outside the classroom. The general public and museum staff also expressed positive satisfaction, although they were more critical of technical aspects such as content accuracy, audio quality, and user comfort in the exhibition space. Kindergarten visitors, on the other hand, reported good satisfaction but required more guidance due to limitations in operating the technology. Overall, AR in museums has been shown to increase visitor satisfaction through interactivity, emotional engagement, and engaging information presentation. This aligns with findings [24]showing that AR in museums significantly increases motivation and learning effectiveness, as well as studies [26] that emphasize the importance of designing AR interfaces that meet the needs of various visitor segments.

Therefore, the use of audio and visual barcode-based augmented reality technology in the museum's collection of five historical figures has been shown to enhance the learning experience and satisfaction of visitors from various categories. This shows that digital innovation not only enriches educational media, but also strengthens the museum's function as an interactive learning space that is relevant to current developments.

CONCLUSION

The research results from this study in the form of digitizing the collection of 5 educational figures with AR based on sound and visual barcodes are proven in historical understanding, interactivity, and visitor satisfaction across categories. Then the Satulat MPI flow (pickup to the outdoor park) creates a more systematic, enjoyable, and memorable visiting experience. Both of these are ways to increase visitor attraction to visit MPI. The level of visitor satisfaction is in the high category, averaging more than 4.5 with the most positive responses from elementary and junior high school students. Teachers consider AR very relevant as a contextual learning tool, it makes the museum can be used as a learning resource. Meanwhile, general visitors and museum staff appreciate the innovation but remain critical of the technical aspects. Digital innovation strengthens the role of MPI UNY as a center for education, historical preservation, and educational tourism space that supports downstreaming of added value for higher education.

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Designing for Cultural Responsiveness: An Emergent Model Approach to Digital Mathematics Learning through Dynamic Ethno-Situation

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Abstract. This study aims to develop and evaluate a culturally responsive digital didactic design that integrates the Emergent Model and Dynamic Ethno-Situation frameworks to support students' transition from contextual reasoning to algebraic abstraction. Conducted with 30 seventh-grade students at SMPN 7 Cirebon, the research employed a design-based approach to test the effectiveness of the developed learning environment. The instructional sequence guided students through six stages of learning objectives, from understanding equality in simple linear equations to applying linear and inequality models in real-world contexts. Results show that the digital design effectively enhanced students' conceptual understanding, representational transition, and engagement, achieving an overall evaluation score above 85%. The Emergent Model process progressing from contextual situation, model of situation, model for mathematics, to formal mathematics enabled students to construct meaning through reflective modeling activities. The integration of dynamic cultural contexts within the digital environment fostered active participation and deeper reasoning. These findings suggest that combining Emergent Models with Dynamic Ethno-Situation provides a powerful foundation for culturally grounded digital mathematics learning that promotes abstraction through meaningful contextualization.

INTRODUCTION

The global shift toward digital learning has transformed how mathematics is taught and understood in contemporary classrooms. As technology becomes increasingly integrated into education, the demand for pedagogical approaches that are both adaptive and contextually grounded continues to grow (1,2). Digital learning environments promise flexibility and accessibility, yet many of them remain limited to procedural and decontextualized forms of mathematical instruction (3,4). These designs often privilege efficiency and standardization over meaning-making, leaving a gap between what students learn and how they experience mathematics in their everyday lives.

In this context, the need for culturally responsive and meaningful digital mathematics learning becomes urgent. Mathematics is not a culture-free domain; rather, it is shaped by language, symbols, and practices that reflect human experience (5,6). A truly adaptive digital pedagogy must therefore consider the cultural dimensions that influence how learners construct mathematical meaning (7–9). When digital environments neglect these dimensions, they risk alienating students whose ways of reasoning and understanding mathematics are deeply intertwined with their local and cultural contexts.

Conventional instructional designs in mathematics education often assume universality, adopting abstract and formal representations that are detached from students' sociocultural realities. This detachment can lead to cognitive and emotional dissonance, particularly for learners who engage with mathematics through contextual and experiential understanding (10–13). The challenge lies in creating digital learning designs that not only represent mathematical ideas accurately but also resonate with the students' cultural background and lived experiences.

Culturally grounded situations known as ethno-situations offer a promising way to bridge this divide. Rooted in the principles of ethnomathematics, ethno-situations bring local cultural practices, patterns, and artifacts into the mathematics classroom as sources of inquiry and reasoning (14–17). When designed dynamically within digital learning environments, these situations allow learners to explore mathematical structures that emerge from familiar contexts (18,19). This approach positions culture not as a backdrop but as a living, generative context for mathematical thought.

To make such learning effective, however, it is essential to guide students' transition from concrete cultural experiences toward more formal mathematical reasoning. The Emergent Model serves as a theoretical bridge for

this process (20–22). It supports the gradual evolution of students' understanding from contextual problem-solving to abstract representation by emphasizing the role of intermediate models that emerge from students' activity. Through this framework, learners are not merely receivers of mathematical knowledge but active constructors of meaning, capable of linking informal understanding with formal abstraction.

Integrating the Emergent Model with the Dynamic Ethno-Situation framework offers a powerful synergy. While the Emergent Model focuses on the cognitive trajectory of abstraction, the Dynamic Ethno-Situation situates this trajectory within a culturally meaningful and digitally interactive context (23–25). This integration allows digital learning environments to simulate cultural dynamics that evolve alongside learners' reasoning, making mathematical exploration both intellectually rigorous and culturally relevant.

A digitally and culturally responsive didactic design, therefore, must account for both the representational transitions that support abstraction and the cultural contexts that give mathematics its human meaning. Such a design moves beyond static, one-size-fits-all instruction to a more dialogical form of pedagogy one that invites students to engage with mathematical ideas through their lived cultural narratives (26). It embodies an educational vision where mathematics is experienced as a dynamic interplay between the universal and the local, the symbolic and the contextual.

This research aims to design a culturally responsive digital didactic framework that integrates the Emergent Model and Dynamic Ethno-Situation to enhance students' mathematical abstraction. By situating digital learning within meaningful cultural contexts and structuring representational transitions through emergent modeling, this study seeks to demonstrate how students can progress naturally from concrete, culturally embedded reasoning to symbolic mathematical understanding (27). Ultimately, the framework aspires to contribute to the development of digital mathematics education that is not only technologically innovative but also culturally and cognitively human-centered.

This study is grounded in two interrelated theoretical foundations: the Emergent Model and the Dynamic Ethno-Situation framework. The Emergent Model, adapted from Realistic Mathematics Education (RME), emphasizes the progressive abstraction of students' reasoning from concrete, context-based experiences to formal mathematical representations (28). It provides a pathway for learners to construct meaning through intermediate models that evolve naturally from their activity. This process enables students to connect intuitive understanding with symbolic reasoning, fostering a deeper conceptual grasp of mathematical structures.

The Dynamic Ethno-Situation framework complements this process by embedding mathematical exploration within culturally meaningful and adaptable contexts. It draws from ethnomathematical principles that recognize local culture as a source of mathematical thinking (29). When applied in a digital learning environment, the framework allows cultural situations to be simulated dynamically, providing students with interactive experiences that reflect real-world reasoning. Integrating both frameworks creates a didactic design that bridges culture and cognition, enabling digital mathematics learning to be both contextually relevant and intellectually rigorous.

METHOD

This study employed a Design Research approach framed within the principles of Didactical Engineering (30,31). The approach was chosen because it allows the iterative development, testing, and refinement of a didactical design grounded in both theoretical constructs and classroom realities. The research process consisted of three main stages: (1) Preliminary Design, (2) Experimentation (Implementation), and (3) Retrospective Analysis. Each stage was conducted to ensure coherence between the intended, implemented, and achieved learning situations.

During the Preliminary Design phase, a digital didactic framework integrating the Emergent Model and Dynamic Ethno-Situation was developed. The design was structured around the topic of linear equations and inequalities, focusing on students' transition from contextual reasoning to symbolic abstraction. In the Experimentation Phase, the digital learning design was implemented with 30 seventh-grade students at SMP Negeri 7 Kota Cirebon. The implementation aimed to explore how students interacted with the dynamic cultural context and how their mathematical abstraction emerged through digital simulation activities. The Retrospective Analysis then examined the data from classroom observations, students' digital task performances, and reflective interviews to evaluate the effectiveness, didactical coherence, and cultural responsiveness of the design.

RESULTS AND DISCUSSION

The implementation of the digital didactical design integrating the Emergent Model and Dynamic Ethno-Situation demonstrated promising results in enhancing students' mathematical abstraction. The learning activities, centered around culturally meaningful contexts such as tiling and spatial reasoning, effectively engaged students in constructing and representing mathematical ideas. Students' interactions during the digital simulation revealed a gradual shift from intuitive reasoning based on real-life contexts toward more formal symbolic expressions. This

progression aligns with the core function of the Emergent Model, where conceptual understanding evolves through intermediate models that bridge the gap between concrete experience and abstract representation.

1. Learning Objectives Flow

The learning flow presented above illustrates the progressive structure of the digital didactical design, integrating the Emergent Model and Dynamic Ethno-Situation frameworks. Each stage of learning is intentionally sequenced to guide students from contextual engagement to symbolic abstraction. The design begins with students' intuitive understanding of balance and equality (Stage 1) and gradually advances toward formal manipulation of linear equations and inequalities (Stages 3–5), before culminating in contextual applications and reflection (Stage 6). This progression reflects the fundamental principle of the Emergent Model, in which conceptual understanding develops through successive representational shifts.

TABLE 1. Learning Objectives Flow

Learning Stage	Learning Objectives (LO)	Activities / Indicators
Stage 1 – Concept of Linear Equations	Students understand the concept of equality and balance in linear equations.	Solving simple models; verifying correctness.
Stage 2 – Constructing One-Variable Linear Equations (OVLE) from Context	Students can transform contextual problems into one-variable linear equations.	Writing symbolic models from word problems.
Stage 3 – Solving OVLE	Students can determine the variable values that satisfy the equation.	Solving and verifying solutions.
Stage 4 – Concept of Linear Inequalities	Students understand the meaning of inequality and its representation.	Marking solutions on the number line.
Stage 5 – Constructing and Solving Linear Inequalities	Students can formulate and solve inequalities derived from contextual problems.	Determining the solution set.
Stage 6 – Application and Reflection	Students can apply equations and inequalities in real-world contexts.	Solving mixed problems and interpreting the meaning of solutions.

During implementation, the digital simulation supported students in visualizing equality and inequality through culturally familiar contexts. For instance, the use of tile-based ethno-situations allowed learners to construct mental models of mathematical balance using tangible, relatable representations. As they interacted with the simulation, students began to identify numerical relationships and express them symbolically indicating the emergence of algebraic reasoning. This transformation from concrete to abstract reasoning aligns with the Emergent Model's emphasis on bridging intuitive and formal thought.

Moreover, the integration of Dynamic Ethno-Situation elements ensured that students' learning remained culturally responsive and meaningful. Students reported that contextual problems grounded in local experiences made mathematics more understandable and engaging. This aligns with ethnomathematical principles that view cultural context as a valid source of mathematical reasoning (32,33). The dynamic nature of the digital tasks, where cultural situations were simulated interactively, helped sustain students' attention and fostered collaborative exploration.

Overall, the alignment between learning objectives (ATP), digital tasks, and theoretical frameworks resulted in coherent and effective learning processes. The sequencing of activities facilitated students' conceptual growth while preserving cultural relevance. The findings suggest that a well-structured digital didactical design grounded in both Emergent Model progression and Dynamic Ethno-Situation adaptability can effectively bridge the gap between contextual experience and symbolic abstraction in mathematics learning.

2. Emergent Models Framework

The diagram illustrates the development of Emergent Models as a layered process that bridges the gap between students' contextual experiences and formal mathematical understanding. The model is represented metaphorically as an iceberg, where learning begins from the visible, tangible context at the base and gradually progresses toward the abstract, symbolic representations above the surface. Each layer of the model signifies a distinct cognitive and representational shift that students undergo during mathematical learning.

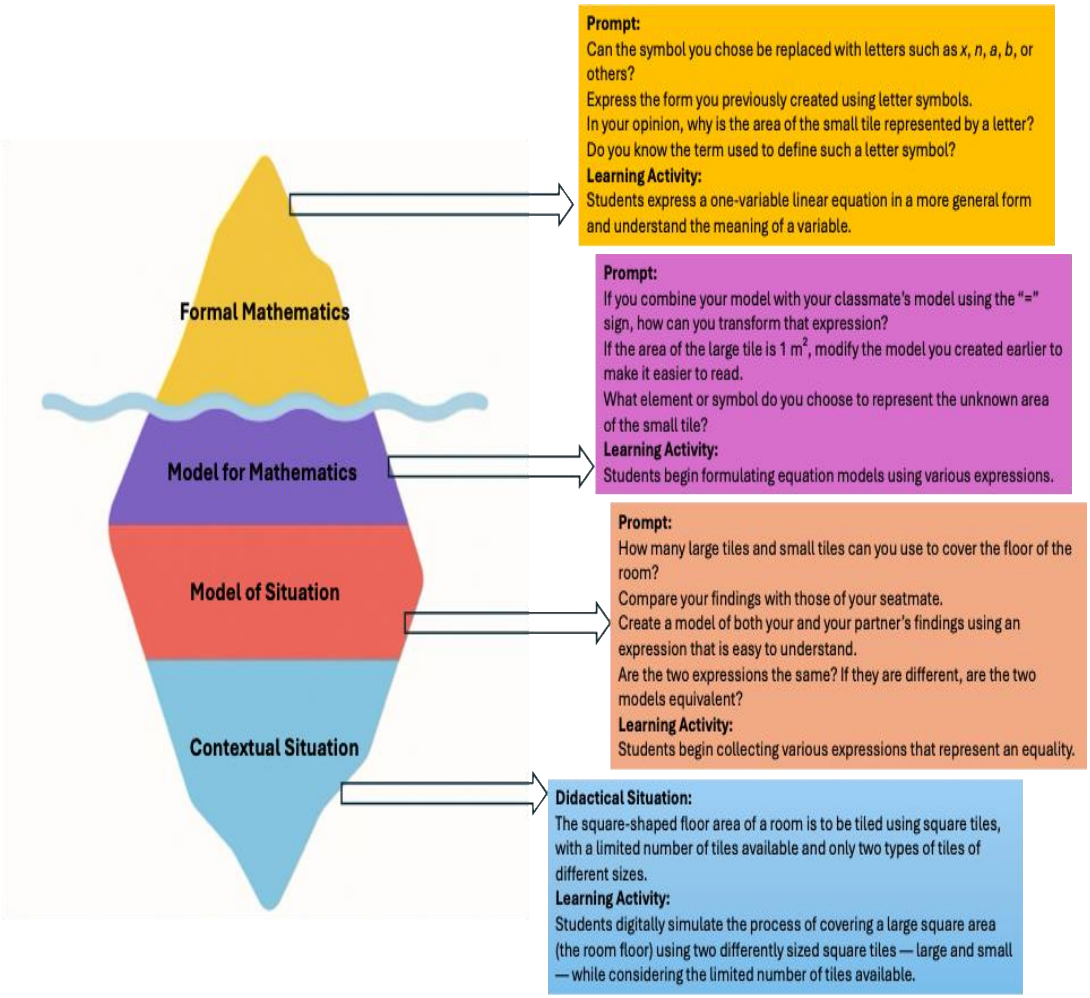

FIGURE 1. Emergent Models Framework

At the foundation lies the Contextual Situation, where students engage in meaningful and culturally grounded activities. In this design, learners explore a digital simulation of tiling a square-shaped floor using large and small tiles. Through this process, they encounter a real-world limitation finite quantity of tiles and begin to reason about area and equivalence (34). This stage situates mathematical ideas in familiar, concrete experiences, making learning accessible and meaningful.

Building on this foundation, students move into the Model of Situation, where their contextual understanding begins to stabilize into structured representations. Here, learners describe their actions and outcomes using informal quantitative expressions (e.g., "two large tiles equal three small tiles"). These expressions serve as early models that capture the relationships inherent in the contextual task without yet invoking formal symbolism.

The third layer, the Model for Mathematics, marks a critical transition from situational reasoning to symbolic abstraction. Students start combining their informal models, introducing operations such as addition or equality ("="), and identifying unknown quantities represented by symbols (35,36). Through prompts and guided interactions, they begin constructing equations that express balance and equivalence marking the emergence of algebraic thinking.

Finally, at the top of the iceberg lies Formal Mathematics, where learners express their models in generalized algebraic forms using variables such as x, a, or n. At this level, they understand that the symbols represent variable quantities that can take different values and can manipulate these equations according to established mathematical rules. This culminates in a formal understanding of linear equations, achieved through a gradual, meaning-oriented progression from context to abstraction.

Overall, this emergent pathway reflects the essence of the Emergent Model approach: mathematical understanding does not arise from direct instruction of formal symbols, but emerges naturally from students' engagement with contextual, meaningful activity (37). Each level of the model contextual situation, model of situation, model for mathematics, and formal mathematics functions as a bridge that preserves meaning while transforming representation. This ensures that students' abstract reasoning remains grounded in experience, supporting sustainable conceptual growth in learning algebra.

3. Overview of Evaluation Results

The evaluation results of the digital didactical design integrating the Emergent Model and Dynamic Ethno-Situation are presented in the following summary table:

TABLE 2. Learning Objectives Flow

Evaluation Aspect	Indicator Description	Mean Score (%)
Didactical Coherence	Alignment between intended, implemented, and achieved design	85%
Cultural Responsiveness	Relevance of ethno-situations to students' sociocultural context	88%
Student Engagement	Activeness, participation, and collaborative interaction	90%
Conceptual Understanding	Transition from contextual to symbolic reasoning	84%
Expert and Teacher Feedback	Practicality, clarity, and pedagogical feasibility	87%

The evaluation outcomes indicate that the integration of the Emergent Model and Dynamic Ethno-Situation effectively supports students' mathematical learning processes across cognitive and affective dimensions. The overall achievement level, reaching nearly 87%, reflects strong alignment between the theoretical intentions of the design and its practical realization in the classroom.

High scores in student engagement (90%) reveal that the use of dynamic cultural contexts encouraged active participation and meaningful collaboration among learners. Students interacted not only with the digital media but also with one another, negotiating interpretations of mathematical relationships within familiar, culturally inspired situations. This suggests that culturally grounded contexts can enhance students' motivation and ownership of learning, consistent with principles of culturally responsive pedagogy.

In terms of didactical coherence (85%) and conceptual understanding (84%), students showed noticeable progress in transitioning from concrete models such as tile arrangements in the digital simulation toward more abstract algebraic representations. Their ability to express contextual relationships symbolically indicates the successful operation of the Emergent Model as a cognitive bridge (38–40). This confirms that when contextualized meaning-making is supported by structured modeling, abstraction becomes a natural and integrated process.

Meanwhile, cultural responsiveness (88%) was reflected in students' recognition of the mathematical significance of familiar objects and practices. The digital ethno-situations allowed learners to perceive mathematics as part of their lived experience rather than an isolated subject. Expert and teacher feedback (87%) further validated the design's practicality and didactical soundness, highlighting its potential as a replicable framework for digital mathematics instruction that balances cultural relevance and conceptual rigor.

Overall, the results demonstrate that combining the Emergent Model with the Dynamic Ethno-Situation framework creates a powerful synergy between cognitive development and cultural contextualization (41,42). This approach not only enhances students' understanding of abstract mathematical concepts but also strengthens their connection to the sociocultural realities from which mathematical meaning emerges.

CONCLUSION

This study demonstrates how the integration of the Emergent Model framework with a digitally simulated didactical situation can effectively bridge students' transition from contextual reasoning to formal algebraic thinking. By grounding mathematical exploration in meaningful contexts—such as the tile arrangement task—students were able to construct, compare, and generalize models that gradually evolved into formal symbolic expressions.

The four-layer developmental trajectory from Contextual Situation, Model of Situation, Model for Mathematics, to Formal Mathematics illustrates how understanding emerges progressively rather than being imposed through direct instruction. Each stage supports students in internalizing relationships, developing representations, and articulating generalizations based on their own activity and reasoning.

The findings highlight that cultural and contextual grounding plays a crucial role in promoting conceptual understanding within digital environments. The combination of Emergent Models and Dynamic Ethno-Situation offers a promising framework for designing didactic experiences that are not only interactive and adaptive but also culturally responsive. Future research can expand this approach to other mathematical domains and explore its scalability across diverse learning settings.

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Modification of the Psychological Well-Being (PWB) Scale Based on Cultural Context for High School Students

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Abstract. This study aims to modify the Psychological Well-Being (PWB) scale to align with the cultural and educational context of Indonesian high school students. The modification addresses both academic and practical needs in assessing psychological well-being by adapting language, examples, and constructs to better reflect students' cultural values, social norms, and school environments. The revised scale retains six dimensions of PWB—self-acceptance, positive relations, personal growth, purpose in life, environmental mastery, and autonomy—while ensuring cultural sensitivity. A quantitative approach was employed to test the psychometric properties of the scale. Content validity was established through Aiken's V and Gregory's formula, confirming high relevance of the items. Construct validity was assessed using Confirmatory Factor Analysis (CFA), with alternative structures explored through Exploratory Factor Analysis (EFA) when required. Reliability testing demonstrated strong internal consistency, with Cronbach's alpha exceeding recommended thresholds across all dimensions. Findings indicate that the culturally modified PWB scale is both valid and reliable, providing a more accurate tool to measure students' psychological well-being. This instrument can support educators, counselors, and psychologists in identifying and fostering students' well-being within diverse school contexts. The study contributes to advancing culturally relevant psychological assessment in Indonesia and informs future interventions to promote students' mental health.

INTRODUCTION

Psychological Well-Being (PWB) is one of the core concepts in positive psychology, emphasizing individuals' psychological well-being. The concept was first developed by Carol D. Ryff, who identified six key dimensions of psychological well-being: self-acceptance, personal growth, positive relations with others, purpose in life, environmental mastery, and autonomy (Ryff, 1989). These six dimensions reflect a person's positive psychological functioning across various aspects of life. Among adolescents, particularly high school students, psychological well-being is a crucial factor influencing their academic, emotional, and social development.

Adolescence is characterized by various challenges, such as identity exploration, peer pressure, and adjustment to academic expectations. Therefore, measuring PWB among high school students requires adjustments to ensure relevance to their developmental context. However, most available PWB instruments have not fully addressed the specific needs and characteristics of Indonesian high school students. Cultural factors, educational environments, and distinct social norms necessitate instrument modification to produce more accurate results. Previous studies have demonstrated that adapting measurement tools into local contexts enhances their validity and reliability (Fadhil, 2021). Thus, this study focuses on modifying the PWB scale for high school students in Indonesia.

The modification aims to produce a scale that not only demonstrates strong content validity but also captures students' psychological well-being across multiple domains of life, including social relationships, academic achievement, and school environment management. The developed instrument is expected to be utilized by educators, counselors, and psychologists to identify and enhance students' psychological well-being. Furthermore, this study seeks to address both practical and academic needs in assessing adolescents' psychological well-being in Indonesia. By developing a culturally and contextually relevant scale, this research contributes to improving the quality of psychological interventions in schools [3].

LITERATURE

Psychological well-being (PWB) emphasizes how and why individuals live their lives in positive ways, including cognitive evaluations and affective reactions. This concept encompasses studies that explore various aspects such as happiness, satisfaction, morality, and positive affect. The fundamental aim of nations, societies, and individuals is to understand and acknowledge that human well-being is the foundation, premise, and essential condition for a healthy society, as well as for successful development and prosperity. Ryff defined psychological well-being as an intrinsic drive to explore one's full potential. this drive may lead individuals either to surrender to circumstances that lower their well-being or to strive toward improving their living conditions, thereby elevating their psychological well-being.

Individuals with high psychological well-being are characterized by life satisfaction, positive emotional states, resilience in facing negative experiences, positive relationships with others, self-determination without dependency, control over their environment, clear life goals, and continuous personal growth. Conversely, unhappy individuals are unable to foster collective well-being in society, which in turn hinders the creation of conditions necessary for others' well-being. Human well-being can thus be understood on two levels: internal (subjective) and external (objective). Ryff identified six dimensions of psychological well-being: self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth.

Self-acceptance reflects a fundamental aspect of mental health and personal maturity. High self-acceptance is associated with positive attitudes toward oneself, acknowledgment of strengths and weaknesses, and acceptance of past experiences. Low self-acceptance, on the other hand, often leads to dissatisfaction, disappointment with life, and a desire to be someone else. positive relations with others highlight the importance of empathy, trust, intimacy, and reciprocity in interpersonal relationships. High scores in this dimension are linked to warm, trusting, and empathetic relationships, whereas low scores suggest difficulties in forming meaningful connections. Autonomy represents the capacity for self-regulation, independence, and resistance to social pressures. Individuals with strong autonomy rely on personal standards rather than external validation, while low autonomy often correlates with conformity and dependence on others' judgments.

Environmental mastery refers to one's ability to shape or adapt to surroundings in meaningful ways, such as managing daily responsibilities, taking advantage of opportunities, and creating a supportive personal environment. purpose in life entails having clear goals and a sense of meaning that provides direction and fulfillment. High levels of purpose reflect optimism and motivation, while low levels suggest a lack of aspirations or meaningful direction. Personal growth emphasizes openness to new experiences, continual development, and realization of one's potential. Individuals high in this dimension perceive themselves as evolving and improving, whereas those low in personal growth often feel stagnant, bored, and unmotivated. together, these dimensions illustrate that psychological well-being is marked by the ability to accept oneself, maintain positive relationships, act autonomously, master environmental demands, pursue meaningful goals, and experience ongoing growth.

The Indonesian cultural context adds unique considerations to psychological well-being. cultural values influence the ways individuals experience, interpret, and express their well-being. Religion plays a significant role, shaping moral behavior and community responsibility. Education also presents challenges and opportunities, particularly in enhancing quality and integrating cultural values into learning. Social communication in the information age highlights the tension between globalization and cultural preservation. Furthermore, advancements in science, technology, and healthcare create new demands for adaptation, resilience, and mental health awareness. sources of values—ranging from social norms, religious teachings, laws, and knowledge—deeply shape indonesian adolescents' psychological experiences. schools, therefore, are not only agents of knowledge transfer but also institutions of social control and transformation, responsible for nurturing mental health, preserving cultural values, and promoting critical thinking and innovation.

State of the art: this research aims to modify the psychological well-being (pwb) scale to better suit the context of indonesian high school students. The modification considers cultural values, social norms, and educational settings, ensuring that the scale reflects the lived realities of adolescents in indonesia. Specifically, the adapted instrument focuses on ryff's six core dimensions—self-acceptance, positive relations, autonomy, environmental mastery, purpose in life, and personal growth—while embedding cultural sensitivity into each. ultimately, the goal is to produce a culturally relevant, standardized instrument that can serve both academic and practical purposes, enabling educators, counselors, and psychologists to more effectively assess and enhance students' psychological well-being.

RESEARCH METHOD

This study employs a quantitative research design aimed at modifying and validating the Psychological Well-Being (PWB) measurement instrument. The quantitative method is used to analyze data objectively, utilizing statistical techniques to evaluate the construct validity and reliability of the instrument. Convenience sampling is

applied to select the research participants. The study is conducted in four main stages. First, the PWB instrument is modified to ensure its relevance to the local context of high school students, including item revisions to enhance clarity and alignment with theoretical constructs. Second, content validity is tested using Aiken's V and Gregory's method, with assessments conducted by five expert judges. Third, the validated instrument is administered to high school students to collect empirical data. Finally, the data are analyzed using Confirmatory Factor Analysis (CFA) to test construct validity. If the CFA does not achieve acceptable fit indices, Exploratory Factor Analysis (EFA) will be applied to identify alternative factor structures. The reliability of the instrument is further assessed using Cronbach's alpha coefficient to evaluate internal consistency.

RESULTS AND DISCUSSION

Content validity was assessed by obtaining evaluations from five experts in educational psychology and guidance and counseling. The analysis using Aiken's V indicated that all PWB scale items scored between 0.75 and 0.92, exceeding the minimum threshold of 0.70. This confirms that all items are relevant to the PWB construct. Moreover, evaluation using Gregory's formula produced an expert agreement coefficient of 0.82, which falls into the high category. These findings demonstrate that the modified scale items are culturally appropriate for Indonesian high school students.

Construct validity was examined through Confirmatory Factor Analysis (CFA). The initial CFA results showed $\chi^2/df = 2.31$; CFI = 0.91; TLI = 0.90; and RMSEA = 0.056, all meeting good-fit criteria. However, several items had factor loadings below 0.50 and were subsequently removed. After eliminating four items, the final model retained six dimensions consistent with Ryff's theory and demonstrated good fit with the empirical data.

Reliability was assessed using Cronbach's alpha coefficient. The results indicated a total reliability score of 0.934, categorized as very high. Each dimension also demonstrated strong internal consistency, with alpha values ranging from 0.81 to 0.89, confirming the scale's reliability in measuring PWB among high school students.

Dimension	Items	Cronbach's Alpha	Category
Self-Acceptance	5	0.87	Reliable
Positive Relations	6	0.89	Reliable
Autonomy	4	0.83	Reliable
Environmental Mastery	4	0.81	Reliable
Purpose in Life	5	0.88	Reliable
Personal Growth	4	0.85	Reliable
Total	28	**0.934**	Very Reliable

Descriptive analysis was conducted on 412 high school students from Yogyakarta, Karanganyar, and Malang. The results showed that the overall mean score of PWB was high (M = 92.6; SD = 11.3). The highest dimension was positive relations with others (M = 16.4), while the lowest was autonomy (M = 12.1). Furthermore, urban students (Yogyakarta and Malang) reported higher PWB scores compared to students in semi-urban areas (Karanganyar).

Location	N	Mean Total PWB	Category
Yogyakarta	140	93.2	High
Malang	132	95.0	High
Karanganyar	140	89.7	Moderate–High

The findings demonstrate that the culturally adapted PWB scale for Indonesian high school students is both valid and reliable. Adjustments in language, context, and cultural values—such as the emphasis on social connectedness, gotong royong (mutual cooperation), and religiosity—make the instrument more accessible and relevant for the target population. The descriptive results highlight that social relations are the strongest dimension of students' well-being, consistent with the collectivist nature of Indonesian culture. Conversely, autonomy scored relatively lower, which aligns with Eastern cultural values that prioritize harmony and interdependence over individual independence.

The differences across regions indicate that social context and educational environments significantly influence students' PWB. Students in urban areas tend to benefit from greater access to educational resources, counseling services, and extracurricular opportunities, leading to higher levels of well-being compared to their semi-urban counterparts. Overall, this study successfully developed a culturally adapted PWB instrument suitable for educational contexts in Indonesia. The scale can serve as a foundation for counseling assessments, further research, and school policies related to student mental health.

CONCLUSION

Based on the findings and data analysis, it can be concluded that the culturally adapted Psychological Well-Being (PWB) scale is valid and reliable for use among Indonesian high school students. Content validity assessed by expert judgment yielded high coefficients, while construct validity tested through CFA confirmed a six-dimensional model consistent with Ryff's theoretical framework. The modified instrument demonstrated very high reliability, with a Cronbach's alpha coefficient of 0.934, indicating strong internal consistency across all dimensions. Descriptive analysis revealed that overall psychological well-being among students falls within the high category, with positive relations with others as the strongest dimension and autonomy as the weakest. The results emphasize the significant role of cultural factors in understanding and measuring psychological well-being. Collectivism, religiosity, and social relationships emerge as more salient aspects in the Indonesian student context compared to Western cultures. This instrument can serve as a practical tool for guidance and counseling teachers, school counselors, and researchers to assess students' PWB and provide a foundation for designing culturally appropriate interventions.

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Design of Game-Based IPS Learning Materials with A Deep Learning Approach Integrated with Field Activities to Develop Environmental Love Attitude in Elementary School Students

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Abstract. Human activities contribute significantly to the ongoing ecological crisis on Earth. Nevertheless, environmental issues have received insufficient attention in the curriculum and support teaching materials. This development research aims to produce Social Studies (IPS) e-learning material based on a game approach integrated with field activities and deep learning to foster environmental awareness among elementary school students. The study employed the ADDIE design model, consisting of the stages: analyze, design, develop, implement, and evaluate. The results show that the developed e-learning media passed validation by media experts with an assessment score of 88.3% ("Highly Feasible" category). The evaluated aspects included content suitability, clarity of language and instructions, and media attractiveness. Practitioner (teacher) validation obtained a score of 91% ("Highly Feasible" category). A one-to-one trial conducted at SDN Siraman 1 demonstrated that the Ecosystem Card Game was practical, engaging, and easy to implement in class. Students showed high enthusiasm, actively participated in discussions, and were able to understand ecosystem concepts contextually. Furthermore, a small-group trial at SDN Jambe yielded a practicality level of 90% ("Very Practical" category). Trials conducted in five schools indicated that the learning product achieved practicality scores ranging from 74% to 98.75%, all categorized as "Practical" to "Highly Practical."

INTRODUCTION

The Earth is currently experiencing an ecological crisis. This crisis includes air and water pollution, deforestation, fossil fuel extraction, overfishing, species extinction, rising global temperatures[1], climate change, ocean acidification, land degradation, and the loss of biodiversity[2]. This crisis has been recognized for many years by societies across different cultures and regions[3], [4], [5]. At the core of this crisis lies the rapidly changing global climate. A scientific consensus is that climate change results from human activities[6]. Numerous environmental problems continue to be triggered by the lack of human awareness and responsibility in protecting and preserving the environment.

The phenomena described above reinforce the importance of environmental education. Environmental education has a lifelong impact on humans [7], [8]. In this context, the most crucial period to develop environmental literacy [9] begins in early childhood. Positive childhood experiences in nature are associated with the emergence of environmental Concern and participation in pro-environmental behaviors in adulthood [10], [11]. Children's behavior toward the environment [12] has positive implications, such as ecological awareness

[13], environmental attitudes [7], environmental consciousness[14] [15], and connectedness with nature [16]. Environmental character education must instill Concern for the environment, particularly within the school environment. Character education is a deliberate effort to develop students' moral and ethical values.

Environmental education is defined as "an approach, a philosophy, a tool, and a profession" to create environmentally literate citizens capable of addressing issues of sustainability and resource management [17]. Play-based and nature-rich pedagogical approaches combining movement and social interaction are practical strategies to develop children's environmental literacy and their cognitive, social, and emotional competencies [18].

Social Studies (IPS) as an elementary school subject aims to shape students into effective citizens within various communities [19] However, environmental issues have received little emphasis [20] in the curriculum and supporting learning materials. Preliminary data from interviews with 13 elementary school teachers in Gunung Kidul Regency in January 2025 revealed several key findings. Most teachers believe that teaching environmental issues in social studies is important. However, they rarely do so due to the following challenges: (1) teachers feel uncomfortable preparing learning materials because of limited knowledge about environmental issues suitable for elementary students; and (2) the elementary school curriculum is already overloaded with content that does not focus on environmental topics.

The fifth-grade Social Studies topic that supports the implementation of Environmental Sustainability Education is "Humans, Places, and the Environment." The IPAS textbook published by the Ministry of Education and Culture [21] discusses this topic in Chapter 8, titled "My Beloved Earth, My Suffering Earth." The conceptual information provided includes Earth's changes, natural events, natural disasters, and environmental changes caused by humans. The factual information focuses on plastic waste accumulation and forest fires. Most of the student activities in this textbook are dominated by cognitive aspects. Learning activities designed in games and fieldwork are not yet available in the fifth-grade IPAS textbook published by Kemdikbud. Consequently, the learning process implemented by teachers and students has not yet adopted a deep learning approach characterized by being mindful, meaningful, and joyful.

Deep Learning (DL) is a practical approach to acquiring new knowledge [22]. DL involves understanding and connecting conceptual and procedural knowledge and the ability to apply conceptual knowledge in new contexts [23]. Thus, learning is expected to be applicable and beneficial in the students' lives.

LITERATURE REVIEW

A. E-Teaching Materials for Elementary School Social Studies

Teaching materials consist of content that students must learn in printed form and that teachers must facilitate to achieve learning objectives [24]. Teaching materials play an essential role as a guide for teachers in conducting learning activities [25] as an innovative tool that assists teachers [26], thereby making the learning process more effective [27] The use of appropriate teaching materials has a positive impact on improving students' learning abilities [28]. Therefore, teaching materials should be designed to meet students' needs.

Teachers can package teaching materials using technological tools in accordance with 21st-century developments. The material in teaching resources can be presented through digital devices [29]. E-learning materials are developed according to the characteristics of the instructional content, organized systematically, and can be actively utilized by students at their own pace and skill level[30]. The content of teaching materials may include text, images, graphics, animations, and videos that can be accessed anytime and anywhere through suitable learning simulations [31].

In the digital era, games also meet the needs of versatile learners[32]. Teachers can apply game-based learning because knowledge or concepts are integrated into the game, allowing learners to acquire relevant concepts or knowledge [33] naturally. Game-based learning can enhance knowledge of social issues, influence attitudes toward sustainable development and related subjects[32], [34], [35] increase motivation and facilitate various types of learning [33], and equip learners with complex interdisciplinary concepts and knowledge necessary for sustainable development practices [36], [37], [38]

B. Integrated Deep Learning Approach to Field Activities

Deep Learning (DL) is a practical approach to acquiring new knowledge [22]. DL involves understanding and connecting conceptual and procedural knowledge and the ability to apply conceptual knowledge in new contexts [23] Thus, learning is expected to be applicable and beneficial in students' lives. DL occurs when learners are challenged and motivated by real-world problems that require interdisciplinary knowledge through an inquiry-based learning approach [39].

One type of education currently receiving little attention in schools is outdoor experiential education. As exam-based accountability has become increasingly emphasized, there are fewer school opportunities for children to experience nature and actively participate in outdoor environmental science activities. Building learning experiences that move from the classroom to the field and then back to the classroom produces memorable, comprehensive, and long-term learning outcomes [40], [41], [42], [43]. Although this type of learning offers tremendous benefits for all students, it is particularly valuable for those who struggle with traditional school tasks or have developed apathy toward school and learning [40], [41].

C. Environmental Education and Elementary School Social Studies Education

A healthy, functioning, and resilient ecosystem is essential for all living beings, including humans [44][5] Protecting and restoring the global environment requires transformative changes in human production and consumption behaviors—changes that reflect individual choices and large-scale collective actions mediated by culture

Environmental education is "an approach, a philosophy, a tool, and a profession", aimed at creating environmentally literate citizens who can address issues of environmental and resource sustainability [45]. Through the development of attitudes, values, knowledge, dispositions, and skills for pro-environmental action, environmental education fosters engagement in enhancing the sustainability of human–nature interactions over time.

Environmental education is relevant throughout one's lifespan—from infancy to senior citizenship—across both formal and non-formal settings [46]. Lifelong engagement is crucial because scientific and social conditions surrounding environmental and sustainability issues are constantly changing. These shifts require continuous critical thinking, engagement, and decision-making as individuals and within communal contexts.

Human life cannot be separated from the Earth on which it exists. Humans are part of the Earth—a vast and dense web of matter constantly fluctuating and transforming. This web encompasses humans, animals, plants, other "living" beings, air, soil, water, and all other forms of matter. Humans depend on other parts of this website to obtain food and drink and provide clothing and shelter that protect their bodies. Thus, humanity cannot be separated from the Earth, as we continuously interact with the organisms and materials around and within us.

RESEARCH METHOD

This research and development (R&D) aims to produce a product in the form of game-based social studies e-teaching material with a DL approach integrated with field activities to foster an environmental attitude in elementary school students to support quality education from the aspects of validity, practicality, and effectiveness. The development procedure uses ADDIE, which consists of the following stages: Analyze, Design, Develop, Implement, and Evaluate. The prototype of the elementary school social studies e-teaching material, after being validated by experts and its feasibility is known, then the practicality of its content is tested by asking users (teachers and students) to provide quantitative and qualitative responses. The practicality test of the e-teaching material content is carried out at the development stage 3 times, namely one-to-one (1 teacher, six students), small group (1 teacher, 12 students), and field trial (1 teacher, 1 class of students) involving two schools.

RESULTS AND DISCUSSION

A. Results developing

The steps in developing a Game-Based Social Studies E-Learning Material with an Integrated Deep Learning Approach and Field Activities to Cultivate an Environmentally Friendly Attitude in Elementary School Students were carried out using the ADDIE (Analysis-Design-Develop-Implement-Evaluate) development model. The researcher only carried out the small group evaluation stage in this study. The ADDIE stages can be seen as follows:

1. Analysis Stage

Based on the interview results, the learning resources utilized in social studies lessons include government-issued textbooks as the primary source, supplemented with supplementary books and internet materials to enrich the learning content, including books on the students' environment, the internet, and Chromebooks. Teachers also create their own simple worksheets to suit students' needs better. They also utilize electronic media such as YouTube and PPT presentations to enhance understanding and deliver the material more engagingly. Teachers also link the material to the school environment as a contextual learning resource, such as the local ecosystem (limestone), and assign observation assignments at home so students learn directly from the real environment. The

learning resources needed include current learning resources (e-books, learning videos, learning apps, and concrete objects).

Evaluation results and teacher observations indicate that students' pro-environmental attitudes and actions are still low. Students often lack concern for environmental cleanliness, such as littering, and need constant reminders to maintain cleanliness. Although they understand basic rules, these habits have not yet become firmly embedded in their daily lives. However, in terms of social interaction, students are good at cooperating and helping each other, although initially they choose the same friends when working in groups. Through familiarization and guidance, students interact more openly with their peers. Students must be encouraged to explore the importance of environmental protection and concern for other humans.

2. Design Stage

The design of a game-based social studies e-teaching material using a deep learning approach integrated with field activities to foster environmental stewardship in elementary school students was developed based on needs analysis, resource availability, product development orientation, and product objectives. The e-teaching material refers to the Independent Curriculum's fifth-grade social studies learning outcomes. It is based on various relevant game-based field activities for implementation using a DL approach, as the latest curriculum currently being prepared by the government. The social studies e-teaching material to be developed will be an application that teachers can download and access via smartphone or PC. The details of the activities carried out in the design stage are:

a. Flowchart and storyboard creation

The storyboard designed as the basis for developing a game-based social studies e-teaching material using a deep learning approach integrated with field activities to foster environmental stewardship in elementary school students is as follows.

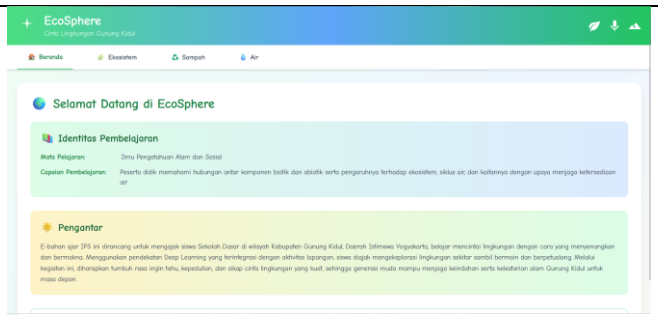
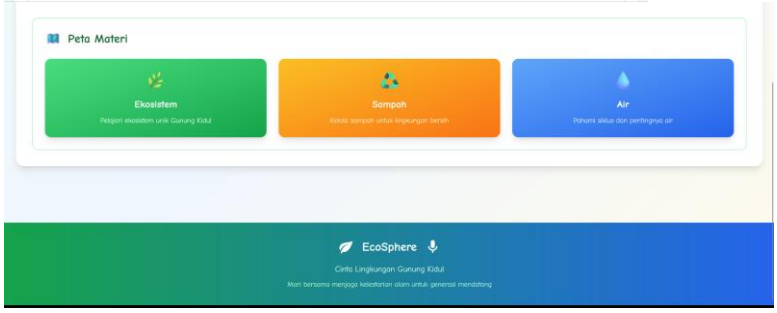
TABEL 1. Storyboard design

Design Section	Information
Website name	*EcoSphere*
Design style	Child-friendly, clean, natural. Use editable/ replaceable nature icons (leaves, water, mountains).
Main color	Light green, sky blue, earth brown.
Font	Simple and easy to read. The frame is inserted with a 4:6 image without overlay text.
Main Tab	Branda, Map of material “Ecosystem:, “Waste”, “Water”.

b. Web Design Creation

Creation of a web design for the development of game-based social studies e-teaching materials using a deep learning approach integrated with field activities to foster environmental awareness in elementary school students. The Ecosphere website appearance (https://hijaubumikita.my.canva.site/ecosphere1) is as follows.

TABEL 2. Web Design

Media Components	Picture	Information
Homepage		This page is the first one that will be displayed when a user accesses the EcoSphere website.
Material Map Page		This page contains material that supports the development of an attitude of love for the environment in social studies learning.

Interactive page		This page contains interactive game media.
LKPD		This page contains LKPD for each activity

3. Development Stage

The development stage aims to validate the developed learning tools. The advantages of this media include an attractive and consistent display design, with layout, colors, and icons that facilitate navigation. The flow of thought and activities is logically structured from simple to complex, helping students understand concepts in depth. Integrating games and field activities aligns with deep learning principles and fosters active student engagement. The language and activity instructions are clear, concise, and easy to understand.

Media expert validation was conducted to assess the appropriateness of the display, ease of use, and suitability of the game-based social studies e-learning materials design with a deep learning approach integrated with field activities. Based on the suggestions, revisions were made to improve the quality of the developed game-based social studies e-learning materials with a deep learning approach integrated with field activities to foster environmental awareness in elementary school students. The suggestions and input from the media experts are as follows.

TABEL 3. suggestions and input from the media experts

Suggestion	Follow-up
Learning objectives are not explicitly displayed at the beginning of the activity	Add clear learning objectives on the opening page of each activity so that students understand the direction of the activity.
The playing card size is too small and has not been adjusted for printing.	The card design is enlarged to the appropriate A4 proportions and is accompanied by a printable guide.
There is less material and activities on the topic of “garbage” than on other topics.	Adding explanatory content and reflective activities to the topic of “trash”

The assessment results of the media expert validation questionnaire related to game-based social studies e-teaching materials with a deep learning approach integrated with field activities to foster an environmental attitude in elementary school students contain 15 assessment items with a scale of 1–4, covering aspects of content suitability, clarity of language and instructions, and media appeal. Based on the assessment results by the validator, the e-teaching materials obtained a total score of 53 with a percentage range of 88.3% which is included in the "Very Appropriate" category, so that it can be used without significant revisions. The product has generally met the design principles of digital learning media that are attractive, interactive, and appropriate to the characteristics of fifth-grade elementary school students. Overall, the validation results show that the e-teaching materials are very suitable for use in the field trial stage, because they have met the aspects of content suitability, appearance, and function of practical and attractive learning media for students.

4. Implementation and Evaluation Stage

This stage assesses the effectiveness of the game-based social studies e-learning materials with a deep learning approach integrated with field activities on elementary school students' environmental attitudes. Practitioner validation aims to ensure no significant deficiencies in the game-based social studies e-learning materials with a deep learning approach integrated with field activities on elementary school students' environmental attitudes. Practitioner validation was conducted by soliciting teacher feedback on the media

after reviewing the e-learning material's web interface, particularly the interactive game section with the theme "Ecosystem." The discussion revealed that although the web interface structure was attractive and interactive, several aspects needed adjustments to make it easier for elementary school students to understand and use. The teacher's responses are as follows:

TABEL 4. Teacher's responses

Suggestion	Follow-up
The design of the ecosystem game card, which is considered to still need to be readjusted by clarifying the ecosystem illustration, increasing the text size, and simplifying the narrative content so that the information is easier to understand.	The card design has been recreated following the teacher's suggestions.
There is a more structured game guide, so that students can understand the flow and rules of the game without much help from the teacher.	Add a special page containing a guide to the game steps, examples of implementation, and an explanation of the learning objectives related to the activity.
The cards are made of ivory paper type 260 which is too thick, making it difficult for students to use in card games.	The card is designed with ivory type 210 material and laminated to make it more durable and easier to use in field activities.

The assessment results from the validation questionnaire by practitioners regarding the IPS e-learning material based on games with a deep learning approach integrated with field activities to foster elementary school students' environmental awareness consisted of 15 items and five respondents using a 1-4 scale. Based on the practitioners' assessment of the e-learning media, the total average score was 54.4 with a percentage range of 91%, which falls into the "Highly Feasible" category, making it usable without significant revisions. After making improvements based on practitioners' suggestions, a positive impact was observed on the functionality and attractiveness aspects of the media. The website interface became more communicative, while the ecosystem game is now easier for students to understand and operate independently. Adding a guide also strengthened the user experience element and ensured the integration between visual components, content, and field activities worked harmoniously.

Based on the observation results of the one-to-one product trial conducted at SDN Siraman 1 on Tuesday, September 30, 2025, involving four students and one teacher as a facilitator. The trial activity used a learning product in the form of an Ecosystem Card Game designed to strengthen students' understanding of the ecosystem concept, particularly the ecosystem in the Gunung Kidul area. During the gameplay, the classroom atmosphere appeared enjoyable and interactive. Students enthusiastically participated in the game, actively discussing and collaborating to determine the relationships between ecosystem components on the cards. The game rules were easy to understand, allowing the implementation to run smoothly without significant obstacles. In addition, the teacher played an active role in providing additional explanations and confirming the knowledge gained by students during the game, so the learning was not only focused on the fun of playing but also strengthened the conceptual aspects. Overall, this trial showed that the developed product and game were practical, engaging, easy to implement in the classroom, and capable of fostering cooperation and contextual understanding among students regarding the ecosystem in the Gunung Kidul environment.

The small group trial was conducted on Tuesday, September 30, 2025, at SD Negeri Jambe, Gunung Kidul District, Special Region of Yogyakarta. This trial aimed to obtain preliminary data on the comprehensibility, implementability, and practicality of the IPS e-learning material based on games with a deep learning approach integrated with field activities before a broader field trial. The activity was attended by 12 fifth-grade students and one classroom teacher. The learning topic tested was Waste Audit, one of the activities in the e-learning material designed to foster environmental awareness through observation, classification, and reflection activities on types of waste in the school environment.

The trial implementation ran smoothly and pleasantly. The teacher began the activity by introducing the importance of waste management and explaining the activity rules contained in the e-learning material. Students showed high enthusiasm, listened carefully to the explanations, and quickly understood the flow of activities and the field steps to be taken. During the activity, no significant obstacles were found regarding either the technical use of the e-learning material or the understanding of the learning concepts. Students conducted a waste audit around the school. Each group was assigned its respective audit area. They actively collected, sorted, and identified organic and inorganic waste according to the guidelines provided in the e-learning material.

The interaction among students showed good cooperation and mutual respect for roles within the group. Every group member was involved in discussions, completing worksheets in groups, and reflecting on the activity results. The teacher also played a role as a learning facilitator by providing scaffolding in the form of guiding questions and confirmations of the new knowledge gained by the students during the deep learning

process. Observation results showed that the waste audit activity encouraged students to connect their field experiences with the concepts of IPS resource and environmental management. It also fostered environmental awareness, which was reflected in their consciousness of maintaining cleanliness and correctly sorting waste.

Based on the results of the small group trial conducted on Tuesday, September 30, 2025, at SD Negeri Jambe, Gunung Kidul District, Yogyakarta, data were obtained from the practicality assessment of the product by 12 fifth-grade students regarding the IPS e-learning material based on games with the topic "Waste Audit." The assessment was conducted through a practical questionnaire comprising 15 statement items, covering aspects of comprehensibility, attractiveness, ease of use, and the product's usefulness in IPS learning. Each item was rated using a four-point scale. The recap of scores showed that the total score obtained was 649 out of a maximum score of 720, with a practical percentage of 90%. Based on the interpretation criteria of practicality, this result falls into the "Very Practical" category. In detail, individual student scores ranged from 44 to 60, with the highest score achieved by A (60) and the lowest by SP (44). Despite the variation in student scores, all responses showed a positive tendency toward ease of use and the appeal of the e-learning material. Students stated that the visual appearance, game flow, and field activities in the Waste Audit topic were easy to understand and engaging. In addition, the deep learning activities packaged as games and field observations encouraged students to actively discuss, collaborate, and apply IPS knowledge in real-life contexts. No significant difficulties were found in using the product or following the game instructions.

Subsequently, after obtaining student responses during the small group stage, the next stage was the Field Trial conducted in class VB of SD Negeri Wonosari. The results of the practicality assessment by 28 students toward the product "Kutu Sampah" showed a high level of practicality. The total score obtained was 1,382 out of a maximum score of 1,680, with a practical percentage of 82%, which falls into the "Very Practical" category. This assessment included 15 statement items with a scoring range of 1–4, reflecting aspects such as clarity of instructions, ease of use, visual appeal, meaningfulness of activities, and learning benefits.

Further analysis showed that the highest score given by students was 59, while the lowest score was 38. The average score obtained by students was 49.36, or approximately 82% of the maximum individual score (60 points). The score distribution indicated that most students gave ratings in the 45–55 range, reflecting a positive perception of the learning product. Only a small number of students gave scores below 40, and no students gave scores in the low category.

The Field Trial stage was also carried out in class VC of SD Negeri Wonosari. The results of the practicality assessment by 27 students toward the product "River" showed excellent outcomes. Out of the maximum total score of 1,620, a total score of 1,364 was obtained, with a practical percentage of 84%, which falls into the "Very Practical" category. The analysis showed that the highest student score was 60, while the lowest was 40, with an average score of 50.52 or around 84% of the maximum individual score (60 points). Most students gave scores in the range of 45–55, indicating consistently positive perceptions toward the learning product. Only a few students scored below 45; no scores were categorized as low or impractical.

Based on the overall results of the practicality trials of the IPS game-based learning product conducted in five elementary schools in Gunungkidul Regency, involving a total of 89 students, it can be concluded that the developed learning product shows a very high level of practicality across various trial contexts (one-to-one, small group, and field trial). The percentage of practicality scores ranged from 74% to 98.75%, with most results falling into the "Very Practical" category.

The Ecosystem Card Game product obtained the highest practicality percentage (98.75%) during the one-to-one stage, followed by the Waste Audit topic (90%) and the Water Cycle topic (74%) in the small group stage, as well as the Kutu Sampah (82%) and River (84%) topics during the field trial stage. Students' scores were generally spread in the medium to high range, with the majority falling between 45 and 60 points out of a maximum score of 60. These results indicate that the product is easy to use, engaging, contextually relevant, and supports active learning activities.

B. Discussion and Findings

Report states that Indonesia has the highest rate of deforestation in the world [47]. In the same report, it was also revealed that Indonesia ranks 112 out of 178 surveyed countries. This shows that not everyone has the same concern for environmental sustainability. According to [13], a relationship exists between developing pro-environmental attitudes in adulthood and memories of childhood experiences that often-involved nature. The analysis in the study shows that environmental concern in adulthood serves as a mediator between childhood experiences with nature and pro-environmental behaviors in adulthood, such as recycling, saving water, and other environmental activities. Therefore, fostering environmental awareness among elementary school students is very important, as environmentally conscious behaviors and character will have long-term impacts.

Technological development influences learning media development, including computer-based learning media (Computer-Based Media). Computer media are attractive and even interactive. Learning through

computer media equips individuals with various characteristics that form the strengths and weaknesses of how the media work to package information, from how messages are interpreted in programs or media packaging, to how people receive education. These media have the potential to capitalize on their strengths in conveying messages and delivering information. This is known as interactive and multimedia, where media capable of handling user interactivity is called interactive (interactive multimedia), or also referred to as linear multimedia. In many applications, users can choose what to do next, ask questions, and receive answers that influence the computer's next steps. Each interactive option can be created with multimedia software.

A study by [48] developed Character-Based Interactive Multimedia on "Our Environment Friends" for Theme 8, Sub-theme 1, for Grade V students at SD Negeri Kepatihan. The results of this study showed that interactive multimedia was feasible to use. Additionally, research conducted by [49]on the development of video-based interactive learning multimedia about patriotism and environmental concern showed that the media developed effectively increased students' patriotism and environmental concern, as evidenced by comparisons with groups that did not use the media.

CONCLUSION

This study uses the ADDIE design, which consists of analysis, design, development, implementation, and evaluation stages. The developed e-learning material media has been validated by media experts with an assessment result of 88.3% (category "Very Appropriate"). Aspects assessed include the suitability of the content, clarity of language and instructions, and media appeal. The results of practitioner (teacher) validation showed a percentage of 91% (category "Very Appropriate"). One-to-one trials at SDN Siraman 1 showed that the Ecosystem Card game was practical, interesting, and easy to implement in the classroom. Students showed high enthusiasm, actively discussed, and understood the concept of ecosystems contextually. Furthermore, small group trials at SDN Jambe resulted in a practicality level of 90% (category "Very Practical"). The results of trials in five schools showed that the learning product had a practicality range of 74%–98.75%, all of which were in the "Practical" to "Very Practical" categories.

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Validity and Reliability of The Hand-Eye Coordination Test Tool Based on Sensing Gloves Hand Eye Coordination

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Abstract. Hand-eye coordination is the ability to integrate visual information with hand movements, which is essential in various human activities, including sports, arts, and daily tasks. This study aims to test the validity and reliability of a technology-based hand-eye coordination test tool called "sensing gloves hand-eye coordination," which can provide more accurate, efficient, and practical measurements compared to conventional methods. In the context of sports, measuring hand-eye coordination is important for assessing and improving athlete performance. Conventional methods, such as tennis ball catch tests, are often used to measure this ability. However, these methods have limitations in terms of measurement accuracy and efficiency of implementation. Previous research has shown efforts to integrate technology into coordination measurement. For example, the development of a switch-based agility test instrument that utilizes microcontrollers to improve measurement accuracy and efficiency. The results of this study indicate that technology-based instruments can provide more accurate and practical results compared to conventional methods. Although efforts have been made to develop technology-based measurement instruments, there is still a need for instruments that are specifically designed to measure hand-eye coordination more accurately and efficiently. The method used is quantitative descriptive, and the data obtained is then analyzed using a validity test approach using the Pearson Correlation formula, as well as a reliability test using Cronbach Alpha. The results of this analysis will produce outputs, one of which is in the form of a scientific article published in a reputable journal. This is in line with the research TKT, namely TKT 2, which seeks to formulate a concept and apply it, in this case in the form of a technology-based eye-hand coordination test tool called "Sensing Gloves Hand-Eye Coordination."
Keywords: Validity, Reliability, Hand-Eye Coordination, Sensing, Gloves

INTRODUCTION

Hand-eye coordination is the ability to integrate visual information with hand movements, which is essential in various human activities, including sports, arts, and daily tasks. This ability allows a person to perform tasks with precision and efficiency, such as catching a ball, writing, or operating equipment. In the context of sports, measuring hand-eye coordination is important for assessing and improving an athlete's performance. Hand-eye coordination tests help assess a person's fine and gross motor skills. For example, in sports such as petanque, good hand-eye coordination contributes significantly to throwing accuracy. Research shows that hand-eye coordination contributes 54.61% to the success of shooting in petanque (Nurfatoni & Hanief, 2020). By conducting this test, coaches or therapists can identify areas that need improvement, so that training or rehabilitation programs can be tailored to optimize individual performance. For example, in table tennis, the right training methods and good hand-eye coordination can improve the accuracy of forehand sidespin serves. Safari & Saptani (2019) state that distributed practice training methods are more effective for athletes with high levels of coordination in improving this accuracy. Good hand-eye coordination is often a key indicator in predicting athletic performance, especially in sports that require high precision. Research on woodball athletes shows that hand-eye coordination and concentration together contribute 71.6% to the accuracy of short-distance shots (Murdaningsih & Rahayu, 2022). Conventional methods, such as tennis ball catch-and-throw tests, are often used to measure this ability. However, these methods have limitations in terms of measurement accuracy and efficiency of implementation. With the development of technology, there is a need to develop measurement instruments that are more accurate, efficient, and technology-based.

Technology plays an important role in sports testing and measurement, especially in improving the accuracy and efficiency of data collection. For example, in the development of technology-based agility testing instruments, it was found that current technology systems contribute to the implementation of sports testing and measurement systems and affect the accuracy of the information provided (Sari, 2021). Previous studies have shown efforts to integrate technology into coordination measurement. For example, the development of switch-based agility testing

instruments that utilize microcontrollers to improve the accuracy and efficiency of measurement. The results of this study indicate that technology-based instruments can provide more accurate and practical results than conventional methods (Permatasari et al., 2016). In addition, other studies have developed microcontroller-based reaction time measurement tools designed to measure the speed of hand reactions to visual stimuli. This tool uses several push buttons equipped with LED lights as stimuli, which are then processed by a microcontroller and displayed on an LCD screen. The results of the study show that this tool is effective in measuring reaction time with high accuracy.

The use of Android-based applications in volleyball passing tests shows that technology using Android, especially in volleyball passing tests, is very important because the new technology that will be used in volleyball passing tests can present passing results with valid data and immediately store and assess passing results (Destriana et al., 2023). Thus, the integration of technology in sports testing and measurement not only improves accuracy and efficiency but also ensures the validity of the data obtained. Although there have been efforts to develop technology-based measurement instruments, there is still a need for instruments specifically designed to measure hand-eye coordination more accurately and efficiently. Therefore, this study aims to examine the validity and reliability of the technology-based eye-hand coordination test tool "sening gloves hand-eye coordination" that was created in previous research so that it can provide a more accurate, efficient, and practical measurement/test process and results compared to conventional methods.

METHODS

This type of research is quantitative descriptive using a cross-sectional method. A cross-sectional design is used, in which data from two instruments (a new instrument and a standard instrument) are collected at the same time from the same sample. The new instrument is tested to determine whether the results are consistent with the standardized measuring tool. The sample in this study was determined using saturated sampling, which is done when the entire population is used as the sample. Therefore, the sample used in this study consisted of all athletes training at the Sleman District Training Center for floor gymnastics, totaling 32 athletes. Instruments are tools used during research to collect data with the aim of measuring research data results systematically (Sugiono, 2014). The measurement instruments used were anthropometric tests using conventional tools and sensing gloves tools to measure height, weight, sitting height, and arm length. The results of the two tests were then compared to see if there were significant differences. The data analysis will be conducted using SPSS Version 26, and then the concurrent validity of the two types of anthropometric measurements will be examined.

RESULTS AND DISCUSSION

RESULTS

The data obtained were processed using the SPSS version 26 program. The description of the research data is as follows:

A. Results of Eye-Hand Coordination Measurement Analysis

Table 1. Normality Test of Eye-Hand Coordination Measurement

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Conventional	.134	32	.157	.963	32	.336
Sensing Gloves	.136	32	.139	.961	32	.301
a. Lilliefors Significance Correction						

Based on the data above, it is known that the normality test value for the conventional measurement method is 0.157 and the sensing gl;oves is 0.139, which means> 0.05 so that it can be said that the results of measuring sitting height are normally distributed, so it is recommended to do a parametric test.

Table 2. Homogenity Test of Eye-Hand Coordination Measurement

Test of Homogeneity of Variance				
	Levene Statistic	df1	df2	Sig.

Hasil	Based on Mean	.002	1	62	.965
	Based on Median	.008	1	62	.927
	Based on Median and with adjusted df	.008	1	61.998	.927
	Based on trimmed mean	.001	1	62	.975

Based on the data above, it is known that the homogeneity test value is 0.965 which means > 0.05 so it can be said that the results of weight measurement are homogeneous, so it is recommended to do parametric tests.

Table 3. Independent Sample T Test of Eye-Hand Coordination Measurement

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil	Equal variances assumed	.002	.965	-2.946	62	.005	-3.06250	1.03939	-5.14021	-.98479
	Equal variances not assumed			-2.946	61.970	.005	-3.06250	1.03939	-5.14023	-.98477

Based on the previous normality test and homogeneity test, it is known that the data is normally distributed and homogeneous, so it is advisable to know the significance value between the two measurement methods, namely conventional measurement and sensing gloves measurement using an independent sample t test approach. The result obtained is 0.005 which means < 0.05, it can be explained that there is no significant difference between the results of anthropometric measurements using conventional methods and sensing gloves methods.

DISCUSSION

This study aims to analyze the differences in the effectiveness of measuring hand-eye coordination using two methods, namely the conventional method and the sensing gloves-based method. Data analysis was performed using SPSS version 26 to provide a more valid picture of data distribution, variance homogeneity, and the significance of differences between the two groups. The results of this test provide a strong basis for determining whether the newly developed method can be used as a reliable alternative to the conventional method.

Normality tests were conducted to ensure that the data obtained from both research groups were normally distributed so that the selection of parametric tests could be justified. Based on the Kolmogorov-Smirnov and Shapiro-Wilk results, the significance values for the conventional method are 0.157 and 0.336, while for the sensing gloves they are 0.139 and 0.301. All of these values are greater than 0.05, which indicates that the data in both groups are normally distributed. Thus, the data meet the basic assumptions for the use of parametric tests.

In addition to data distribution, variance homogeneity also needs to be tested to ensure similarity of variance between groups. Levene's test shows that the significance value obtained is 0.965, which is greater than 0.05. This result proves that the data of the two groups is homogeneous, or in other words, the variation in values between the conventional method and the sensing gloves is not significantly different. This condition confirms that the data is suitable for analysis using the independent sample t-test.

The next step is to test the hypothesis using an independent sample t-test. This test is used to determine whether there is a significant difference or no significant difference between the results of eye-hand coordination measurements using the conventional method and sensing gloves. The analysis results show a significance value of 0.005, which is less than 0.05. Thus, it can be concluded that there is no significant difference between the two measurement methods.

The absence of significant differences indicates that the use of sensing gloves provides measurement results that are as accurate as conventional methods. A mean difference of -3.06 shows that the average measurement results with sensing gloves are lower than those obtained with conventional methods. These results need to be interpreted carefully, whether they reflect the weaknesses of the new method or actually indicate higher accuracy in detecting variations in eye-hand coordination. In general, it can be seen that sensing gloves provide results that are as accurate as conventional methods but are superior in terms of measurement effectiveness.

From a validity perspective, sensing gloves can be considered superior in capturing complex coordination dynamics, especially in sports that require high speed and precision such as badminton, tennis, or other small ball sports. However, the disadvantages of this method are the higher cost and the need for special technological devices, which may be an obstacle to large-scale implementation.

These findings also indicate the need for further research. The reliability and external validity of sensing gloves need to be tested by comparing them with other standard instruments or with motion capture-based biomechanical methods. Thus, the significant differences found in this study should not be viewed as weaknesses, but rather as opportunities for innovation in the development of more precise coordination measurement instruments.

The results of this study have practical implications for the world of sports, physical education, and scientific research. For coaches, the use of sensing gloves can be an additional tool to monitor athletes' progress more objectively. For researchers, the significant differences found can encourage further study on how this new technology can be integrated into motor performance measurement. Meanwhile, for teachers, the results of this study can be used as material for critical discussion regarding the adaptation of technology in motor skill evaluation.

Overall, the statistical analysis results show that although the data of both groups are normally distributed and homogeneous, there is no significant difference between the measurement results of the conventional method and the sensing gloves. This similarity can be interpreted as an indication of the superiority of technology-based methods that are sensitive and accurate, although further study is needed to ensure their reliability and efficiency. Thus, this study emphasizes the importance of evaluating new instruments before they are widely adopted in the fields of sports and physical education.

CONCLUSION

The results of the study show that eye-hand coordination measurements using conventional methods and sensing gloves both meet basic statistical assumptions (normal distribution and homogeneity), but produce statistically significant differences (p=0.005), with the average sensing glove score being lower than that of the conventional method. This difference indicates that sensing gloves have a higher level of sensitivity in detecting movement details that are not always captured through manual measurements, thus tending to provide more rigorous and objective results. These findings confirm that the use of technology in motor skill evaluation, particularly through sensing gloves, can provide a new, more accurate and relevant perspective for the development of sports science, although its implementation needs to consider aspects of cost, availability, and the broader validity and reliability of the instrument. Thus, this study not only shows fundamental differences between methods but also opens up great opportunities to integrate modern technology into the process of evaluating athlete performance, while emphasizing the importance of further research so that sensing gloves can be used effectively, efficiently, and consistently in various sports contexts.

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DIFFERENCES IN THE EFFECTS OF NUTRITIONAL THERAPY AND WEIGHT TRAINING ON WEIGHT REDUCTION, REDUCTION IN MAXIMUM HEART RATE (FHR) AND WORK EFFECTIVENESS OF TEACHING STAFF AT THE FACULTY OF VOCATIONAL SCHOOL YOGYAKARTA STAE UNIVERSITY

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Abstract. Obesity and overweight are global health problems affecting cardiovascular health and work effectiveness. This study aimed to compare the effects of nutrition therapy and resistance training on weight reduction, resting heart rate, and work effectiveness among lecturers of the Faculty of Vocational Studies, Yogyakarta State University. This experimental research employed a pretest–posttest control group design with 40 participants randomly assigned into two groups: nutrition therapy (n=20) and resistance training (n=20). Interventions lasted three months. Results revealed that both interventions significantly reduced body weight, lowered resting heart rate, and improved work effectiveness ($p<0.05$). The nutrition therapy group showed greater weight loss (4.05 kg) compared to the resistance training group (2.95 kg), while resistance training produced more consistent improvements in heart rate. It can be concluded that combining nutrition therapy and resistance training is an optimal strategy for managing health and productivity in lecturers.

Keywords: Nutritional Therapy, Resistance Training, Weight Loss, Resting Heart Rate Reduction, Maximum Heart Rate, Work Effectiveness

INTRODUCTION

Obesity and being overweight are two conditions of excess weight with different causes. Obesity occurs due to an increase in the amount of body fat, while being overweight can be caused by fat accumulation, increased muscle mass, heavier bones, or fluid retention (Sumarni & Bangkele, 2023). Both conditions increase the risk of metabolic diseases and impact work productivity.

The prevalence of obesity continues to increase globally, including in Indonesia. Data from the Basic Health Research (Riskesdas) (2018) recorded that 21.8% of adults were obese, a significant increase compared to 15.4% in 2013. Obesity is a major risk factor for heart disease due to narrowing of the coronary arteries and contributes to hypertension through increased cardiac output (Arnisam & Wagustina, 2019; Tiara, 2020). Furthermore, obesity triggers metabolic disorders, such as increased triglycerides, decreased HDL cholesterol, and the risk of other chronic diseases, which ultimately reduce work effectiveness (Ministry of Health, 2018).

Weight loss can be achieved through nutritional interventions and physical activity. Nutritional therapy based on a healthy calorie deficit, high in protein, and rich in fiber can increase the Thermic Effect of Food (TEF), thus optimizing calorie burning (Halim et al., 2019). Meanwhile, weight training, especially when combined with High-Intensity Interval Training (HIIT), effectively increases basal metabolism, cardiovascular fitness, and heart function. The combination of nutrition and weight training can also improve sleep quality, reduce stress, and enhance concentration, all of which contribute to the effectiveness of teachers' energy work (Filippou et al., 2020). Therefore, this study is important to compare the effects of nutritional

therapy and weight training on weight loss, maximal heart rate measurements, and the work effectiveness of teaching staff at the Faculty of Vocational Studies, Yogyakarta State University (YSU).

RESEARCH METHODS

This study used a pretest–posttest control group experimental design. The subjects were 40 lecturers at the Faculty of Vocational Studies, Yogyakarta State University (UNY) with a BMI above normal. Respondents were selected based on the following inclusion criteria: age 30–50 years, no chronic diseases, and willingness to participate in the intervention. They were randomly divided into two groups: nutrition therapy (n=20) and weight training (n=20). The nutrition group underwent a personalized calorie deficit diet program, high in protein, fiber, and healthy fats. Evaluations were conducted weekly by a nutrition counselor. The weight training group followed a structured exercise program three times per week for 60 minutes per session, including strength and endurance training.

The research instruments included digital scales, heart rate monitors, and a valid and reliable work effectiveness questionnaire. Data analysis used the Kolmogorov–Smirnov normality test, paired t-test, unpaired t-test, and Mann–Whitney for non-parametric data. Significance was set at $p<0.05$.

RESULTS

1. Body Weight Comparison

   Descriptively, the nutrition therapy group showed greater weight loss than the weight training group. The average weight loss in the nutrition therapy group was 4.05 kg, while the weight training group lost 2.95 kg. Similar results were seen for Body Mass Index (BMI) and hip circumference, with the nutrition therapy group showing greater changes. However, this comparison is still descriptive in nature and requires statistical tests to confirm significance.
2. Maximum Heart Rate (MHR) Comparison

   Based on the Mann-Whitney test, the group exercise burden show difference significant in part big variables (P1–P8, $p<0.05$), although No significant at P9 and P10. Group therapy nutrition is also significant throughout variable ($p=0.000$). However , the exercise burden assessed more effective Because own influence which are more consistent and comprehensive compared to Group Nutritional Therapy .
3. Comparison of Work Effectiveness

   Both groups demonstrated significant results in improving work effectiveness. However, most variables in the nutrition therapy group had smaller p-values than those in the weight training group. A smaller p-value indicates stronger evidence, even though both interventions were statistically significant.

DISCUSSION

1. The Effect of Nutritional Therapy on Weight Loss

The nutrition therapy group showed greater weight loss than the weight training group. This can be explained by the physiological mechanism that a healthy energy-deficit diet can induce a decrease in body fat mass. High protein intake increases the Thermic Effect of Food (TEF) by 15–30%, meaning the body burns more energy to digest and metabolize protein compared to other macronutrients. Furthermore, protein and fiber have an appetite-suppressing effect through the regulation of the hormones leptin and ghrelin, thereby reducing daily calorie intake (Halim et al., 2019; Indriyani et al., 2024).

The findings of this study align with those of Halim et al. (2019), which reported that intensive clinical nutrition interventions can reduce weight and improve body composition in overweight/obese adolescents. Similarly, a systematic review by Indriyani et al. (2024) confirmed that both low-carbohydrate and low-fat diets can reduce weight if adherence and energy deficit are maintained. Thus, empirical evidence supports the effectiveness of nutrition therapy in significantly reducing weight.

2. The Effect of Weight Training on Weight Loss

Weight training is also effective for weight loss, although not as effective as nutritional therapy. It increases muscle mass (muscle hypertrophy), which results in increased basal metabolic rate and excess post-exercise oxygen consumption (EPOC).

Research by Afgenesya et al. (2024) demonstrated that weight training effectively reduces body fat, while Nasrulloh et al. (2022) found that compound set weight training increased muscle strength and endurance. Therefore, despite lower weight loss rates, weight training is beneficial in the long term by improving body proportions.

3. The Effect of Nutritional Therapy on Resting Heart Rate

Weight loss through nutritional therapy contributes to a reduction in resting heart rate (RHR). Physiologically, reduced body mass decreases the heart's workload, increases pumping efficiency, and reduces vascular resistance. A balanced diet, particularly the DASH (Dietary Approaches to Stop Hypertension) plan, has been shown to lower blood pressure and improve cardiovascular function (Filippou et al., 2020).

This research supports the theory that while maximal heart rate (MRR) is more influenced by age and genetics, the MRR is more responsive to lifestyle changes. By reducing weight through nutritional therapy, the heart doesn't have to work as hard to pump blood, resulting in a lower resting heart rate.

4. Effect of Weight Training on Resting Heart Rate

Weight training also lowers RHR by increasing stroke volume and cardiac contraction efficiency, although the effects are more moderate than those of aerobic exercise. A study by Irawan et al. (2020) showed that regular physical exercise lowers resting heart rate, suggesting similar adaptations may occur with weight training.

A study by Irawan et al. (2020) found that aerobic exercise reduced resting heart rate in overweight adolescents. Although this study focused on aerobic exercise, similar adaptations can occur in intensive weight training, which has a metabolic component. Therefore, weight training still contributes positively to cardiovascular health, although the mechanisms differ from those of nutritional therapy.

5. The Effect of Nutrition Therapy on Work Effectiveness

Work effectiveness increased in the nutrition therapy group. Improved diets resulted in more stable energy throughout the day, improved focus and concentration, and reduced blood sugar fluctuations that often trigger fatigue. A healthy diet also improved sleep quality and reduced stress, two important factors in supporting teaching productivity.

Several studies support the link between nutritional status and work performance. Adequate and balanced nutrition plays a role in cognitive performance, memory, and academic productivity. Therefore, the findings of this study are consistent with the theory that good nutritional status supports optimal work performance.

6. The Effect of Weight Training on Work Effectiveness

Weight training also increases work effectiveness by improving posture, reducing musculoskeletal complaints, and improving sleep quality. Furthermore, regular physical exercise

improves mood and executive function. Chaput et al. (2020) reported that regular exercise has a positive impact on mental health and productivity.

7. Comparison of the Two Interventions

a. Weight Loss

Nutritional therapy is superior in producing kilogram loss. This is logical because the primary mechanism of nutritional therapy is to create a direct energy deficit, which reduces daily calorie intake, causing the body to use energy reserves (fat) to meet metabolic needs. With a diet high in protein, rich in fiber, and low in simple carbohydrates, patients achieve weight loss more quickly.

Conversely, weight training plays a greater role in improving body composition than in total weight loss. Weight loss may not be as significant as in the nutritional group because increased muscle mass offsets fat loss. However, in terms of weight loss quality, weight training provides a greater advantage because it increases the proportion of fat-free mass, which is directly related to basal metabolism and long-term weight maintenance. In other words, nutrition is superior for the scale, while weight training is superior for body composition and long-term metabolism. This finding is consistent with the literature suggesting that a combination of a healthy diet and resistance training provides optimal results in weight management.

b. Resting Heart Rate

Both therapies have been shown to reduce RHR, although through different mechanisms.

1) Nutritional therapy reduces RHR primarily by reducing cardiac workload due to weight loss and blood pressure. Previous research has confirmed that a 5–10% weight loss is sufficient to lower systolic/diastolic blood pressure and resting heart rate (Filippou et al., 2020).
2) Weight training, on the other hand, lowers RHR through cardiovascular adaptations. Weight training increases stroke volume and cardiac contraction efficiency. This is similar to aerobic exercise, although the effects tend to be smaller. A study by Irawan et al. (2020) in overweight adolescents demonstrated that regular physical exercise significantly reduced resting heart rate.

From this comparison, it can be concluded that nutritional therapy reduces RHR more quickly through hemodynamic pathways (weight loss and blood pressure reduction), while weight training provides peripheral cardiac adaptations that support long-term reduction in RHR.

c. Work Effectiveness

Increased work effectiveness was found in both groups, but the causes were different.

1) In the nutrition group, improvements in work effectiveness were primarily influenced by daily energy stability, improved sleep quality, and reduced blood sugar fluctuations. A healthy diet has been shown to support cognitive function, focus, and concentration, enabling teachers to work more efficiently.
2) In the weight training group, increased work effectiveness was more influenced by physical and psychological aspects. Weight training reduced musculoskeletal complaints, improved posture, increased stamina, and had a positive effect on mood through increased endorphins. Chaput et al. (2020) reported that regular exercise can improve sleep quality, reduce stress, and enhance executive function, all of which have a positive impact on work productivity.

Thus, nutrition contributes more to cognitive and energy aspects, while weight training contributes more to physical and psychological aspects of work effectiveness.

CONCLUSION AND SUGGESTIONS

Conclusion

The relusts of the study show that nutritional therapy and weight training are equally effective in reducing weight, lowering resting heart rate (RHR), and improving the effectivenes of teachers with above normal BMI. Nutritional theraphy provides greater weight losss through the mechanisms of energy deficit, increased thermic effect of food (TEF), and regulation hormone lust eat . Meanwhile that , practice burden although produce decline relative body weight more small , capable increase mass muscles , basal metabolism , and give adaptation physiological more cardiovascular stable .

Both of them contribute to improvement effectiveness work , with therapy nutrition more dominant in aspects cognitive and energy , whereas exercise burden more dominant in aspects physical and psychological . With Thus , the combination nutrition and exercise burden recommended as the most optimal strategy for increase health and productivity power teacher .

Suggestion

1. Study furthermore need done with duration more interventions long For evaluate effect term long .
2. Instrument more detailed measurements , such as composition body (mass) muscle , fat mass , visceral fat), preferably used so that the results more comprehensive .
3. Variables style another life like quality sleep , level stress , and activity physique daily need considered in analysis .
4. Implementation of combination program nutrition and exercise load on the environment campus recommended For guard fitness and productivity power teacher .
5. Study next should involving more samples wide cross faculty and profession to improve generalization results .

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Cross-Sectional Configuration of Microcells in Relation to Sound Attenuation in Viscous Medium

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Abstract. The goal of this research is to determine the best H-type microcell design configuration in viscous environments to maximize sound propagation. The pressure on each component of the microcell, which is discontinuous, and its axis symmetry are two of the elements that influence sound propagation in viscous medium. Three assumptions underlie this problem, which requires a mathematical formulation. These are that the H-type microcell shell is rigid and extremely hard to prevent heat loss, that acoustic propagation creates a convection waveform in the z-direction, i.e., at the lowest longitudinal axis, and that the effect of gas thermal conductivity is taken into consideration. Simulated using the transmission matrix approach, which is directly connected to the genetic algorithm method, the H-type microcell's cross-sectional area design was optimized to achieve maximum sound amplification. The buffer cell length, (l_b), = 48.82 mm, the resonator cell length, (l_r), = 102.47 mm, the buffer cell radius, (r_b), = 8.78 mm, and the resonator cell radius, (r_r), = 2.93 mm, as well as the sound propagation frequency, (f), = 1618.59 Hz, and the transmission loss (TL) in ethylene gas (C_2H_4).

Keyword: H-type microcell, sound attenution, viscous medium, optimal design

INTRODUCTION

Wave propagation in a homogenous medium is an easy problem to solve. In this context, the pressure and velocity of the wave are often considered constant and are often addressed. When wave propagation occurs in a non-uniform medium, such as when the cross-sectional area of the medium suddenly changes, altering the pressure and flow velocity, the problem becomes extremely complex. However, this problem is limited to cylindrical-medium microcells, commonly seen in piping networks, blood vessels, and other such structures. When the cross-sectional area suddenly changes from large to small (contraction) or vice versa (expansion), it is referred to as cell discontinuity.

The issue of discontinuities for acoustic waves in cylindrical tubes was initially examined by Miles (Miles, 1946a, 1946b). He derived the fundamental equations controlling sound propagation close to discontinuities and demonstrated that cell discontinuities can be compared to impedance. Using a piston approach, Ingard (Morse & Ingard, 1986) investigated sound emission into a circular tube while accounting for termination effects. Karal investigated the acoustic inductance for cell discontinuities in two circular cells with different cross-sections and lengths in order to design an acoustic transmission system. According to Karal (1953), the acoustic pressure passing through the resonator—a cell with a smaller radius—is only useful at extremely low frequencies. The mode-matching method was used by Kergomard & Garcia (1987) to obtain the Karal correction factor from coaxial discontinuities. They also went into great detail regarding the convergence criteria and the number of modes that must be considered for various parameter values. Finally, they provided an endless list of formulas for changes in circular cross sections. In order to investigate discontinuities in impedance matrices, Kergomard J., (1991) later developed the mode-matching technique.

Based on the aforementioned issues, this work aims to identify the optimal H-type microcell design while accounting for the length and cross-sectional area of each cell. The main reason is that fluid flows within each cell with unequal velocity and pressure due to sudden changes in its cross-sectional area. The two main techniques used to address this problem are Bernoulli's equation and the Transmission Matrix Method (TMM).

PROPAGATION OF WAVES IN H-TYPE MICROCELLS

The properties of each cell have a significant impact on the impedance and resonance frequency when two or more cells with different cross-sectional areas and lengths are connected in parallel. The geometric complexity of a cell is particularly important when there are sudden changes in the cross-sectional area, like contraction or expansion.

Three cells connected in parallel and coaxially make up an H-type microcell. A smaller cross-section is found in the central cell compared to the other two outside cells, which have the same cross-sectional size. All three cells have different lengths. Figure 1

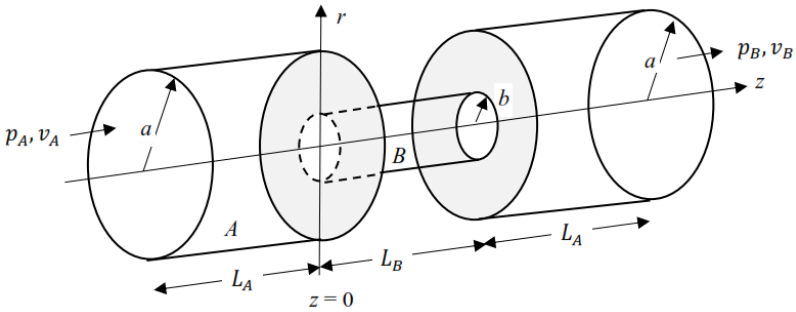


Figure 1. Microcells H-Type

A convection waveform is created as waves propagate. (Besson & Thévenaz, 2006; Karal, 1953; R. Y. A. Sari et al., 2020, 2022; Y. A. S. Sari et al., 2025; Yosi Aprian Sari et al., 2022). In the z-direction, the convection wave equation is:

$$\nabla^2 p(\vec{r},\omega) + k_0^2 p(\vec{r},\omega) = 0 \tag{1}$$

where $k_0 = \omega / c_s$ is the wave number, and c_s is the sound velocity. The coupling of cells A, B, and C results in an orthogonal, azimuthal, and axisymmetric normal mode shape. $\partial p / \partial n = 0$ since it is expected that all cell surfaces are rigid. Equation 1's general solution related to Figure 1 (Liu et al., 2018):

$$p(r,z) = \sum_{n_x=0}^{\infty} \left[A_{n_x}^{+} e^{ik_{zA}(z+l_A)} + A_{n_x}^{-} e^{-ik_{zA}(z+l_A)}\right] J_0\left(\frac{\pi \alpha_{0n_x}}{a} r\right), \begin{cases} -l_A \le z \le 0 \\ 0 \le r \le a \end{cases} \tag{2}$$

The superscripts (+) and (-) indicate the right and left propagation directions, respectively. The velocity of the acoustic volume is

$$Q(r,z,\omega) = \frac{-S}{i\omega\rho_0} \frac{dp}{dz} \tag{3}$$

In Figure 1, the boundary conditions of a rigid and very hard cell are displayed so that $\partial p / \partial n = 0$, where Γ_1 and $\Gamma_2$are discontinuities at cell contractions, Γ_3 and Γ_4 are discontinuities at cell expansions, and Γ_5 is continuous at $z = 0$ and $z = l_B$.

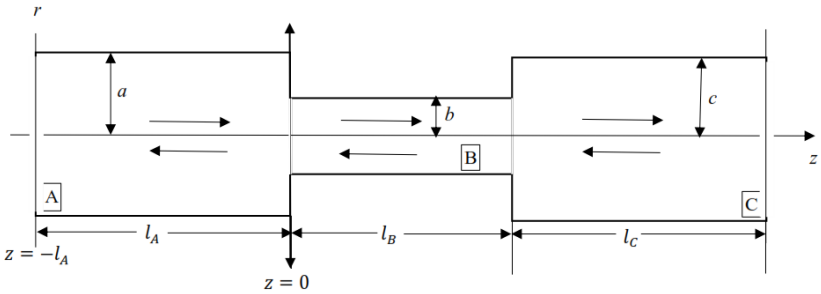


Figure 2. Pressure propagation analysis in type-H microcells

At $z = 0$ and $z = l_B$, observe that the cell exhibits a discontinuity, more precisely a change in the cell's cross-sectional area. It is assumed that the pressure and volume velocity of cells A, B, and C are identical in this case.

1. The Bernoulli Equation

Pressure propagation at discontinuities $z = 0$ and $z = l_B$ is analyzed using the Bernoulli equation (see Figure 2). When applying this equation, the flow's equation of motion is taken into account. A fluid system's total head remains constant throughout, according to Bernoulli's equation, assuming there is no shear stress along the flow. The head is equal to the sum of height, pressure, and velocity. Shear stress happens both within the fluid and along the fluid/system interface in a genuine system. Therefore, as the energy equation shows, the total head

in a fluid system is not constant. The energy equation and the Bernoulli equation are similar in many respects. According to the continuity law, the energy equation should apply to the pressure and volume velocity propagation (Elnady et al., 2011).

$$p_{sA}^{(1)} + \frac{1}{2}\rho\left(v_A^{(1)}\right)^2 + \rho g z_A^{(1)} = p_{sB}^{(2)} + \frac{1}{2}\rho\left(v_B^{(2)}\right)^2 + \rho g z_B^{(2)} + \rho g h_e \quad (4)$$

where the fluid's static pressure is represented by p_s, its density by ρ, its height by z, its acceleration from gravity by g, and its head loss by h_e. Head is the potential energy that is converted to kinetic energy. Head loss is caused by cell system barriers, such as those on valves, fittings, entry, or connections/size changes. Superscript 1 indicates the entry side, and superscript 2 indicates the exit side. Typically, the elevation heat differential is negligible, meaning that $z(0^-) = z(0^+)$. Head pressure plus head velocity equals stagnation pressure, which is $p = p_s + \frac{1}{2}\rho v^2$. Equation (4) can be reduced to

$$p(0^-) = p(0^+) + \rho g h_e \quad (5)$$

Another way to express equation (5) is as a function of the head loss coefficient, k_e

$$p(0^-) = p(0^+) + \frac{1}{2}k_e\rho\left(v(0^+)\right)^2 \quad (6)$$

The fluid volume, Q, that passes through the system is frequently referred to as "pressure loss" in equations (5) and (6). We can therefore write equation (5).

$$p(0^-) = p(0^+) + R_f Q(0^+) \quad (7)$$

where R_f is the flow resistance. However, according to equation 3, the total amount entering the system and the total amount exiting it are not equal.

$$Q(0^-) = \frac{S_A}{S_B}Q(0^+) \quad (8)$$

Equations (5) and (7) can be compared to determine that the flow resistance associated with head loss is

$$R_f(Q) = \frac{\rho g h_e}{Q} \quad (9)$$

The flow determines the flow resistance because this is the head loss. A comparison of equations (6) and (7) reveals that the flow resistance is associated with a loss coefficient of

$$R_f(Q) = k_e\frac{\rho}{2S^2}|Q| \quad (10)$$

Here, S stands for the cross-sectional area of the entrance or outflow. The loss coefficient is a constant that is influenced by the geometry of the cell.

Separate attention is given to the problems of cell discontinuity expansion and contraction. In the case of expansion, consider the continuous flow of a cell with sudden enlargement. Ignoring the potential energy difference is one method to construct the energy equation (5).

$$R_f Q = p(0^-) - p(0^+) + \rho k_e\frac{\left(v(0^-)\right)^2 - \left(v(0^+)\right)^2}{2} \quad (11)$$

Newton's second law states that the net force acting on the fluid is equal to the rate at which momentum rises.

$$\left(p(0^-) - p(0^+)\right)S_B = \rho Q\left(v(0^+) - v(0^-)\right) \quad (12)$$

Equation (11) can be changed to produce equation (12).

$$R_f = \rho\frac{v(0^+)\left(v(0^+) - v(0^-)\right)}{Q} + \rho\frac{\left(v(0^-)\right)^2 - \left(v(0^+)\right)^2}{2Q} \quad (13)$$

which is reduced to

$$R_{f\to e} = k_{e\to e}\frac{\rho}{2S_A^2} \quad (14)$$

where $k_{e\to e}$ is the coefficient of expansion loss, as shown by equation (5).

$$k_{e\to e} = \left(1 - \frac{S_B}{S_C}\right)^2 \quad (15)$$

In the case of contraction, the area ratio determines the loss coefficient for abrupt contraction, which is given by equations (6) and (9).

$$R_{f\to c} = k_{e\to c}\frac{\rho}{2S_B^2} \quad (16)$$

where $k_{e\to c}$ is the contraction loss coefficient (Elnady et al., 2011)

$$k_{e\to c} = \left(1 - \frac{S_B}{S_A}\right)^2 \quad (17)$$

From the explanation, it can be written.

$$\left.\begin{aligned} p(0^-) &= p(0^+) + R_c Q(0^+) \\ p(l_B^-) &= p(l_B^+) + R_e Q(l_B^+) \end{aligned}\right\} \; 0 < r < b \quad (18)$$

$$\left.\begin{aligned} Q(0^-) &= \frac{S_A}{S_B} Q(0^+) \\ Q(l_B^-) &= \frac{S_B}{S_C} Q(l_B^+) \end{aligned}\right\} \; 0 < r < b$$

$$Q(0^+) = 0, \quad b < r < a$$

$$Q(l_B^-) = 0, \quad b < r < c$$

So the form of transfer matrix at the discontinuity of cell A and B (contraction)

$$\begin{pmatrix} p(0^-) \\ Q(0^-) \end{pmatrix} = \begin{pmatrix} 1 & R_c \\ 0 & \frac{S_A}{S_B} \end{pmatrix} \begin{pmatrix} p(0^+) \\ Q(0^+) \end{pmatrix} \tag{19}$$

and on cell B and C (expansion)

$$\begin{pmatrix} p(l_B^-) \\ Q(l_B^-) \end{pmatrix} = \begin{pmatrix} 1 & R_e \\ 0 & \frac{S_B}{S_C} \end{pmatrix} \begin{pmatrix} p(l_B^+) \\ Q(l_B^+) \end{pmatrix} \tag{20}$$

2. Transmission Matrix Method (TMM)

The Transmission Matrix Method (TMM), which is based on the acoustic behavior of plane waves in uniform cell elements of length l and uniform fluid flow (average density, ρ_0. and sound velocity, c_s), can be used to evaluate wave propagation within cells A, B, and C. The H-type microcell system is investigated step-by-step, beginning with the acoustic wave traveling from the left end at $z = -l_A$. to the right end at $z = l_B + l_C$. across discontinuities at $z = 0$ and $z = l_B$. The propagation of this cell is caused by pressure p and volume velocity Q. Figure 2 illustrates how cell A's acoustic transmission changes from $z = -l_A$ to $z = 0^-$,

$$\begin{pmatrix} p(-l_A) \\ Q(-l_A) \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} \begin{pmatrix} p(0^-) \\ Q(0^-) \end{pmatrix} \tag{21}$$

where

$$A_{11} = [\cos(k_{zA} l_A)]$$

$$A_{12} = \left[i \left(\frac{\rho_0 c_0}{S_A} \right) \sin(k_{zA} l_A) \right]$$

$$A_{21} = \left[i \left(\frac{S_A}{\rho_0 c_0} \right) \sin(k_{zA} l_A) \right]$$

$$A_{22} = [\cos(k_{zA} l_A)]$$

Similarly, a transmission matrix $z = 0^+$ to $z = l_B^-$ and from $z = l_B^+$ to $z = l_C$ can be used to express the analysis of acoustic propagation of cells B and C.

Formulas (21), (19), and (20) are used to derive the transmission from $z = -l_A$ to $z = l_C$.

$$\begin{pmatrix} p(-l_A) \\ Q(-l_A) \end{pmatrix} = \begin{pmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{pmatrix} \begin{pmatrix} p(l_C) \\ Q(l_C) \end{pmatrix} \tag{22}$$

where

$$\begin{pmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} \begin{pmatrix} 1 & R_c \\ 0 & \frac{S_A}{S_B} \end{pmatrix} \begin{pmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{pmatrix} \begin{pmatrix} 1 & R_e \\ 0 & \frac{S_B}{S_C} \end{pmatrix} \begin{pmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{pmatrix} \tag{23}$$

Transmission loss (TL), insertion loss (IL), and noise reduction (NR) are at least three important considerations while using this technology. Because TL is independent of the sound source and because it accounts for height fluctuations when computing the dispersion effect, this method is used in this instance. Throughout propagation, the pressure and volume velocity inside the cell, as well as at the discontinuities in the cell from the inlet source to the outlet, are expected to remain constant. Most sound calculations are based on the relationship between frequency (measured in Hz) and intensity (measured in dB). Sound waves can be impacted by a variety of environmental conditions, such as temperature, pressure, and medium density (Kuttruff, 2006).

$$TL(l_A, l_B, l_C, S_A, S_B, S_C) = 10 \log \left(\frac{|T_{11} + T_{12} + T_{21} + T_{22}|}{2} \right) + 10 \log \left(\frac{S_A}{S_C} \right) \tag{24}$$

3. The impedance of H-type microcells

According to Kinsler et al. (2000) and Noreland (2003), impedance is a crucial component of acoustics. The normal component of particle velocity, $Q(z, \omega)$, and the acoustic pressure, $p(z, \omega)$, on a solid object or real surface interact to determine impedance. Frequency, ω, affects this relationship. When applied to the surface of an object, impedance can be used as a boundary condition to treat wave problems outside of it without having to explicitly address its interior (Chaigne & Kergomard, 2016; Kim, 2010; Kuttruff, 2006; Noreland, 2003; R. Y. A. Sari et al., 2020, 2022; Y. A. S. Sari et al., 2025; Yosi Aprian Sari et al., 2022).

Since the characteristics of each cell will significantly alter the impedance and frequency, this issue may get more complex if two or more cells are connected by parallel axes of varying lengths and cross-sectional areas. When abrupt changes in cross-sectional area (cell discontinuities) become the primary focus of this study, whether for acoustic propagation from cells with large cross-sectional areas to smaller ones (contraction) or vice versa (expansion), the geometric problems of microcells become a very important concern.

Contraction discontinuity

In contraction cells with the boundary conditions $z = -l_A$ and $z = 0$, the impedance during propagation is (see Figure 2) (Kuttruff, 2006).

$$Z_A(0^-) = Z_{0A}\frac{[iZ_{0A}\tan(k_{zA}l_A) - Z_A(-l_A)]}{[iZ_A(-l_A)\tan(k_{zA}l_A) - Z_{0A}]} \tag{25}$$

where

$$Z_{0A} = \frac{\omega\rho_0}{S_A k_{zA}}$$

If the cell$A$ is opened at $z = -l_A$ then $Z_A(-l_A) \to 0$, such that we get

$$Z_A(0^-) = iZ_{0A}\tan(k_{zA}l_A) \tag{26}$$

In the same way for cell B at $z = 0$ and $z = l_B$, we get

$$Z_B(0^+) = Z_{0B}\frac{[Z_B(l_B^-) + iZ_{0B}\tan(k_{zB}l_B)]}{[Z_{0B} + iZ_B(l_B^-)\tan(k_{zB}l_B)]} \tag{27}$$

where

$$Z_{0B} = \frac{\omega\rho_0}{S_B k_{zB}}$$

Cells A (and C are referred to as buffers) and B (referred to as resonator) are situated at $z = l_B$ in a symmetrical connection at $x = 0$. Assuming that the acoustic volume pressure and velocity are the same on both sides of the discontinuity, the equation connects the impedance at the discontinuity, $p(0^-) = p(0^+) + R_c Q(0^+)$. Equation (18) shows that $Q(0^-) = \frac{S_A}{S_B}Q(0^+)$.

$$\frac{Z_A(0^-)}{S_A} = \frac{Z_B(0^+)}{S_B} \tag{28}$$

In order to determine the contraction discontinuity's impedance, specifically:

$$Z_B(l_B^-) = iZ_{0B}\frac{[S_B^2 k_{zB} - S_A^2 k_{zA}\tan(k_{zA}l_A)\tan(k_{zB}l_B)]}{[S_A^2 k_{zA}\tan(k_{zA}l_A) + S_B^2 k_{zB}\tan(k_{zB}l_B)]}$$

On the discontinuity of contraction, $S_A > S_B$, the form, $S_B k_{zB} S_B \tan(k_{zB}l_B)$.It is possible to ignore the following in the denominator of the equation above. Assuming that the propagated sound's wavelength is extremely tiny in relation to the cell's length, $kk_{zA}l_A \ll 1$ and $k_{zB}l_B \ll 1$, the impedance can be reduced to:

$$Z_B(l_B^-) = iZ_{0B}\frac{S_B^2 k_{zB} - S_A^2 k_{zA}\tan(k_{zA}l_A)\tan(k_{zB}l_B)}{S_A^2 k_{zA}\tan(k_{zA}l_A)} \tag{29}$$

This follows directly from the continuity equation. This demonstrates how an abrupt alteration in the cell's cross section functions as an impedance transformer.

Expansion Discontinuity

Similar to cell A, if cell C is closed at $z\, z = l_B + l_C$, then $Z(l_B + l_C) \to \infty$ and due to the discontinuity of cells of cells B and C, $S_B < S_C$. is a type of expansion. Assuming that, $k_{zC}l_C \ll 1$, the equation for the impedance of cells B and C becomes:

$$Z_C(l_B) = \frac{-iZ_{0C}}{k_{zC}l_C} \tag{30}$$

If the AB cell's discontinuity is linked to cell C and occurs at $z = l_B$, then:

$$\frac{Z_B(l_B^-)}{S_B} = \frac{Z_C(l_B^+)}{S_C} \tag{31}$$

Assuming that cells A and C have the same dimensions, the longitudinal wave number can be found by replacing equations (29) and (30) into equation (31):

$$k_{zC}^2 = k_{zA}^2 = \frac{S_B^2}{l_A l_B S_A^2} \tag{32}$$

We already know the wave number in cell B (Besson & Thévenaz, 2006), which is:

$$k_{zB}^2 = \left(\frac{\pi k}{l_B}\right)^2 = k_0^2 - \left(\frac{\pi\alpha_{mn}}{b}\right)^2 \tag{33}$$

The nth root of the equation involving the mth order Bessel function is denoted by the symbol α_{mn}.

Table 1. Values of α_{mn} for some of the first azimutal and radial modes of a H-type microcells.

	$n = 0$	$n = 1$	$n = 2$
$m = 0$	0	3.832	7.016
$m = 1$	1.841	5.331	8.526
$m = 2$	3.054	6.706	9.969

Therefore, the sum of the wave numbers of each cell can be used to determine the resonant frequency of H-type microcells, assuming that $S_A = S_C$ (Bruneau et al., 1985).

$$k_0^2 = k_{zA}^2 + k_{zB}^2 + k_{zC}^2$$

that is

$$\omega_{k00} = c_S \sqrt{\frac{4S_B^2}{l_A l_B S_A^2} + \left(\frac{\pi k}{l_B}\right)^2 + \left(\frac{\pi \alpha_{00}}{b}\right)^2} \tag{34}$$

where k is the longitudinal normal mode with $k = 1$; c_s, b, S_A, S_B, l_A, l_B, and α_{00}. are the velocity of sound in the medium, the radius of cells B, the cross-sectional areas of cells A and B, the lengths of cells A and B., and the, 0th. root of the equation involving the,0-th. order Bessel function, respectively.

The impedance at the cell discontinuity of the microcells disappears at a specific resonant frequency, which is the correction factor for the single cell resonant frequency in equation (33). This is demonstrated by the wave number in equation (32) which is a combination of the dimensions of cell A (buffer) and cell B (resonator).

RESULTS AND DISCUSSION

The following initial H-type microcell dimensions are derived from Bijnen et al. (1996)(Bijnen et al., 1996): The resonator length (l_{res}) is 100 mm, the buffer length (l_{buf}) is 50 mm, the buffer radius (r_{buf}) is 9 mm, and the resonator radius (r_{res}) is 3 mm. The material used is ethylene gas, C_2H_4.

The initial population (pop), crossover probability (pc), mutation probability (pm), maximum generation (itermax), and tolerance value (toll) are the GA optimization parameters that are employed in this genetic approach. The values of these parameters are 30, 0.95, 0.005, 100, and 10^{-20}, in that order. Specific heat at constant pressure is 42.9 J/(mol.K), density is 1.178 kg/m^3, heat capacity ratio is 1.24, molar mass is 0.02805 kg/mol, viscosity is 1.028×10^{-5} Pa.s, and thermal conductivity is 20.362×10^{-3} W/(m.K).

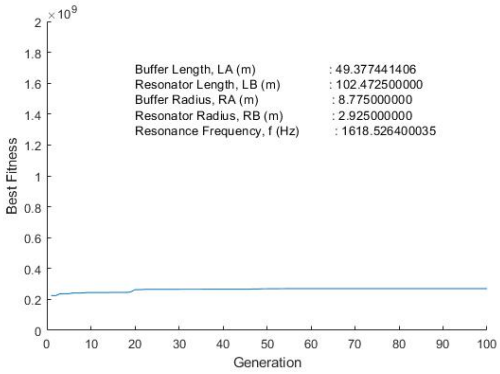
Table 2. Optimizing H-type microcells for ethylene gas in longitudinal mode, $[klm] = [100]$

No	l_{buf} (mm)	l_{res} (mm)	r_{buf} (mm)	r_{res} (mm)	frequency (Hz)	TL (dB)
1	49.38	102.47	8.78	2.93	1618.53	77,32
2	48.76	102.47	8.78	2.93	1618.63	77.32
3	48.83	102.47	8.78	2.93	1618.62	77.32
4	48.75	102.47	8.78	2.93	1618.63	77.32
5	48.39	102.47	8.78	2.93	1618.52	77.32
Averages	48.82	102.47	8.78	2.93	1618.59	77.32

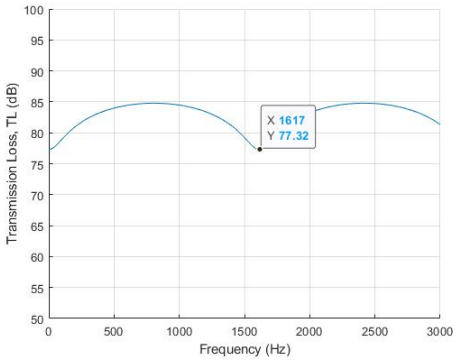
The geometric design, including the transmission loss and consequent frequency, is clearly unchanged after getting the optimization findings of H-type microcells from ethylene gas (Table 2). The real difference is found in the pressure generated since pressure and the physical properties of the gas being used are tightly related.

The wave propagation pattern determines the transmission loss (TL) and resonant frequency (f), which are closely related. A duct's mild pressure is correlated with its high cross-sectional area, and vice versa (head loss). This is because a rapid change in the duct's cross-sectional area causes the wave pressure, which is reliant on the H-type microcell's dimensions, to fluctuate. The energy of the surrounding total field must be controlled in order for the wave to account for "edge conditions" at the discontinuity where it contacts the duct wall. As a result, a unique approach is developed that is directly tied to enhancing the microcell design, which is necessary to achieve the highest wave pressure.

The physical parameter setting of this H-type microcell has values that are similar to one another. This suggests that the resonant frequency is also present in that range. Since the incoming wave will experience transmission losses as it travels across the microcells' discontinuities, its strength dictates the TL in the microcells.



Optimal Design of H-Type Microcells



Resonance Frequency and TL of H-Type Microcells

Figure 3. Optimal Design, Resonance Frequency and Transmission Loss of H-Type Microcells of Ethylene Gas

CONCLUSION

When waves propagate through cell discontinuities, head loss due to collision and friction of the liquid with the cell wall causes acoustic pressure variations. This process cannot be ignored. Bernoulli's equation, the transmission matrix method (TMM) and the genetic algorithm (GA) are used to analyze acoustic propagation in H-type microcells. The configuration of the physical parameter values, such as the buffer's length (l_{buf}) and radius (r_{buf}) and microcells' length (l_{res}) and radius (r_{res}), transmission loss (TL), and resonant frequency (f), are determined.

Impedance limit needs are taken into consideration when designing H-type microcells. The sudden contraction and expansion of H-type microcells' geometric shape has a major effect on their transmission coefficient. The GA technique produces the optimal buffer and microcell sizes, and a high acoustic transmission coefficient necessitates the lowest feasible TL value. The results of this optimization are the following: TL value 77.32 dB, resonance frequency 1618.59 Hz, microcell length 102.47 mm, microcell radius 2.93 mm, buffer length 48.82 mm, and buffer radius 8.78 mm.

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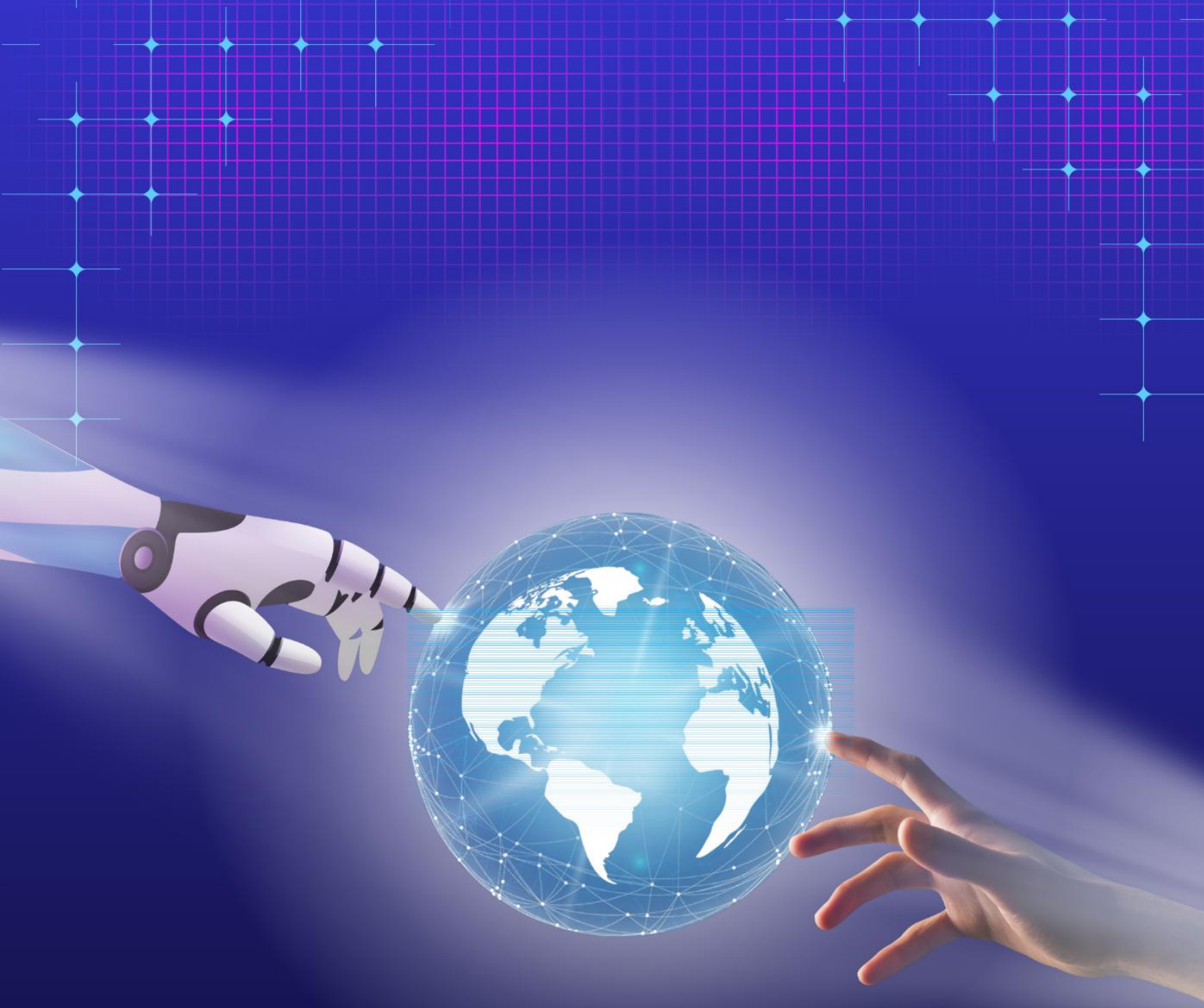

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