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

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Yogyakarta
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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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Development of a 4P-Based Governance Model for Student Organizations to Enhance Organizational Performance at Yogyakarta State University

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Abstract. This study aims to develop an effective governance model for student organizations (Ormawa and UKM) at Yogyakarta State University through a 4P approach consisting of Planning, Procedures, Partnerships, and Performance Feedback. The research employed a research and development (R&D) method using a qualitative case study design. Data were collected from 23 student organizations through surveys, interviews, document analysis, and observation. The findings indicate that the existing governance condition is categorized as good, with an average score of 4.20; however, a performance gap remains compared to the targeted score of 4.60 within one year. The strongest governance dimensions were legality, organizational structure, compliance with university regulations, and financial transparency, while the weakest aspects involved alumni and advisor engagement, member satisfaction, performance indicators, and knowledge management. Based on these findings, a 4P-based governance model was formulated to strengthen administrative foundations while enhancing strategic organizational capacity. The model promotes a continuous improvement cycle through structured planning, standardized procedures, collaborative partnerships, and systematic performance feedback.
Keywords: student organization governance; 4P model; organizational performance; higher education

INTRODUCTION

Student organizations play a strategic role in higher education by fostering leadership, character development, and social competence among students. Through participation in Ormawa and Unit Kegiatan Mahasiswa (UKM), students acquire non-formal learning experiences that complement academic instruction and contribute to holistic competence development (Moroz, 2023). Well-governed student organizations provide structured environments that enhance managerial skills, teamwork, and social responsibility. Consequently, effective governance constitutes a fundamental prerequisite for the sustainability and performance of student organizations (Clark et al., 2023).

At Yogyakarta State University (UNY), the rapid growth in the number and diversity of student organizations has increased the complexity of governance arrangements. Variations in organizational capacity, documentation quality, and leadership regeneration have resulted in inconsistent organizational performance across units. Rahmawati and Inayati (2024) emphasize that without clear governance standards and systematic guidance, student organizations are vulnerable to capacity gaps and inefficiencies. These challenges highlight the need for an adaptive and institutionally aligned governance model.

Another critical issue concerns human resource management and knowledge continuity within student organizations. High turnover rates among student leaders often lead to the loss of institutional memory and weaken organizational learning processes (Lasena & Suking, 2024). In addition, limited involvement of advisors and alumni constrains mentoring and long-term organizational development. Elken (2024) underscores that collaborative governance involving multiple stakeholders is essential for strengthening organizational legitimacy and effectiveness in higher education contexts.

Performance evaluation also remains a persistent challenge. Many student organizations lack standardized key performance indicators (KPIs), resulting in subjective assessments and limited evidence-based improvement. Kravchyk and Ostapchuk (2023) argue that organizations require measurable indicators to support accountability and strategic planning. In response to these challenges, this study adopts a research and development approach to design a governance model tailored to the institutional context of UNY. The proposed 4P model integrates planning, procedural standardization, partnerships, and performance feedback to enhance governance quality and organizational performance in a sustainable manner.

RESEARCH METHOD

This study employed a qualitative research and development (R&D) approach to formulate and validate a governance model for student organizations at UNY. A case study design was used to capture the complexity of governance practices across different organizational types. The research was conducted in four stages: preliminary analysis, model development, model implementation, and evaluation.

Data collection involved surveys administered to 23 student organizations, semi-structured interviews with organization leaders, advisors, and university administrators, document analysis of organizational reports and regulations, and field observations. The survey instrument assessed governance dimensions including legality, organizational structure, compliance, financial transparency, knowledge management, stakeholder engagement, and member satisfaction. Qualitative data were analyzed using descriptive and thematic analysis techniques, while triangulation was applied to ensure validity and reliability.

The feasibility and effectiveness of the developed model were evaluated through expert review, focus group discussions, and feedback from organization representatives. The evaluation focused on practicality, relevance, clarity of procedures, and potential for sustainable implementation within the university.

RESULTS

The evaluation involved 23 student organizations at Yogyakarta State University, representing university-level student executive bodies, faculty-level organizations, student associations, and student activity units. The results show that the overall governance performance achieved an average score of 4.20, categorized as good. However, organizations collectively set a target score of 4.60 within one year, indicating a clear performance improvement gap of 0.40 points.

Table 1. Average Governance Performance and Target

Indicator	Mean Score
Current governance performance	4.20
Target (12 months)	4.60
Performance gap	0.40

This gap reflects organizational awareness of governance weaknesses and a collective commitment to improvement, particularly in strategic and developmental dimensions rather than administrative compliance alone.

Analysis of individual organization scores reveals a relatively homogeneous distribution, with current scores ranging from 4.05 to 4.45. Research-oriented organizations such as UKM Penelitian (LKIM) and UKM Bahasa & Debat achieved the highest scores, while several interest-based UKMs showed lower averages. The most organizations cluster around the 4.15–4.30 range, suggesting stable but not yet optimal governance performance.

Table 2. Average Scores of Lowest-Performing Dimensions

Dimension	Description	Mean Score
F3	Alumni & advisor involvement	3.88
G3	Member/partner satisfaction	3.94
B2	KPI and success indicators	4.18
E3	Knowledge management	4.22

Among these, alumni and advisor involvement (F3) recorded the lowest mean score, indicating weak mentoring structures and limited institutional memory transfer. This condition is exacerbated by annual leadership turnover and the absence of standardized knowledge documentation systems.

In contrast, several administrative dimensions achieved consistently high scores, demonstrating strong formal governance foundations.

Table 3. Average Scores of Highest-Performing Dimensions

Dimension	Description	Mean Score
A1	Legal status & formal decree (SK)	4.62
A2	Organizational structure & job description	4.66
A4	Compliance with university regulations	4.44
D4	Financial transparency	4.52

These results confirm that most student organizations at UNY have well-established administrative compliance, particularly in formal recognition, structural clarity, and financial accountability.

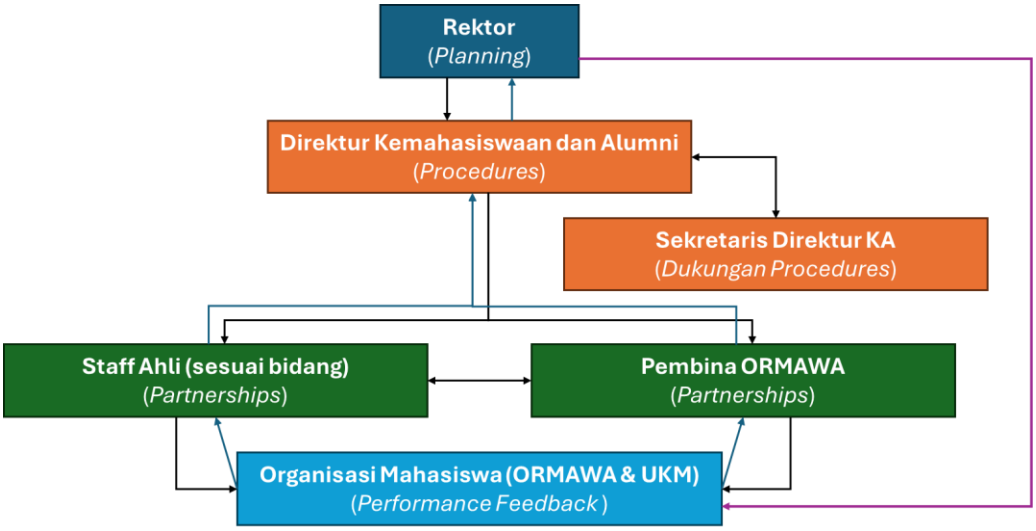

Figure 1. Organizational Structure of Yogyakarta State University Based on the 4P Model

Organizational Structure (UNY Context with Integrated 4P Model)

1. Rector
   • Provides strategic direction and overall governance mandate.
   • Connected to Planning, ensuring institutional vision alignment and strategic coherence.
2. Director of Student Affairs and Alumni
   • Responsible for formulating student affairs procedures and policies.
   • Connected to Procedures, focusing on administrative and bureaucratic supervision.
3. Secretary of the Director
   • Ensures coordination and smooth flow of documents, standard operating procedures (SOPs), and reporting mechanisms.
   • Functions as a supporting unit for Procedures.
4. Expert Staff (based on specific fields such as academic reasoning, arts, etc.) and Student Organization Advisors
   • Provide consultation, facilitate interest negotiation, and assist in conflict resolution within student organizations.
   • Connected to Partnerships, emphasizing collaboration and stakeholder engagement.
5. Student Organizations (ORMAWA & UKM)
   • Implement organizational activities, collect performance feedback, and report achievements.
   • Connected to Performance Feedback, supporting performance evaluation and continuous improvement.

DISCUSSION

The results demonstrate that strong administrative governance alone is insufficient to ensure sustainable organizational performance. Strategic dimensions such as stakeholder engagement, learning processes, and performance measurement play a critical role in organizational development (Abd-Elrahman et al., 2025). The 4P model addresses these gaps by integrating administrative rigor with strategic collaboration and feedback mechanisms.

The Planning and Procedures components reinforce consistency and accountability, aligning with good governance principles outlined by Clark et al. (2023). Meanwhile, Partnerships enhance organizational learning through mentoring and external engagement, as advocated by Elken (2024). Performance Feedback supports a culture of evaluation and continuous improvement, enabling organizations to adapt and innovate.

Overall, the 4P model provides a holistic framework that transforms governance from a compliance-oriented practice into a dynamic system for organizational learning and performance enhancement. Its alignment with institutional governance structures at UNY further strengthens its applicability and sustainability.

CONCLUSION

This study concludes that the governance of student organizations at Yogyakarta State University is generally well-established in administrative terms but requires strategic enhancement to achieve higher performance and sustainability. The developed 4P governance model effectively addresses identified gaps by integrating planning, procedures, partnerships, and performance feedback into a coherent framework. The model promotes

professionalism, accountability, and continuous improvement in student organization governance. It is recommended that the 4P model be implemented gradually and consistently across student organizations and considered as a reference for governance development in other higher education institutions.

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IMPROVING ENTREPRENEURSHIP-BASED LIVESTOCK WASTE MANAGEMENT IN THE SEYEGAN KRAPYAK IX MARGOAGUNG GOLD VILLAGE, SEYEGAN, SLEMAN

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Abstract. The escalating environmental issue of livestock waste necessitates effective management strategies. In Krapyak IX Village, Margoagung, the primary constraints are a lack of knowledge, awareness, and facilities, posing a significant risk of pollution. As a solution, a community service program was implemented to provide mentoring and enhance the community's competency in managing livestock waste. The program is designed to yield simple odor-control technology, a proper barn drainage system, and skills to process waste into organic fertilizer and alternative feed. Program success will be measured through mandatory outputs, including an article in a SINTA-indexed journal and mass media publications.

Keyword: Management, Livestock Waste, Environmental Pollution

INTRODUCTION

Indonesia's livestock industry is experiencing rapid growth. According to the Ministry of Agriculture, the national cattle population rose from 13.4 million in 2015 to 14.4 million in 2020, while the population of broiler chickens increased from 2.3 billion to 2.8 billion over the same period. This expansion is driven by several factors: a growing demand for animal protein due to population growth and shifting consumption patterns, the availability of extensive and fertile land, abundant natural resources, and supportive government policies.

While this development boosts animal protein production, farmer incomes, and job creation, it also poses significant environmental challenges. A major concern is livestock waste, which includes manure, urine, and leftover feed. Poorly managed, this waste leads to water, soil, and air pollution, damaging aquatic and terrestrial ecosystems and posing risks to human health. The scale of the issue is substantial, with the Ministry of Environment and Forestry reporting approximately 140 million tons of livestock waste generated annually. Furthermore, the Central Statistics Agency notes that the livestock sector is a significant contributor to Indonesia's greenhouse gas emissions.

Effective and efficient livestock waste management is therefore critical. Its primary goals are to mitigate environmental pollution, protect public health by reducing disease risks, and promote the efficient use of resources. Proper management systems can directly address pollution of water, soil, and air, while also converting waste into valuable resources. The principles for such a management system are outlined in Figure 1.

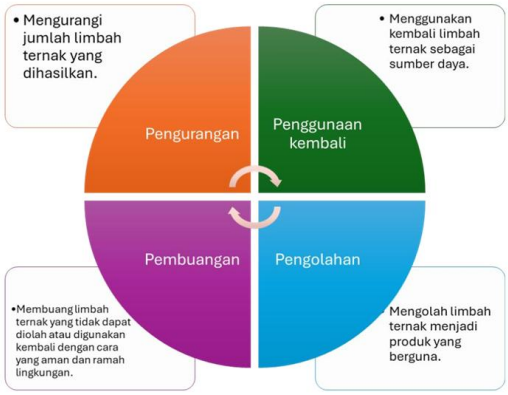

Figure 1. Principles of effective and efficient livestock waste management

Krapyak Village is located in Margoagung, Seyegan District, Sleman Regency, Special Region of Yogyakarta, covering an area of approximately 234.5 hectares. The village borders Sidomulyo Village, Margoagung Village, and Sidorejo Village. Krapyak Village has considerable potential in the livestock sector, particularly in cattle, goats, and poultry farming. The availability of extensive land supports its use for livestock housing and grazing areas. In addition, the village is supported by adequate livestock feed resources, such as rice straw, bran, and concentrate, as well as sufficient water supply to meet livestock needs. Access to livestock markets around the Sleman area is also relatively convenient.

However, the development of the livestock sector in Krapyak Village still faces several challenges. Farmers generally experience limitations in business capital and lack adequate knowledge regarding effective and efficient livestock business management. Furthermore, inadequate infrastructure, including roads and bridges, poses additional obstacles to the growth of livestock activities.

Another significant issue is related to livestock waste management in Krapyak IX Village. Livestock waste has not been properly managed, potentially causing environmental pollution. This condition is influenced by the low level of knowledge and awareness among farmers regarding livestock waste management, as well as limited resources and infrastructure. Therefore, this community service program aims to enhance farmers' knowledge and awareness of livestock waste management, assist farmers in managing waste effectively and efficiently, and ultimately reduce the environmental pollution caused by livestock waste. The target beneficiaries of this program include livestock farmers in Krapyak IX Village, particularly small- and medium-scale livestock enterprises, as well as local communities affected by environmental pollution resulting from livestock waste.

MATERIALS AND METHODS

This community service program applied a Technical Assistance method with a Training and Workshop approach, aiming to enhance entrepreneurship-based livestock waste management in Kampung Emas Seyegan Krapyak IX. The program began with a community socialization phase to introduce the activities, explain the objectives and benefits, and emphasize the importance of proper livestock waste management. This stage was intended to raise awareness and encourage active participation among local farmers.

The training activities were conducted in two sessions with distinct focuses. The first session concentrated on knowledge delivery, where participants were introduced to the concept of livestock waste management and the role of entrepreneurship in improving production outcomes. The materials covered livestock waste processing techniques and strategies to increase economic value through effective management practices. In addition, emphasis was placed on the utilization of Information and Communication Technology (ICT) to help participants understand modern approaches to waste processing and product marketing.

The second session focused on practical guidance in online marketing, including the use of digital marketplaces and social media platforms. This session aimed to equip participants with the skills needed to expand market reach by utilizing digital tools such as laptops and smartphones.

Following the material delivery, participants engaged in hands-on practice related to livestock waste processing. Facilitators provided direct assistance to ensure that participants were able to properly apply the techniques they had learned. Evaluation was conducted periodically throughout the program to assess training effectiveness. The evaluation indicators included participant attendance recorded through attendance lists, levels of participation observed during training activities, and participants' understanding of the material measured through exercises and discussions. The evaluation results were used to provide feedback to participants and serve as a basis for improving future programs.

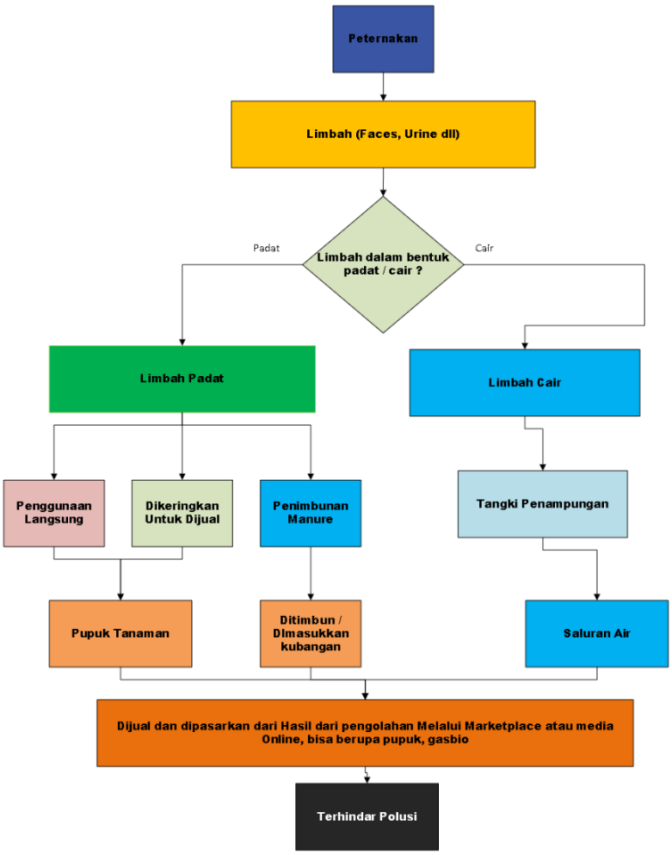

Figure 2 Environmentally friendly livestock waste management process

Properly managed livestock waste can generate substantial benefits. Through appropriate processing, livestock waste can be transformed into compost and biogas. These products not only contribute to increased farmers' income but also enable broader market access through online platforms. Consequently, effective livestock waste management plays a crucial role in reducing environmental pollution caused by unmanaged livestock waste.

RESULT AND DISCUSSION

The implementation of the entrepreneurship-based livestock waste management improvement program in Kampung Emas Seyegan Krapyak IX demonstrated positive outcomes and produced direct impacts on the target community. The program involved nine livestock farmers who were members of the local farmer group and was carried out using a participatory approach that combined training sessions, on-site mentoring, and hands-on practice within the livestock housing area. The activities commenced with a series of training sessions delivered by experts in their respective fields. The first session, led by Andik Asmara, Ph.D., focused on optimizing livestock waste management practices, while the second session, conducted by Ilham Ramadan Pandu Setia Negara Siregar, M.A.B., emphasized livestock waste management integrated with digital-based business development. Through these sessions, participants gained a comprehensive understanding of livestock waste management processes, ranging from waste collection and fermentation to marketing strategies for processed products such as organic fertilizer and alternative animal feed.

The program outcomes indicate a notable improvement in farmers' knowledge and practical skills related to basic livestock waste management. Participants were able to apply fundamental techniques, including the fermentation of livestock manure using decomposing bacteria and the improvement of barn drainage systems to minimize liquid waste accumulation that previously contributed to environmental pollution. These improvements resulted in observable environmental benefits, with livestock housing areas becoming cleaner, more organized, free from unpleasant odors, and more environmentally friendly for surrounding communities.

Figure 3 The atmosphere during the presentation

The outcomes of this program can be classified into two primary dimensions: environmental and socio-economic impacts. From an environmental perspective, the activities successfully enhanced community awareness regarding the importance of maintaining cleanliness within livestock farming areas and significantly reduced pollution caused by unmanaged liquid and solid livestock waste. Improved waste handling practices contributed to a cleaner, healthier, and more sustainable farming environment.

From a socio-economic standpoint, the program generated new business opportunities based on livestock waste utilization and introduced a sustainable entrepreneurial mindset that had not previously been well developed in the area. As a result, the program was not merely educational in nature but also practical and action-oriented, producing tangible benefits that directly contributed to improving community welfare. In a broader context, these outcomes are closely aligned with the Sustainable Development Goals (SDGs), particularly Goal 8 (Decent Work and Economic Growth) and Goal 12 (Responsible Consumption and Production). By transforming livestock waste into value-added products, the program supported the creation of new income-generating activities while simultaneously fostering local awareness of environmentally responsible production practices. This strong alignment with the SDGs indicates that the community service initiative delivers not only short-term benefits but also contributes meaningfully to long-term global sustainable development efforts.

Figure 4 Implementation of activities in the Seyegan Krapyak IX Gold Village

This program demonstrates that simple innovations, when implemented consistently, can serve as powerful catalysts for meaningful social change. Behavioral transformation, the strengthening of collaboration, and the adoption of digital technologies within smallholder livestock farming provide concrete evidence that community empowerment can be effectively achieved through approaches that are contextual, sustainable, and oriented toward collective well-being.

CONCLUSIONS

This community service program successfully improved the knowledge, skills, and awareness of livestock farmers in Kampung Emas Seyegan Krapyak IX regarding sustainable and entrepreneurship-based livestock waste management. Through a combination of technical training, field assistance, and hands-on practice, farmers were able to understand and apply basic waste management techniques, including waste fermentation, improvement of barn drainage systems, and the processing of solid livestock waste into organic fertilizer with economic value.
The results indicate that integrating technical assistance with entrepreneurial and digital approaches can encourage positive behavioral changes among small-scale livestock farmers. Participants demonstrated improved environmental awareness, better waste handling practices, and increased motivation to utilize livestock waste as a productive resource rather than an environmental burden. The introduction of digital marketing concepts through marketplaces and social media also broadened farmers' perspectives on market access and potential income diversification.

From an environmental perspective, the program contributed to reducing pollution risks caused by unmanaged solid and liquid livestock waste, leading to cleaner, healthier, and more organized livestock housing areas. From a socio-economic perspective, the program created new opportunities for community-based eco-entrepreneurship by transforming livestock waste into marketable products, thereby supporting local economic resilience.
Overall, this program supports the achievement of the Sustainable Development Goals (SDGs), particularly Goal 8 (Decent Work and Economic Growth) and Goal 12 (Responsible Consumption and Production). The findings demonstrate that simple, context-based innovations combined with consistent community engagement can serve as an effective model for rural community empowerment. This approach has strong potential to be replicated in other rural areas facing similar challenges in livestock waste management across Indonesia.

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THE APPLICATION OF LASER CUTTING TECHNOLOGY, MANAGEMENT, AND DIGITAL MARKETING IN THE DEVELOPMENT OF WAYANG KULIT CRAFT AT WUKIRSARI WAYANG TOURISM VILLAGE

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Abstract. Wukirsari Village, Bantul, Yogyakarta is renowned as a center of *wayang kulit* craftsmanship and was recognized as one of the 55 Best Tourism Villages in the World by UNWTO in 2024. Despite its significant cultural and creative economic potential, *wayang kulit* artisans still face major challenges in production efficiency, design innovation, business management, and digital marketing. The manual production process limits capacity, design innovations remain stagnant, financial management is not yet professional, and marketing is still heavily dependent on tourist visits and exhibitions. These issues have led to the low competitiveness of products in both national and global markets.
This community service program aims to enhance the competitiveness and sustainability of culture-based creative industries through the application of modern technology, optimization of business management, and digital marketing strategies. The solutions offered include: (1) the use of laser cutting technology to improve production efficiency and precision by up to 50%; (2) the application of software-based graphic design tools (CorelDRAW, Adobe Illustrator, CAD) to enrich *wayang* design variations by 30–50%; (3) the adoption of digital business management through ERP, CRM, and modern financial recording systems; and (4) the optimization of packaging technology and digital marketing strategies through social media, e-commerce, and branding with a target of increasing profits by 30%.
The implementation method consists of socialization, technology and marketing training, IPTEK workshops, intensive mentoring, evaluation of outcomes, and sustainability planning. Active participation of artisans is the key factor, supported by appropriate technology, design innovation, and broader distribution strategies. This program aligns with the SDGs (No Poverty, Decent Work and Economic Growth, Industry-Innovation-Infrastructure, Sustainable Cities and Communities, and Responsible Consumption and Production), Higher Education Key Performance Indicators (IKU), Asta Cita, and the National Research Master Plan (RIRN) in the field of creative economy.
The expected outcomes include improved artisans' skills in operating modern technology, diversification of *wayang kulit* products that are adaptive to global markets, and strengthened digital marketing capable of expanding product reach to international levels. Thus, this program not only supports the preservation of national cultural heritage but also improves artisans' welfare, strengthens Wukirsari's position as a center of culture-based creative industries, and establishes it as a model of sustainable community empowerment in the digital era.
Keywords: *Wayang kulit*, creative industry, laser cutting, digital marketing, digital management

INTRODUCTION

Wukirsari Village, located in Imogiri District, Bantul Regency, Special Region of Yogyakarta, has long been recognized as one of the most prominent centers of *wayang kulit* (leather puppet) craftsmanship in Indonesia. The village plays a strategic role in sustaining the continuity of traditional *wayang kulit* production, which has historically been transmitted through generations of artisans within family- and community-based systems [1], [2]. *Wayang kulit* represents a traditional art form that not only embodies high aesthetic value, but also conveys profound philosophical, ethical, and spiritual meanings rooted in Javanese cosmology and moral teachings [3], [4].

As an integral component of Indonesia's cultural heritage, *wayang kulit* has received international recognition from UNESCO as a Masterpiece of the Oral and Intangible Heritage of Humanity. This designation highlights its global cultural significance and underscores its strategic importance in reinforcing national identity and advancing cultural diplomacy [5], [6]. Cultural heritage recognition of this nature has been widely

acknowledged as a catalyst for safeguarding traditional arts while simultaneously opening opportunities for socio-economic development through cultural tourism and creative industries [7], [8].

This global recognition was further reinforced in 2024 when Wukirsari Village was designated as one of the 55 Best Tourism Villages in the World by the United Nations World Tourism Organization (UNWTO). This award signifies that Wukirsari has evolved beyond a traditional craft production center into a cultural tourism destination with strong global appeal, community participation, and heritage-based innovation [9]. Previous studies have emphasized that tourism villages rooted in local culture and creative industries can significantly contribute to rural development, community empowerment, and cultural sustainability when supported by appropriate governance and innovation strategies [10], [11]. Accordingly, the recognition of Wukirsari reflects the substantial potential of culture-based creative industries to generate economic value while preserving cultural identity [12].

Despite these achievements, the *wayang kulit* craft industry continues to face structural challenges that limit its growth and competitiveness. Production processes remain heavily dependent on manual techniques, resulting in limited production capacity, longer production cycles, and inconsistent product quality. In the context of contemporary creative industries that prioritize efficiency, precision, and product diversification, such traditional methods present significant competitive constraints [13], [14]. Furthermore, design innovation within *wayang kulit* craftsmanship tends to stagnate, as many artisans rely primarily on hereditary patterns that have been preserved for generations. While cultural continuity is essential, excessive dependence on traditional designs may restrict adaptability to dynamic market demands, particularly among global consumers who increasingly value uniqueness, innovation, and sustainability [15], [16].

Challenges in business management further exacerbate these limitations. Numerous artisans continue to manage their enterprises using conventional practices, often without systematic financial documentation or structured business planning. This condition constrains their ability to assess profitability, plan long-term investments, or access external financial support [17], [18]. In addition, marketing activities for *wayang kulit* products remain largely dependent on tourist visits and periodic art exhibitions, which are inherently seasonal and geographically limited. Such reliance restricts market expansion and undermines the sustainability of artisan incomes at national and international levels [19], [20].

Amid these challenges, the rapid development of digital technology and the creative economy presents new opportunities for traditional artisans. The adoption of laser cutting technology, for example, has been shown to significantly enhance production efficiency and precision—by up to 50% compared to fully manual methods—while maintaining artistic quality [21], [22]. Moreover, the utilization of graphic design software such as CorelDRAW, Adobe Illustrator, and CAD expands opportunities for innovative design development [23], [24].

Beyond production, digital transformation is equally crucial in improving business management practices. The implementation of application-based systems, including Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM), has been widely recognized as an effective strategy for enhancing operational efficiency, strengthening customer relationships, and ensuring transparent financial management within small and medium-sized enterprises [25], [26].

From a marketing perspective, digital strategies have become increasingly decisive in expanding market reach. The effective use of social media, e-commerce platforms, and integrated branding strategies enables traditional craft products to penetrate global markets beyond physical tourism channels [19], [27]. In addition, modern and attractive product packaging plays a critical role in enhancing perceived value, strengthening brand identity, and increasing competitiveness in international markets [28].

The community engagement program designed by the university team seeks to address these multidimensional challenges through close collaboration with artisans and relevant stakeholders. Furthermore, this initiative aligns with global and national development agendas, particularly the Sustainable Development Goals (SDGs) [29], as well as national higher education and research policy frameworks [30].

COMMUNITY SERVICE METHODS

This community engagement program adopts a participatory and collaborative approach involving a university-based team, *wayang kulit* artisans in Wukirsari Village, village government representatives, and other relevant stakeholders. Recent studies emphasize that participatory community engagement is essential for ensuring ownership, capacity building, and long-term sustainability of development programs, particularly in culture-based creative industries [1], [2]. Accordingly, the program is designed not merely as a technology transfer initiative, but as a comprehensive empowerment process aimed at strengthening artisans' autonomy in technology utilization, business management, and sustainable digital marketing practices [3].

1. Preparation and Needs Assessment

The program commenced with field surveys and in-depth interviews to identify key challenges related to production processes, business management, and marketing practices. Needs assessment is widely recognized as

a critical foundation for effective community-based interventions, as it ensures that solutions are context-sensitive and aligned with local capacities [4], [1].

The assessment focused on:

• The condition and adequacy of production equipment used by artisans;
• Artisans' skill levels in digital design and production technology;
• Existing business management systems and financial record-keeping practices;
• Current marketing strategies and product distribution channels.

The findings from this assessment were used to design training modules, mentoring schemes, and appropriate technology solutions tailored to the specific needs and readiness of the artisans. Evidence-based program design has been shown to significantly improve technology adoption and program effectiveness in micro and small creative enterprises [2], [5].

2. Program Socialization

Figure 1. Socialization of the program with community partners

Program socialization was conducted through structured meetings with artisan groups, village government officials, and community leaders. This stage aimed to communicate program objectives, expected outcomes, and implementation mechanisms clearly. Recent literature highlights that early stakeholder engagement is critical for building trust, ensuring participation, and reducing resistance to change in community development programs [1], [2]. Through this process, a shared commitment among stakeholders was established to support the successful implementation of the program.

3. Training and Technology Transfer

Training activities were implemented through hands-on and practice-oriented workshops, consistent with contemporary adult learning and skills development approaches that emphasize experiential learning and immediate application [3]. The training covered three core components:

a. Production Technology

Artisans received training on the operation of laser cutting machines to enhance efficiency, precision, and consistency in *wayang kulit* production. Recent studies indicate that laser cutting technology can significantly improve productivity in traditional craft industries while preserving artistic value when appropriately integrated [4], [5]. In addition, artisans were trained to use graphic design software such as CorelDRAW, Adobe Illustrator, and CAD to diversify product designs. Production simulations were conducted to reinforce skills and build confidence in technology adoption.

b. Digital Business Management

Digital business management training focused on the implementation of simplified Enterprise Resource Planning (ERP) systems to support inventory management, production planning, and distribution. Recent research shows that ERP adoption in micro and small enterprises improves operational efficiency, data accuracy, and decision-making capacity [6], [7]. Furthermore, Customer Relationship Management (CRM) tools were introduced to strengthen customer engagement and retention, particularly in online markets. Training in application-based financial recording was provided to enhance transparency and financial accountability, which are essential for long-term business sustainability [5].

c. Digital Marketing and Packaging

Digital marketing training emphasized branding strategies and product identity development, recognizing branding as a critical factor in competitiveness within creative industries [8]. Artisans were trained to utilize social media platforms (Instagram, TikTok, and Facebook) and e-commerce platforms (Shopee, Tokopedia, and Etsy) to expand market reach beyond local tourism. Additionally, product packaging innovation was introduced to align with national and international market standards, as recent studies confirm that packaging design significantly influences perceived value and consumer purchasing decisions in global online markets [9], [3].

4. Intensive Mentoring

Following the training phase, intensive mentoring was conducted to ensure effective application of newly acquired skills. Continuous mentoring has been identified as a key success factor in sustaining digital transformation and behavioral change among micro-entrepreneurs [10], [5]. Mentoring activities included technical assistance in operating laser cutting machines, design consultations integrating traditional values with contemporary market trends, supervision of business management practices, and support for digital marketing implementation such as online store setup and promotional content development.

5. Monitoring and Evaluation

Monitoring and evaluation were carried out periodically to assess technology adoption, business management effectiveness, and digital marketing performance. A results-based evaluation framework was applied, consistent with recent development program evaluation standards [11]. Key indicators included:

• Improvements in production efficiency and precision;
• The number of new product design variations developed;
• The level of digital management system adoption;
• Sales growth through digital platforms;
• Artisans' participation and satisfaction levels.

Evaluation outcomes were used to provide feedback to artisans and to refine strategies aimed at ensuring program continuity and scalability.

6. Sustainability Plan

To ensure sustainability beyond the program period, a structured sustainability plan was developed. This included the establishment of a joint business group (*Kelompok Usaha Bersama*—KUB) to facilitate collective production and shared resources, consistent with recent cooperative-based development models [12]. Partnerships with local government institutions and tourism authorities were strengthened to expand market access and institutional support. Furthermore, the university committed to ongoing support through teaching factory initiatives and student entrepreneurship programs. The preparation of young artisans as innovation cadres was prioritized to ensure intergenerational continuity of technological adoption and digital marketing development in Wukirsari Village [10], [3].

RESULTS AND DISCUSSION

1. Improvement of Production Efficiency through Laser Cutting Technology

Figure 2. Laser cutting–based production process

The implementation of laser cutting machines had a significant impact on the *wayang kulit* production process. Prior to the program, artisans required an average of 3–4 hours to complete a single puppet figure using manual techniques. Following the adoption of laser cutting technology, production time was reduced to approximately 1.5–2 hours, accompanied by a substantially higher level of precision. Evaluation results indicate an efficiency increase of up to 50%. In addition, the cutting quality became neater and more consistent, thereby minimizing production errors that frequently occurred with manual methods.

Another notable outcome was the increase in production capacity. With enhanced technical skills, artisans were able to meet higher demand volumes, both for tourist consumption and customized orders from collectors. This improvement directly supports the program's objective of enhancing product competitiveness in national and international markets.

2. Design Diversification through Graphic Design Software

Figure 3. Training in wayang design and packaging development

The utilization of graphic design software, including CorelDRAW, Adobe Illustrator, and CAD, facilitated the development of more innovative *wayang kulit* designs. Before the training, most artisan-produced designs focused primarily on classical characters using inherited, traditional patterns. After the training, design variations increased by approximately 30–50%, including the development of contemporary motifs that integrate traditional elements with modern aesthetics.

These results demonstrate a process of co-creation between tradition and innovation. Artisans were able not only to preserve the philosophical values embedded in *wayang kulit* but also to adapt their products to global consumer preferences, particularly in the form of souvenirs, merchandise, and decorative artworks.

3. Optimization of Digital Business Management

Figure 4. Business management capacity-building program

The implementation of simplified ERP- and CRM-based applications resulted in tangible improvements in business governance. Artisans who previously lacked systematic financial records are now able to generate sales reports, manage raw material inventories, and monitor cash flow more effectively.

Furthermore, the CRM system enabled artisans to establish stronger communication with customers, particularly repeat buyers and international clients. Through improved customer data management, purchase history tracking, and after-sales service strategies, artisans demonstrated a more professional approach to customer relationship management. In the long term, this contributes to increased consumer trust and higher potential for repeat purchases.

4. Strengthening Digital Marketing and Product Packaging

Figure 4. Digital marketing training

Digital marketing emerged as one of the most prominent outcomes of the program. Prior to the intervention, artisans' sales relied heavily on tourist visits and art exhibitions. Following the training, most artisans successfully

established online stores on e-commerce platforms such as Shopee, Tokopedia, and Etsy, as well as business-oriented social media accounts on Instagram, Facebook, and TikTok.

Initial evaluations indicate an increase in online sales of up to 30% compared to the pre-program period. Additionally, artisans' skills in creating promotional content—including product photography, short videos, and branding narratives—improved significantly. More modern and visually appealing product packaging further supported digital marketing success by enhancing aesthetic value and strengthening competitiveness in global markets.

CONCLUSION

The community engagement program implemented in Wukirsari Village, Bantul, Yogyakarta demonstrates that the integration of modern technology, digital business management optimization, and digital marketing strategies can generate tangible improvements in the competitiveness of culture-based creative industries. The implementation results indicate that:

1. **Production efficiency increased significantly** through the use of laser cutting technology, reducing production time by up to 50% while enhancing precision, consistency, and aesthetic quality. This directly improved production capacity and the ability to meet larger market demands.
2. **Design diversification expanded substantially** through the use of graphic design software such as CorelDRAW, Adobe Illustrator, and CAD. Artisans achieved a 30–50% increase in design variations by combining traditional values with modern elements, making products more adaptable to global market needs.
3. **Business management became more professional** through the adoption of digital management systems, including ERP, CRM, and modern financial recording. Artisans gained skills in inventory control, cash flow management, and customer relationship development, thereby improving transparency, efficiency, and business sustainability.
4. **Digital marketing strategies successfully expanded market reach** through social media, e-commerce platforms, and innovative product packaging. Artisans who previously depended solely on tourist visits were able to reach national and international consumers, achieving online sales growth of up to 30%.
5. **Key challenges**, including limited digital literacy among some senior artisans and restricted access to high-quality raw materials, were identified. However, through sustained mentoring and the empowerment of young artisans as innovation cadres, these challenges can be addressed progressively.

In conclusion, the adoption of laser cutting technology, digital management systems, and modern marketing strategies not only enhances artisans' welfare but also strengthens Wukirsari Village's position as a highly competitive, culture-based creative industry hub. More broadly, this success demonstrates that the integration of traditional cultural preservation and digital transformation can be achieved harmoniously, positioning Wukirsari as a sustainable community empowerment model in the digital era.

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ANALYSIS OF THE INFLUENCE OF ERGONOMIC DESIGN ON THE COMFORT OF USERS OF CABRETTA LEATHER CRAFT PRODUCTS WITH ECOPRINT TECHNIQUE

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Abstract. This study aims to analyze the influence of ergonomic design on the comfort of users of Cabretta leather craft products that use ecoprint techniques. The research method was carried out with a survey approach using a questionnaire that included five aspects of assessment, namely ergonomics, aesthetics, color strength, functionality, and general satisfaction. A total of 20 respondents were involved in filling instruments with a Likert scale of 1–5. The results showed that the ergonomics aspect obtained an average score of 4.2, aesthetics 4.6, color strength 4.1, functionality 4.4, and general satisfaction of 4.5. Overall, ecoprint plant-based leather craft products received a positive rating with a high level of satisfaction (mean total 4.4). These findings confirm that the implementation of ergonomic design not only contributes to user comfort, but also improves aesthetic aspects, color fastness, and functionality, thus impacting overall improved consumer satisfaction.

Keywords: ergonomic design, plant-based leather craftsmanship, ecoprint, user comfort, consumer satisfaction

INTRODUCTION

Leather craft products represent an important part of the creative industry that combines functionality, aesthetic value, and cultural expression. In recent years, the development of sustainable design and the use of environmentally friendly materials have become a central concern in the creative craft sector. One of the innovative techniques that reflects this trend is *ecoprint*—a natural dyeing method that utilizes pigments from plants through direct contact with the substrate surface, such as fabric or leather. The combination of *Cabretta leather*, which has fine grain and flexibility, with the *ecoprint* technique, offers new potential for developing eco-friendly and high-value leather crafts.

However, the attractiveness of a product cannot rely solely on visual aesthetics. For a product to be truly accepted by consumers, ergonomic aspects—such as shape conformity, ease of use, and comfort—play an essential role. Ergonomic design ensures that the product not only looks appealing but also provides functional comfort and reduces user fatigue during interaction. In leather crafts, especially those involving accessories or wearable items, the tactile quality and ergonomic form significantly influence user satisfaction. Yet, research linking ergonomic design with comfort perception in *Cabretta leather* crafts using *ecoprint* techniques remains limited.

Previous studies have mostly focused on material characteristics, such as the color fastness of natural dyes [1], [2], [3], [4], [5] or the sustainability aspects of *ecoprint* techniques [6], [7], [8], [9]. Meanwhile, ergonomic evaluation in craft-based design has often been explored from a functional or anthropometric perspective [10], but rarely integrated with aesthetic and material performance. Therefore, this study seeks to fill the research gap by analyzing the influence of ergonomic design on user comfort in *Cabretta leather* products decorated with *ecoprint* motifs.

The rationale for choosing *Cabretta leather* lies in its distinctive physical properties—soft texture, fine pore structure, and high elasticity—which make it suitable for detailed printing and comfortable for skin contact. When combined with *ecoprint*, *Cabretta* surfaces can capture natural plant patterns with impressive visual depth, creating products that are not only functional but also artistically expressive. Nonetheless, the ergonomic performance of these products must be empirically assessed to ensure that their design aligns with user expectations of comfort and usability.

This study aims to evaluate how ergonomic design influences user comfort and satisfaction in *Cabretta leather* crafts produced using *ecoprint* techniques. By employing a survey method with five assessment dimensions—

ergonomics, aesthetics, color strength, functionality, and general satisfaction—the study provides quantitative insight into how users perceive and experience these products. The findings are expected to contribute to the discourse on sustainable design, particularly in integrating ergonomic principles into eco-friendly leather craftsmanship. Moreover, the results may serve as a reference for artisans, designers, and researchers in developing innovative craft products that balance aesthetics, sustainability, and user well-being.

LITERATURE REVIEW

1. Ergonomic Design and User Comfort

Ergonomics is the science of designing products and systems that fit human capabilities and limitations to ensure safety, efficiency, and comfort [11], [12]. In the context of craft design, ergonomics concerns how form, proportion, and texture influence the ease and comfort of product use. Ergonomic design aims not only to prevent physical discomfort but also to improve the overall user experience, including perceptual and emotional satisfaction [13]. Therefore, ergonomic principles have become essential in the design of wearable or handheld products, such as bags, wallets, gloves, and other leather-based crafts.

2. Cabretta Leather as Craft Material

Cabretta leather is a fine-grained, soft, and strong type of sheepskin derived mainly from hair sheep. It is often used for gloves, footwear, and fashion accessories due to its smooth texture, elasticity, and excellent dye absorption [14]. These properties make it ideal for surface treatments such as *ecoprint*, allowing natural pigments from leaves or flowers to penetrate the collagen fibers effectively. The natural cream color of *Cabretta*—resulting from chrome tanning—provides a neutral base that enhances the visibility and clarity of *ecoprint* patterns.

3. Ecoprint and Sustainable Craft Practices

Ecoprint is a sustainable textile and leather coloring technique that uses natural pigments from plants without synthetic dyes or excessive chemical waste [15]. The process involves contact printing, where plant materials are placed directly on the substrate surface and steamed to transfer pigments and tannins. Compared to synthetic printing, *ecoprint* minimizes environmental impact while producing unique and non-repetitive patterns. Previous studies [2], [16], [17], [18], [19], [20] indicate that the quality of *ecoprint* outcomes depends on the type of plant, mordant, and substrate used. In this research, *Cabretta leather* was selected to explore its visual and tactile interaction with *ecoprint* pigments.

4. Integration of Ergonomics and Aesthetics in Craft Design

In the creative craft industry, especially leather-based products, ergonomic and aesthetic considerations are closely intertwined. A well-designed product must provide not only physical comfort but also visual and emotional appeal. According to Djelantik [21] and Dewey [22], aesthetic experience in craft objects arises from a balance between form, function, and sensory quality. When ergonomic design principles are applied effectively, they enhance the aesthetic appreciation by improving the user's perception of harmony and usability. Thus, the integration of ergonomics and aesthetics can significantly affect user satisfaction and product acceptance.

5. Conceptual Framework

Based on the reviewed literature, this study assumes that ergonomic design directly influences user comfort, and this comfort correlates positively with overall satisfaction. The study also considers aesthetic value, color strength, and functionality as supporting dimensions that shape user perceptions. Hence, the research integrates ergonomic theory with aesthetic and sustainable craft design principles to analyze *Cabretta leather* products with *ecoprint* techniques.

RESEARCH METHOD

1. Research Design

This study employed a quantitative descriptive design using a survey approach to measure user perceptions of ergonomic design and its relationship to comfort and satisfaction. The research focused on *Cabretta leather craft products* developed using the *ecoprint* technique. Data collection was conducted through a structured questionnaire containing five aspects of evaluation: ergonomics, aesthetics, color strength, functionality, and general satisfaction.

2. Population and Sample

The research involved 20 respondents who were potential users or craft product consumers aged 20–45 years. The sampling method used was purposive sampling, emphasizing respondents who had prior experience in evaluating or using handmade leather accessories, such as wallets, bags, or covers. The number of respondents was considered adequate for preliminary analysis of user satisfaction in design evaluation studies [23].

3. Research Instrument

The questionnaire used a **Likert scale** ranging from 1 (strongly disagree) to 5 (strongly agree). Each item was designed to capture user perceptions of product comfort, visual appeal, color durability, and functionality. The

ergonomic indicators included aspects of grip comfort, proportion, and ease of use; aesthetic indicators focused on visual harmony and motif clarity; color strength indicators measured the visual durability of *ecoprint* motifs; functionality included practical usability; while general satisfaction reflected overall evaluation.
Before distribution, the questionnaire was reviewed by two design experts to ensure content validity and clarity of the items. Reliability testing from the pilot data produced a Cronbach's alpha coefficient of 0.86, indicating that the instrument was reliable.

4. Data Collection and Analysis

Data were collected through Google Forms and then processed using Microsoft Excel and SPSS. Descriptive statistics (mean, percentage, and standard deviation) were used to describe user responses for each aspect. The relationships among variables—particularly between ergonomic design and user satisfaction—were analyzed using Pearson correlation. The results were interpreted to determine how ergonomic considerations contribute to comfort, perceived color quality, and functional satisfaction.

5. Research Ethics

All participants voluntarily participated and provided informed consent. No personal identifying data were collected, and all responses were treated confidentially for academic purposes only. This study was conducted in accordance with the ethical principles of research involving human participants.

RESULTS AND DISCUSSION

1. Descriptive Results of User Assessment

The assessment of Cabretta leather craft products produced using the ecoprint technique was conducted through a questionnaire distributed to 20 respondents. The evaluation focused on five main aspects: ergonomics, aesthetics, color strength, functionality, and overall satisfaction. Respondents rated each aspect on a 5-point Likert scale ranging from 1 (very poor) to 5 (excellent).

(a) (b) (c)

FIGURE 1. Cabretta leather craft products created using the ecoprint technique with natural plant dyes and ergonomic design considerations: (a) sling bag, (b) pouch, (c) bifold wallet.

TABLE 1. Descriptive Statistics of User Evaluation Scores

Aspect	Mean	SD	Interpretation
Ergonomics	4.2	0.7	Very good – comfortable design
Aesthetics	4.6	0.5	Excellent – visually appealing
Color Strength	4.1	0.6	Good – natural color tone
Functionality	4.4	0.6	Very good – easy to use
Overall Satisfaction	4.5	0.5	High satisfaction

Source: Processed primary data, 2025.

The quantitative results show generally positive perceptions of Cabretta leather products made using the ecoprint technique. The overall mean score of 4.36 indicates that users perceive the products as comfortable, aesthetically pleasing, and functionally effective. Among these aspects, aesthetics achieved the highest score (4.6), highlighting the strong visual appeal of ecoprint motifs on Cabretta leather. Conversely, color strength obtained the lowest score (4.1), implying that users may perceive slight fading or inconsistency in long-term color durability.
These results confirm that ergonomic design significantly supports comfort and usability [24], [25], [26]. The use of natural dyes fixed with mordants such as alum, lime, and iron sulfate provided adequate color retention under normal use [27], [28], [29], [30]. Functionality (4.4) and overall satisfaction (4.5) scores also demonstrate that the combination of ergonomic form, aesthetic value, and durable coloration enhances user experience holistically [22], [24], [31].

2. Relationship between Ergonomics and User Satisfaction

The findings indicate a clear and positive relationship between ergonomic design and user satisfaction in Cabretta leather craft products made with the ecoprint technique. Respondents who rated the ergonomic aspect highly also tended to express greater overall satisfaction, suggesting that comfort and usability strongly influence the user's perception of product quality.

Products with well-proportioned shapes, smooth finishing, and comfortable grip were particularly appreciated for their user-friendly design. The softness and flexibility of Cabretta leather contributed to a pleasant tactile experience, while its light weight enhanced ease of handling during daily use. These ergonomic qualities reinforced feelings of comfort and practicality, which directly affected users' emotional and aesthetic responses.

This tendency aligns with the ergonomic design principles proposed by Helander [32] and Norman [13], who emphasize that products designed to fit human physical and sensory needs can increase comfort, usability, and emotional attachment. In this context, ergonomic considerations not only support functional aspects but also strengthen the aesthetic and affective value of the product, leading to higher user satisfaction.

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3. Aesthetic and Color Evaluation

The aesthetic aspect received the highest mean score (4.6), indicating that the ecoprint technique on Cabretta leather successfully created products that were visually appealing and artistically distinctive. Respondents described the resulting motifs as *natural, organic, and harmonious*, with each piece showing a unique pattern that reflected the natural forms of the leaves used. This visual uniqueness is a key factor in the attractiveness of handcrafted products, aligning with Dewey's [22] view that aesthetic experience emerges from the harmony between material, process, and perception.

The color appearance also played an important role in shaping the aesthetic appeal. Variations in mordant type—alum, iron sulfate, and lime produced distinct tonal outcomes. Alum generated bright and clean color tones, iron sulfate deepened the hue with stronger contrast, while lime created softer and muted tones. Such diversity was perceived by users as an element of *artistic richness* and *natural authenticity*, emphasizing the handmade character of the ecoprint process.

(a) (b) (c)

FIGURE 2. Ecoprint results on Cabretta leather using three mordants: (a) alum – bright tone, (b) iron sulfate – dark contrast, and (c) lime – soft muted tone.

However, the color strength aspect, with a mean score of 4.1, suggests that although the tones were visually pleasing, their durability could be further improved. Some respondents noted that natural colors tend to fade slightly over time, especially with frequent exposure to light or washing. This observation aligns with Guo et al. [33] and Zhou et al. [34], who reported that natural dye performance on protein-based substrates like leather is influenced by mordant bonding and fiber porosity.

In summary, the ecoprint process on Cabretta leather achieved a strong aesthetic response due to its organic visual character and natural color palette. Yet, improving mordant fixation and UV resistance could further enhance color stability, supporting both the aesthetic and functional longevity of the product.

4. Functional and Emotional Value

From a functional perspective, Cabretta leather craft products made with the ecoprint technique received a high mean score of **4.4**, indicating that users found them easy to use, durable, and adaptable to various contexts of daily life. Respondents emphasized that the products not only fulfilled their functional role as accessories or fashion items but also maintained comfort and usability—key indicators of ergonomic success. The soft and flexible nature of Cabretta leather contributed to ease of handling, while its lightweight character made the products suitable for prolonged use without discomfort.

The ergonomic attributes, such as balanced proportions, smooth surface finishing, and appropriate material thickness, were identified as major contributors to this functionality. These qualities are consistent with Helander's [32] ergonomic design principles, which emphasize harmony between physical comfort, task efficiency, and user

interaction. The results therefore demonstrate that ergonomically designed handmade products can achieve both *practical efficiency* and *aesthetic refinement*, bridging art and usability [13].
Beyond practical performance, respondents also expressed a strong **emotional connection** to the products. Many associated the natural colors and organic motifs of ecoprint with a sense of calmness, authenticity, and environmental awareness. This emotional resonance supports Dewey's [22] concept of *art as experience*, wherein aesthetic appreciation extends to personal meaning and sensory satisfaction. Furthermore, the use of natural dyes and manual craftsmanship enhanced the perceived ethical and cultural value of the products, aligning with the principles of sustainable creativity described by Throsby [35] and Howkins [36].
In this context, the functional and emotional dimensions of the Cabretta ecoprint crafts are intertwined—ergonomic comfort amplifies aesthetic enjoyment, while ecological awareness deepens emotional satisfaction. This synthesis of usability, beauty, and sustainability positions ecoprint Cabretta leather as a contemporary example of *green craftsmanship*, reflecting innovation grounded in cultural and ecological consciousness.

5. Summary of Findings

This study analyzed the influence of ergonomic design on the comfort and satisfaction of users of Cabretta leather craft products made using the ecoprint technique. Quantitative data from 20 respondents indicated consistently positive evaluations across five aspects: ergonomics (mean = 4.2), aesthetics (mean = 4.6), color strength (mean = 4.1), functionality (mean = 4.4), and overall satisfaction (mean = 4.5). The results reveal that users perceived these products as visually appealing, comfortable, and highly functional.
The aesthetic dimension emerged as the most dominant factor influencing satisfaction, reflecting the strong appeal of natural patterns and hues produced by plant-based dyes and eco-friendly mordants. The ergonomic design aspects also showed a significant positive relationship with user satisfaction, confirming that comfort, proportion, and material flexibility play essential roles in enhancing user experience. While color strength received slightly lower scores, it still indicated good performance and suggested opportunities for technical improvement in dye fixation and UV resistance.
Overall, the findings confirm that the integration of ergonomic design principles and ecoprint techniques results in sustainable craft products that combine functionality, aesthetic quality, and environmental responsibility. Cabretta leather—when treated through natural dyeing and careful design—demonstrates high potential for development within the creative and sustainable fashion industries. The study thus contributes to the growing discourse on *eco-ergonomic design*, highlighting how user-centered approaches can harmonize artistic value, comfort, and sustainability in modern craftsmanship.

CONCLUSION

This study concludes that the ergonomic design of Cabretta leather craft products using the ecoprint technique has a significant positive influence on user comfort and satisfaction. The quantitative results show that users highly appreciate the product's visual appeal (mean 4.6), ergonomic comfort (mean 4.2), and functional performance (mean 4.4), leading to an overall satisfaction mean of 4.5. The aesthetic aspect was identified as the dominant factor shaping positive perceptions, while the ergonomic form strengthened comfort and usability. Although color strength (mean 4.1) performed slightly lower, it remained within a good category, indicating potential for technical enhancement in mordanting and fixation stages. These findings emphasize that integrating ergonomic principles with sustainable techniques such as ecoprint can produce environmentally friendly leather craft products that are both functional and artistically valuable. Consequently, Cabretta leather ecoprint products hold strong potential as eco-conscious innovations in the creative craft and fashion industries.

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COMMUNITY-BASED CREATIVE CAPACITY BUILDING FOR BATIK ARTISANS THROUGH FASHION DESIGN AND PATTERN TRAINING IN KEBON VILLAGE, KLATEN

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Abstract: The batik industry in Kebon Village, Bayat District, Klaten Regency plays an important role in sustaining local cultural identity and the community-based creative economy. However, artisans face challenges related to motif saturation, limited design innovation, and difficulties in integrating motifs into fashion patterns. This community service program aimed to enhance artisans' creative capacity through fashion-oriented batik design and pattern training. A participatory approach was employed, including needs assessment, design workshops, hands-on practice, and mentoring, involving 20 batik artisans. The results show improvements in artisans' understanding of motif composition, pattern placement, and creative design development, resulting in more varied and market-oriented batik products. These findings demonstrate that community-based design training can serve as an effective educational innovation to strengthen artisans' skills, support sustainable cultural practices, and enhance long-term community empowerment and product competitiveness.

Keywords: community service; batik artisans; design training; creative capacity building; educational innovation

INTRODUCTION

Batik is one of Indonesia's most important cultural heritages, representing both local identity and a source of livelihood for many communities. In Kebon Village, Bayat District, Klaten Regency, batik craftsmanship plays a vital role in sustaining community-based creative industries. Despite its cultural and economic significance, local artisans face challenges such as motif repetition, limited design innovation, and difficulties in applying motifs to contemporary fashion products, which reduce market competitiveness [1], [2].

To address these challenges, educational interventions and training programs are critical. Community-based design training offers a participatory and practical approach that enables artisans to enhance their technical skills, explore new motifs, and understand the interaction between motif design and garment structure [3], [4]. Such programs not only improve design literacy but also strengthen artisans' capacity to produce market-relevant and aesthetically coherent batik products.

Recent studies indicate that hands-on training combined with mentoring and reflective evaluation can significantly increase artisans' creativity and motivation, fostering sustainable cultural practices while supporting economic empowerment [5], [6], [7]. Despite these findings, few programs systematically integrate motif innovation, fashion pattern application, and participatory learning in a structured model tailored for artisan communities.

This community service program aims to enhance the creative capacity of batik artisans in Kebon Village through training focused on batik motif design and fashion-oriented pattern placement. By employing a participatory and practice-oriented approach, the program seeks to develop a replicable training model that strengthens both skill development and market relevance, contributing to sustainable cultural and economic empowerment.

LITERATURE REVIEW

1. Batik as Cultural Heritage and Creative Economy

Batik is a significant cultural heritage of Indonesia, representing local identity while supporting community-based creative economies. In villages such as Kebon Village, Bayat District, Klaten Regency, batik craftsmanship not only sustains cultural traditions but also contributes to local livelihoods through small-scale creative industries

[1], [2]. However, artisans face challenges including motif repetition, limited design innovation, and difficulties in adapting motifs to contemporary fashion patterns, which can reduce product competitiveness and market relevance.

2. Creative Capacity Building and Participatory Training

Recent research highlights the importance of capacity-building programs to enhance artisans' skills and creativity. Structured training that combines theory, hands-on practice, and mentoring can improve design literacy, stimulate innovation, and enable artisans to create market-oriented products [3], [4]. Such approaches help artisans explore new motif variations, including geometric, abstract, and modernized designs, beyond traditional flora patterns [5], [6].

3. Community-Based Education for Empowerment

Community-based educational interventions function as informal learning systems, promoting knowledge transfer, skill acquisition, and community empowerment. By engaging artisans as active participants, these programs increase motivation, creativity, and ownership of the learning process [4], [7]. Participatory approaches also enable the integration of local knowledge and cultural values into training, fostering sustainable practices that respect artisanal traditions.

4. Integration of Motif Design and Fashion Applications

Training that links motif innovation with fashion pattern application enhances artisans' awareness of market trends and product relevance. Understanding how motifs interact with garment structures allows artisans to produce aesthetically coherent and commercially viable batik products [3]. This integration strengthens both cultural preservation and economic competitiveness, aligning craft production with the objectives of the creative economy.

5. Gap and Rationale for the Study

Although prior studies demonstrate the effectiveness of participatory and practice-oriented training, few examine programs that systematically combine needs assessment, design innovation, hands-on practice, and reflective evaluation for batik artisans. This gap highlights the significance of the current program, which seeks to develop a replicable community-based batik design training model that enhances creative capacity, market relevance, and sustainable cultural empowerment.

METHOD OF COMMUNITY SERVICE

This community service program applied a participatory and educational approach, positioning local batik artisans as active partners in the learning process. The program was conducted in Kebon Village, Bayat District, Klaten Regency, involving 20 artisans engaged in batik production and interested in enhancing their design and fashion-related skills [3], [4].

The program consisted of three main stages: preparation and needs assessment, implementation through participatory training workshops, and evaluation with follow-up mentoring to support sustainable batik production.

1) Preparation and Needs Assessment

- Conducted informal interviews and group discussions with the Kebon Batik Association to identify skill gaps, motif preferences, and market challenges.
- Developed training materials focusing on:
  - Motif innovation beyond traditional flora patterns
  - Basic design principles (composition, balance, color harmony)
  - Pattern placement for fashion-oriented products

This stage ensured the program aligned with community needs and supported sustainable livelihoods [5].

2) Implementation (Training Workshops)

- Theoretical Sessions: Introduction to design principles, contemporary motif trends, and motif composition.
- Practical Workshops: Hands-on practice in sketching motifs, arranging patterns on garment templates, and visualizing designs on fabric.
- Continuous Mentoring: Ongoing guidance to support skill development and creative experimentation.

This approach fostered creativity and skill acquisition through collaborative, hands-on learning.

3) Evaluation and Follow-Up Mentoring

- Evaluation: Direct observation, review of participants' design outputs, and reflective group discussions.
- Follow-Up Mentoring: Assistance in applying acquired skills in ongoing batik production.

This stage ensured sustainable application of skills and strengthened market-oriented batik production.

Data Collection and Analysis

- Qualitative data were collected from observations, participant feedback, and design artifacts.
- Content and thematic analysis were used to identify improvements in design knowledge, creativity, and fashion-oriented application, informing the Community-Based Batik Design Training Model.

Ethical Considerations

- Participation was voluntary, with informed consent obtained.
- Artisans were treated as co-creators, respecting their cultural knowledge and creative autonomy [7].

Figure 1. Stages of The Batik Design Training Program

RESULTS AND DISCUSSION

1. Program Implementation and Participation

The community-based batik training program was implemented successfully with active participation from all 20 artisans. Participants were engaged in theoretical sessions, hands-on workshops, and continuous mentoring, showing strong motivation to improve design skills and apply batik to fashion-oriented products. The participatory approach supported collaborative learning and peer feedback, consistent with previous studies on community-based craft education [3], [4].

2. Improvements in Design Knowledge

The training resulted in notable improvements in artisans' design competencies. Participants demonstrated better understanding of motif balance, composition, and aesthetic coherence on garments. They also learned effective motif placement aligned with garment structure and visual flow. Creativity expanded beyond traditional floral motifs to include geometric, abstract, and contemporary variations. These outcomes indicate that experiential, practice-based learning effectively enhances design skills in non-formal craft education contexts [5], [6].

3. Market Awareness and Product Relevance

The program increased artisans' awareness of market-oriented design. Participants were able to align motif development with current fashion trends, improving product relevance and commercial potential. The integration of batik motifs with fashion patterns enhanced product appeal while maintaining cultural authenticity. Artisans reported increased confidence in producing contemporary items such as scarves, dresses, and accessories, supporting findings by Darmaningrum et al. [7].

4. Community-Based Batik Design Training Model

Based on observations and participant outputs, a replicable training model was formulated, consisting of four interconnected stages: (1) needs assessment, (2) participatory design learning, (3) practice-oriented mentoring, and (4) reflective evaluation. The model emphasizes active participation, contextual learning, and the integration of creative skills with market relevance. This approach aligns with best practices in artisan empowerment and creative capacity building [3], [4].

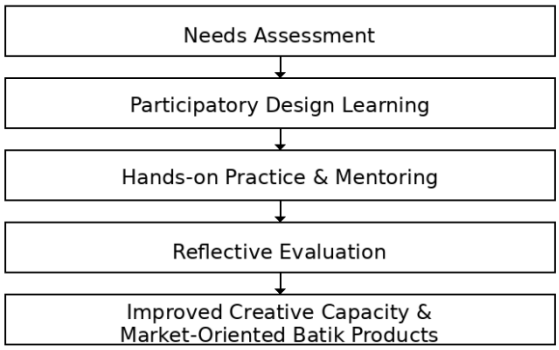

Figure 2. Community-Based Batik Design Training Model

The model can be replicated in other craft communities facing similar challenges, particularly those seeking to enhance creative capacity through educational interventions. By positioning artisans as learners and co-creators, the model supports sustainable skill development and cultural continuity.

5. Sustainability and Long-Term Impact

The program contributed to skill sustainability, creative innovation, and strengthened collaboration between the university and the local artisan community. Artisans continued to apply newly acquired techniques in batik production, supporting cultural preservation and local economic development. In addition, the training enhanced artisans' motivation and confidence in developing new motifs and applying designs to fashion-oriented products. Planned follow-up activities, including integration with production processes and digital marketing, aim to ensure long-term impact. These findings indicate that structured, community-based training can function as a sustainable educational model for creative capacity building and meaningful university–community engagement.

CONCLUSION

This community service program demonstrates that batik design and fashion-oriented pattern training represents an effective educational innovation for enhancing artisans' creative capacity. Through participatory learning and hands-on mentoring, artisans in Kebon Village improved their design skills, creativity, and understanding of fashion-based batik production. The proposed community-based training model highlights the role of structured and contextual learning in supporting sustainable cultural industries and local economic empowerment. Future initiatives should integrate production and marketing components to strengthen long-term impact and replicability of design-based community service programs.

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From Surface to Depth: Systematic Literature Review on Deep Learning Models for Young Learners

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Abstract. This study investigates how deep learning is conceptualised and operationalised in early childhood education through existing pedagogical models. Using a systematic literature review, articles published between 2016 and 2025 were retrieved from Scopus, ProQuest, and ScienceDirect using the keywords "deep learning", "early childhood", and "pedagogy". After applying predefined inclusion and exclusion criteria and removing duplicates, 25 empirical and conceptual studies were retained for in-depth analysis. Data were extracted into an Excel matrix and analysed using descriptive mapping and thematic analysis. Four cross-cutting themes emerged: (1) the central role of teachers as designers of learning contexts, proactive facilitators, and co-learners; (2) play and contextual experiences—such as culturally grounded outdoor learning and school gardens—as key media for deep learning; (3) technology (coding toys, augmented reality, and AI-based assessment) as a trigger rather than a goal for deep learning; and (4) engagement and involvement as proximal indicators of deep learning processes in young children. The review concludes with a conceptual model of deep learning pedagogy for early childhood that integrates these four dimensions and offers implications for curriculum design, teacher professional development, and future empirical research.

Keywords: deep learning, early childhood education, preschool teacher

INTRODUCTION

The deep learning instructional model in education refers to an approach that emphasises meaning-making, conceptual connectedness, and critical reflection, in contrast to surface learning, which focuses only on memorisation and short-term task completion [1], [2]. In early childhood education, deep learning is understood as a learning process that actively engages children cognitively, emotionally, and socially through meaningful experiences, problem solving, and connections with real-life contexts, so that knowledge is not merely recalled but genuinely understood [3], [4]. The urgency of implementing deep learning is increasing in the twenty-first century, which requires the development of critical thinking, creativity, collaboration, and communication from an early age; hence, procedural and teacher-centred instruction is no longer sufficient [2], [5]. Recent studies also indicate that deep learning approaches play an important role in building intrinsic motivation and learner autonomy, which form the foundation of children's long-term learning readiness [1], [6]. This conceptual understanding provides the basis for further examining the concrete benefits of deep learning for young children's development.

The implementation of deep learning-based instruction in early childhood has been shown to offer multiple benefits for children's holistic development, encompassing cognitive, social, emotional, and moral domains [7]. Experimental studies in preschool classrooms report that learning models designed according to deep learning principles such as meaningful play, problem solving, and structured reflection enhance children's engagement and conceptual understanding compared with traditional, routine, and product-oriented models. Other research finds that such approaches increase children's ability to connect knowledge with everyday experiences and foster higher-order thinking skills, such as classifying, comparing, and explaining reasons. In the early childhood context, deeply designed learning through traditional and thematic play activities has been shown to nurture joyful, meaningful, and mindful learning, contributing to socio-emotional development and children's self-regulation [8], [9]. However, these positive findings are not yet fully reflected in everyday early childhood classroom practice.

Despite the recognised potential and benefits of deep learning, instructional practices in many early childhood settings still tend to run counter to its core characteristics [5]. Teaching is often dominated by worksheets and copying tasks, so children engage more in routine, product-oriented activities than in exploration, questioning, and independent meaning-making. In addition, play activities including traditional games are frequently not planned as meaningful learning experiences and function merely as time fillers rather than as vehicles for integrating cognitive, social, emotional, and value dimensions through deep learning experiences . A culture of teaching to the test and an emphasis on administratively meeting developmental indicators also remain strong, leading teachers to prioritise portfolios and written outputs over children's thinking processes and reflective dialogue.

Furthermore, interaction patterns in many early childhood classrooms remain predominantly teacher-centred and one-way, limiting children's opportunities to pose questions, test ideas, and relate learning experiences to their own life contexts. The integration of technology and learning media is likewise often superficial, for example through merely playing videos or showing images without designing activities that promote analysis, exploration, and knowledge reconstruction by children. These conditions reveal a substantial gap between the ideals of deep learning and the realities of early childhood classroom practice, signalling the need for systematic efforts to design instructional models that explicitly accommodate deep learning experiences for young children.To date, numerous studies on deep learning in education have been conducted, yet most focus on primary, secondary, and higher education levels and on the integration of technology and data mining rather than on the development of pedagogical models for early childhood education [1], [10]. Literature reviews show that the term "deep learning" is often used in the context of artificial intelligence and educational data mining to analyse learning data and predict student performance, so the pedagogical dimension of meaningful learning processes has received less attention [11]. At the same time, studies at the primary level conceptualise deep learning as an approach that promotes knowledge integration, problem solving, and character development, but their focus remains limited to specific subjects and does not address early childhood contexts in detail.

Research that specifically examines or develops deep learning instructional models for young children is still scarce, although there are early initiatives for example, using traditional games to facilitate joyful, meaningful, and mindful learning [8], [9]. Therefore, the novelty of this study lies in its effort to formulate a deep learning instructional model explicitly designed for early childhood by integrating deep versus surface learning concepts from international scholarship with contemporary realities of early childhood practice. Unlike previous research that has emphasised technology or higher educational levels, this study focuses on constructing a conceptual model that outlines principles, components, and operational steps of deep learning pedagogy that can be implemented by early childhood teachers in the Indonesian context [3], [4]. Consequently, the study is expected to fill a gap in the literature on deep learning pedagogy in early childhood education and to provide a foundation for policy development, teacher training, and innovation in early childhood classroom practice.

Based on this background, the study aims to (1) identify and synthesise concepts, characteristics, and indicators of deep learning that are relevant for young children based on recent international research; (2) map key problems in early childhood instructional practice that hinder the realisation of deep learning at the planning, implementation, and assessment stages; and (3) formulate a conceptual model of deep learning instruction that is contextualised to the needs and realities of early childhood settings. To achieve these aims, the study employs a systematic literature review (SLR) method, analysing English-language international journal articles published in the last ten years that discuss deep learning in pedagogical, early childhood, and meaningful learning contexts. The SLR process involves defining inclusion and exclusion criteria, searching indexed databases, screening articles, and conducting thematic analysis to produce a comprehensive synthesis as the basis for constructing a deep learning instructional model for early childhood education.

METHOD

This study employed a Systematic Literature Review (SLR) approach following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol to ensure reporting quality and rigour [12]. The SLR was chosen because it provides transparent, replicable access to the strengths and limitations of existing studies, identifies what is currently known, and reveals specific research gaps related to deep learning instructional models in early childhood education.

Eligibility Criteria (Inclusion/Exclusion Criteria)

The review included studies that examined the characteristics of deep learning pedagogy and pedagogical approaches aimed at promoting meaningful learning in early childhood. Specific inclusion and exclusion criteria were developed to select relevant studies (Table 1). Three electronic databases were used to collect the data (Table 2). A search string was constructed to identify key terms in the early childhood education literature, using "deep learning" AND "early childhood" AND "pedagogy m

TABEL 1. Inklusi/Eksklusi Criteria

Criteria	Inclusion	Exclusion
Publication	2016-2025	Before 2016
Language	English	Non-Inggris
Topic	Deep learning pedagogy in ECE	Deep learning AI/teknology
Conteks	Children aged 3–6 years / ECE teachers	>6 tahun, higher
Digital Technology	Pedagogical approaches	Purely

TABEL 2. Database and Search String

Search Engine	n
Scopus	2
ProQuest	718
ScienceDirect	73
Total	793

TABEL 3. Weight of Evidence Criteria

Level	Methodological quality	Methodological relevance	Topical relevance
1 Excellent	Approaches and methods are excellent	Highly aligned with the research question	Highly relevant
2 Good	Good coherence between methodological elements	Aligned with the research question	Relevant
3 Satisfactory	Logically structured and broadly coherent	Generally aligned with the research question	Generally relevant
4 Inadequate	Unclear or weak methodological rationale	Not aligned with the research question	Does not address the research question

Search Strategy and Screening

The search strategy began with an initial exploratory search in Google Scholar, followed by a systematic search across four academic databases (Table 2). For all databases, the search strategy combined core keywords and relevant synonyms related to the research questions using Boolean operators. The screening process was conducted in two stages: an initial screening of titles and abstracts, followed by full-text screening (Figure 1). The primary author carried out the initial title/abstract screening, which was then validated by two independent reviewers. A random sample of 20 out of 70 articles was double-checked, yielding very high inter-rater reliability (Cohen's Kappa $\geq$ 0.8). To ensure the quality of the included studies, each article was appraised using weight-of-evidence criteria based on Gough (2007) [13].

Data Extraction and Analysis

Details of each study were recorded in an Excel spreadsheet, including: authors, country, year of publication, sample size and participants' age, research questions, duration, context, methodology, key findings, and notes. Two types of data analysis were used to organise and synthesise the relevant evidence. First, a descriptive analysis was conducted to map the characteristics of the studies, such as references, study focus, key points, and context. Second, thematic analysis was employed to cluster the data into codes and categories. Study content was systematically extracted and coded in line with the review questions, following the thematic analysis procedures outlined by Clarke and Braun (2014) [14]. This process involved iteratively scanning the literature for areas of interest related to the review questions and identifying potentially valuable emerging themes.

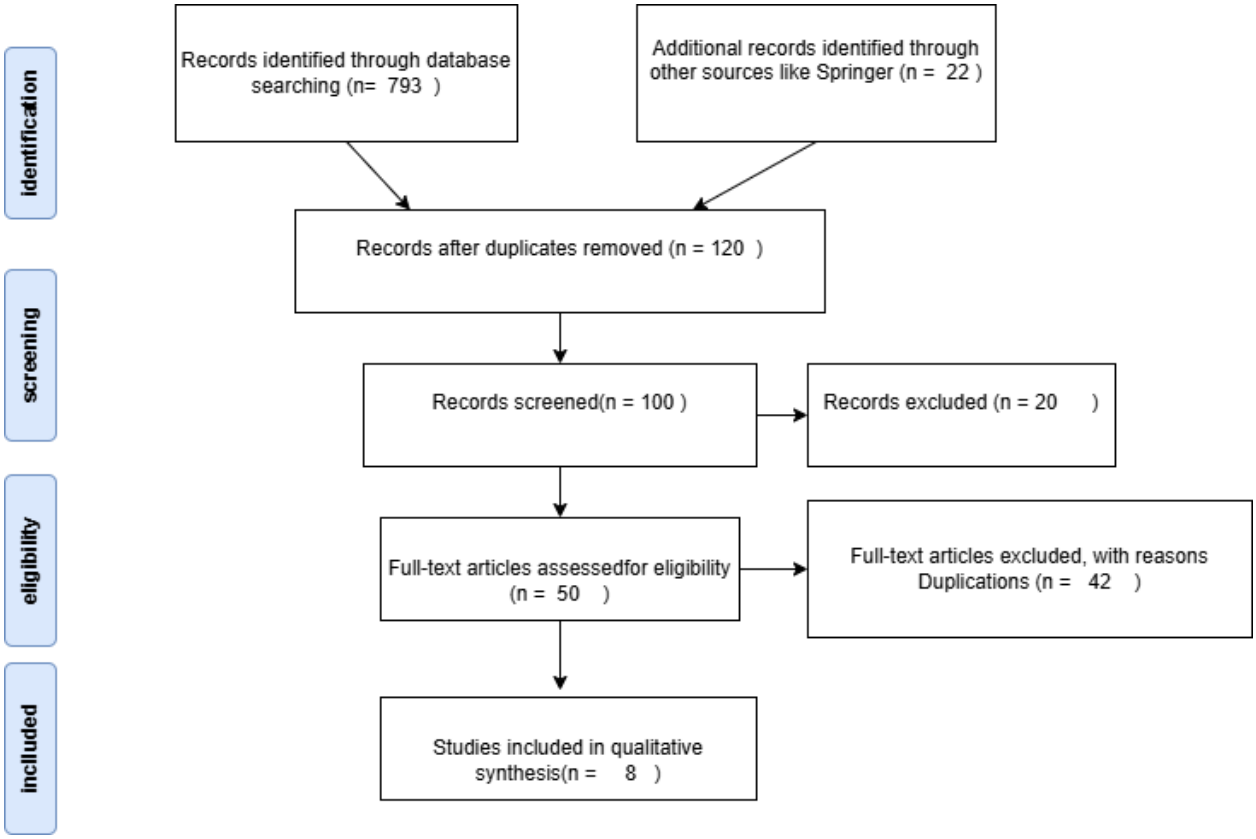

Figure 1. Screening Process

RESULT

Four main themes emerged from the eight articles: the role of teachers as facilitators of deep learning, play and contextual experiences as a medium for deep learning, technology as a trigger (rather than a goal) for deep learning, and engagement/involvement as key indicators of the depth of learning (Table 4)

TABEL 4. Characteristics of the literature.

Author (Year)	Study focus	Sample / Context	Methodology / Instruments	Key findings
Jackson-Barrett & Lee-Hammond (2018)	On Country Learning to strengthen Aboriginal children's identity and involvement through culture- and land-based learning	Year 1 Aboriginal children (5–6 years); weekly half-day visits for ~6 months	Qualitative case study; classroom and On Country observations; teacher, AIEO, and parent interviews; Leuven Involvement Scales	Higher involvement, confidence, language, and cultural identity; children showed strong recall and reflection on experiences.
Catalano et al. (2023)	Child-centred competence and slow pedagogy in early childhood education	376 ECEC teachers; in-service training programme	Mixed methods; focus groups, training activities, survey scales on child-centred competence and constructivist orientation	Training improved child-centred competence and slow pedagogy practices linked to deeper, self-directed play and motivation.
Pollarolo et al. (2024)	Teachers' strategies, views, and child outcomes when using coding toys in ECEC	22 empirical studies on coding toys in ECEC (2010–2022)	Systematic literature review (PRISMA); thematic analysis	Teachers mainly used questioning, dialogic scaffolding, and collaboration; coding toys supported problem solving and computational thinking.
Kelpsiene & Monkeviciene (2024)	Predictors of deep learning and competence with augmented reality in preschool	319 preschool teachers using AR with children aged 5–7	Quantitative survey; regression analysis	Constructivist, socio-cultural teacher roles and positive perceptions of AR predicted children's deep learning and competence development.
Walshe et al. (2025)	School-based food gardening and ecological capabilities under EYLF 2.0	Children in an Australian Early Childhood School; 10-week garden programme	Qualitative ethnography; participant observation, field notes	Gardening fostered empathy with plants, multispecies responsibility, independence, and deep, situated ecological learning.

Buldu & Buldu (2025)	Playful learning in innovative early childhood classrooms in the USA	11 teachers in four early childhood classrooms	Qualitative case study; classroom observations and interviews	Teachers viewed playful learning as most appropriate for children's agency and deep learning through guided and exploratory play.
Ritoša et al. (2023)	Conceptualisation and measurement of children's engagement in ECEC	286 quantitative studies on engagement in ECEC	Scoping review; mapping of definitions, theories, instruments	Identified 77 instruments; engagement treated mainly as observable interaction, involvement as internal experience; called for clearer concepts and validation.
Dong et al. (2025)	Deep learning–based assessment tool for teacher leadership (ITL-LSTM)	371 primary and secondary teachers in Xinjiang, China	Survey; four-dimension leadership scale; factor analysis; Diagonal BiLSTM model	Four-factor leadership scale; AI model accurately classified teacher leadership profiles for dynamic assessment.

Teacher role as deep learning facilitator

Deep learning in early childhood is strongly shaped by how teachers position themselves as designers of learning contexts, proactive facilitators, and co-learners who reflect on the process together with children [15]. Within slow pedagogy and child-centred education, teachers who respect children's natural developmental rhythms, allow them to choose activities, and design interest-based learning experiences have been shown to enhance deep engagement, intrinsic motivation, and children's reflection on their own learning [16].

Play and contextual experiences as a medium for deep learning

Learning experiences grounded in local culture and real environments, such as On Country Learning programmes and school gardens, demonstrate that children achieve deeper learning when they are emotionally, socially, and ecologically connected to the places where they learn [17]. Likewise, playful learning practices in innovative classrooms show that intentionally provoked play, which still leaves room for children's exploration and spontaneity, becomes a key vehicle for developing deep conceptual understanding, decision-making, and reflective capacities [18].

Technology as a trigger, not the goal, of deep learning

Systematic reviews on the use of coding toys in ECEC indicate that technology functions only as a trigger for deep learning when it is combined with pedagogical strategies such as dialogic scaffolding, collaborative work, and higher-order questioning that challenges children's thinking [19]. Studies on augmented reality in preschool education further emphasise that AR creates multimodal conditions for deep learning through exploration, problem solving, and creativity yet the quality of teachers' roles as context designers and facilitators remains the decisive factor [15]. At the same time, the use of deep learning (AI) models for assessing teacher leadership illustrates how technology can support data-informed pedagogical decision-making without becoming the primary goal of the learning process [20].

Engagement and involvement as indicators of deep learning

A scoping review on measuring children's engagement in ECEC shows that engagement and involvement are understood as qualities of participation characterised by high concentration, intrinsic motivation, active exploration, and a sense of meaning features closely aligned with the construct of deep learning [21]. The use of the Leuven Involvement Scales in On Country Learning programmes demonstrates that children display higher levels of involvement, richer recall, and stronger enthusiasm when learning in meaningful cultural and natural contexts than in conventional classrooms [17], while studies on playful learning show that flexible, minimally structured play environments promote deep engagement that is a prerequisite for meaningful learning to occur.

DISCUSSION

The SLR findings reinforce that deep learning in early childhood depends primarily on the quality of the teacher's role as designer of learning experiences, rather than as a mere transmitter of content. Recent studies show that teachers who position themselves as facilitators and co-learners designing exploration-rich contexts, providing opportunities for choice, and scaffolding reflection are more successful in fostering deep cognitive engagement and sustained meaning-making in children [22]. This approach aligns with child-centred and student-centred learning environments, which have been shown to promote higher-order learning strategies,

knowledge transfer, and self-regulation, including in the early years of primary education that are closest to the early childhood context [23], [24]. Within slow pedagogy and child-centred education, the shift from the teacher as a step-by-step instructor to a "designer of learning landscapes" is crucial to ensure that play, exploration, and dialogue lead to conceptual understanding rather than mere compliance with instructions.

The discussion of play and contextual experiences as media for deep learning shows that play and place-based learning function as an "in-between space" where children's emotions, bodies, and cognition converge in a single learning experience. Contemporary research indicates that outdoor and place-based learning environments strengthen children's sense of belonging and connectedness to community and nature, which in turn enhances intrinsic motivation, willingness to take intellectual risks, and capacity for reflection [25], [26]. At the same time, studies on guided play and playful learning suggest that intentionally provoked play—through open questions, challenging materials, and opportunities for collaboration is more effective in supporting conceptual understanding and higher-order thinking than either completely free play or fully teacher-directed instruction [27], [28]. Thus, the SLR finding that culturally grounded, nature-based play and carefully designed playful learning serve as key media for deep learning is consistent with evidence that children learn most deeply when their play is guided yet still preserves agency.

The SLR results on technology as a trigger, rather than a goal, for deep learning are consistent with post-2010 research that positions ICT including educational robotics, coding toys, and augmented reality as tools for thinking rather than learning objects in themselves. Literature reviews indicate that the most meaningful technological experiences for children occur when digital tools are embedded within a constructivist pedagogy, for example to make abstract concepts concrete, facilitate multimodal exploration, and stimulate reflective dialogue between children and teachers [29], [30]. In the field of computational thinking, early childhood studies show that the benefits of robotics and coding arise mainly when teachers scaffold problem solving, encourage children to explain their reasoning, and connect programming activities to real-life situations, rather than when children simply follow command patterns [31], [32]. Meanwhile, the use of machine learning and learning analytics in educational assessment is described as an opportunity to enrich evidence for pedagogical decision-making, but it still requires critical interpretation and ethical judgement from teachers to avoid reducing the complexity of learning processes to algorithmic scores alone[33], [34] In other words, the SLR finding that technology only triggers deep learning when combined with dialogic scaffolding and collaborative work confirms the position of technology as a catalyst rather than the centre of learning.

Finally, the focus on engagement and involvement as indicators of deep learning places the process dimension of children's learning on an equal footing with academic outcomes. Recent reviews and scoping reviews show that child engagement encompassing behavioural, cognitive, and emotional components is strongly associated with academic achievement, socio-emotional development, and psychological well-being, even when socioeconomic background is controlled for [35], [36]. In ECEC, involvement measured through indicators such as concentration, persistence, positive emotional expression, and orientation to meaning is regarded as a proximal indicator of the quality of children's learning experiences in responsive, play-centred, and cognitively challenging environments [37], [38]. Studies of flexible, minimally structured play environments show that when children are given freedom to move, choose materials, and negotiate with peers and teachers, their engagement increases and is accompanied by more complex thinking strategies, such as causal explanations, planning, and evaluation of ideas [39], [40]. Accordingly, the SLR finding that engagement and involvement are prerequisites for meaningful learning strengthens the argument that deep learning pedagogy must always be examined through observable and systematically measured indicators of children's participation.

The main limitation of this SLR lies in the restricted scope and depth of available evidence, both in terms of context and study methodology. Most of the included research is still concentrated in high-income countries and in relatively well-resourced, innovation-oriented settings, so generalising the findings to early childhood contexts in developing countries or under-resourced areas must be done with caution. In addition, many studies are descriptive or correlational, use relatively small samples, and lack longitudinal designs, meaning that relationships between interventions (such as playful learning, technology use, or place-based approaches) and children's deep learning are inferred rather than established causally. The constructs of deep learning, engagement, and involvement are also not consistently defined across studies; variations in operationalisation and measurement instruments may introduce interpretive bias when synthesising findings. These limitations highlight the need for experimental and longitudinal research across diverse contexts, supported by more coherent conceptual definitions, to more robustly test how teacher roles, play, and technology genuinely influence deep learning in early childhood.

CONCLUSION

Overall, this SLR indicates that deep learning in early childhood is not driven by a single component, but by the synergy between teachers' roles as facilitators and co-learners, the design of play experiences and learning contexts that are culturally and ecologically rich, the use of technology as a trigger for exploration and reflection

rather than an end in itself, and children's high behavioural, cognitive, and emotional engagement as a key indicator that meaningful learning is truly occurring.

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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.

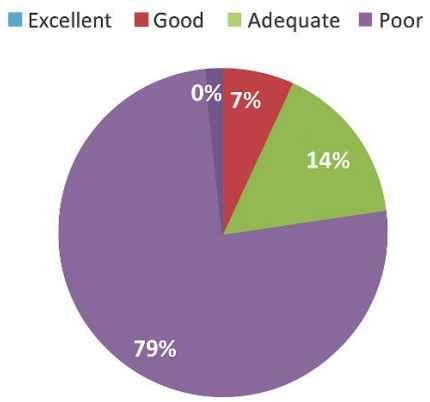

Figure 5. Test Results

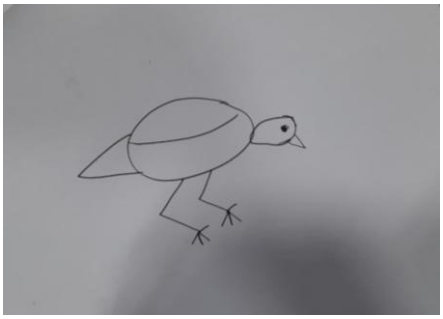

Figure 6. Test Work

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.

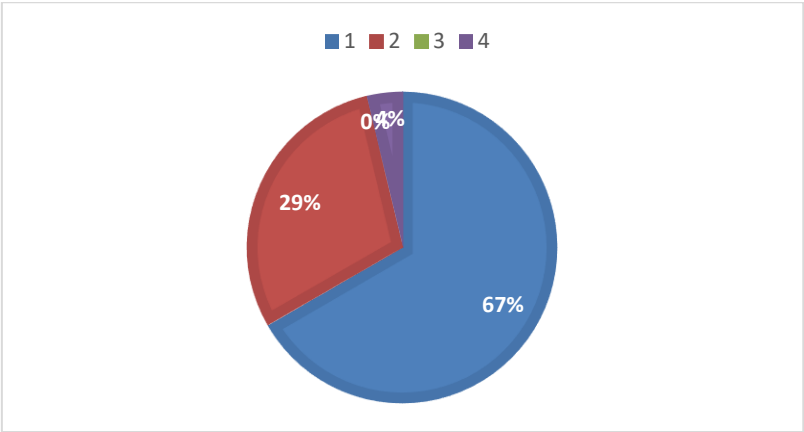

Figure 7. Post-Test Results

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.

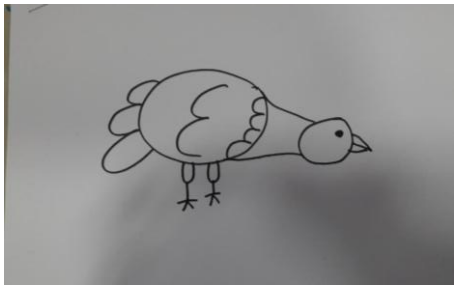

Figure 8. Post- Test Work

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.

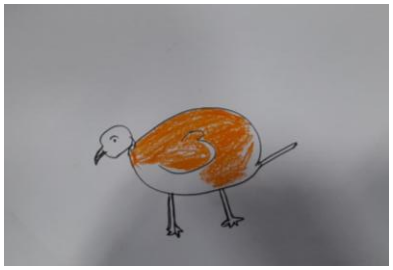

Figure 9. Pre-Test Work

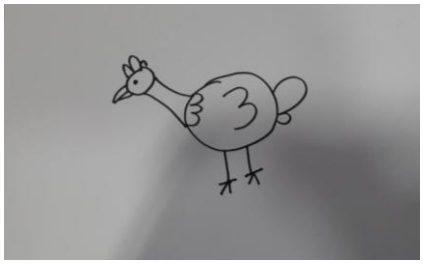

Figure 10. Post-Test Work

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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STRENGTHENING THE JOB HAPPINESS OF INDONESIAN MIGRANT WORKERS IN MALAYSIA

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Abstract: The Strengthening Work Happiness Activity for Indonesian Migrant Workers (PMI) in Malaysia was carried out as an effort to improve the psychological well-being and performance of workers through a structured psychoeducational approach. This program involves 13 PMIs aged between 30 to 60 years old with a working period of between 5 to 35 years. The implementation method includes pre-test, post-test, training, group discussion, and reflection, with a focus on improving understanding of job happiness. The measurement results showed a significant increase in the participants' level of knowledge and awareness of the concept of job happiness after participating in the training. In general, participants showed a positive response to the material and methods used.

Qualitatively, the analysis of participants' responses revealed three main themes, namely pleasure, engagement, and meaningfulness at work. Participants reported improved ability to manage stress, strengthen social relationships in the work environment, and find positive meaning in their professional activities. This intervention has been shown to be effective in strengthening the psychological dimension of happiness and increasing PMI's work motivation. The results of this activity affirm the importance of positive psychology-based training as an adaptive and sustainable strategy for empowering migrant workers, as well as providing recommendations for social institutions and governments to integrate similar approaches in Indonesian labor welfare programs abroad.

Keywords: Job Happiness, Indonesian Migrant Workers, Malaysia.

INTRODUCTION

The phenomenon of international labor migration has become an important part of Indonesia's socio- economic dynamics. In the last two decades, the number of Indonesian Migrant Workers (PMI) has increased significantly in line with limited domestic employment and wage disparities between countries (Raharto & Utami, 2021). Malaysia is one of the main destinations for migrant workers due to its geographical proximity, cultural similarities, and high need for domestic and industrial workers. However, behind these opportunities, PMIs often face challenges that have an impact on their welfare and happiness at work.

Job happiness is an important factor for PMIs because it is related to psychological well-being, motivation, and productivity (Fisher, 2010). However, various studies show that migrant workers are vulnerable to psychosocial pressure due to long working hours, low wages, discrimination, and lack of social support (Suud et al., 2023). This condition decreases job satisfaction and increases the risk of chronic work stress. According to Diener et al. (2018), happiness is not just an emotional condition but is the result of an interaction between individual factors and the social environment that affects subjective well-being. In the context of PMI, job happiness is greatly influenced by the way they interpret work, the quality of social relationships, and the ability to adapt to the new work culture.

Working conditions in Malaysia are often not ideal. Several reports noted discrepancies in employment contracts, violations of working hours, and limited access to mental health services (Kiranantika et al., 2023). Although there is a bilateral agreement between Indonesia and Malaysia, its implementation on the ground is still not optimal. The International Labour Organization (2016) even categorizes work with a monotonous routine as a psychological risk because it can reduce workers' motivation and happiness. This pressure is even heavier when migrant workers struggle to adapt to different cultures, languages, and work values.

In such situations, a positive psychology approach is a relevant strategy to increase job happiness. Positive psychology emphasizes the reinforcement of personal strength, positive emotions, and the meaning of life (Seligman & Csikszentmihalyi, 2000). Interventions involving gratitude reflection or journaling have been shown to improve the subjective well-being of workers (Lyubomirsky et al., 2011). In addition, community social support has also been shown to lower stress levels and increase the happiness of migrant workers (Shin & Lee, 2021). The PMI community can be a source of emotional support and a safe space to share experiences and build solidarity.

Adaptation to work culture also determines the happiness of migrant workers. Research by Chen et al. (2022) shows that cultural intelligence is positively related to job happiness in cross-cultural workers. PMIs who are able to adjust emotionally and socially tend to have a harmonious relationship with their superiors and colleagues, thereby reducing the potential for interpersonal conflicts.

In terms of policy, the protection of migrant workers has so far focused on legal and administrative aspects, but has not specifically touched on the aspect of emotional well-being (ILO, 2022). In fact, job happiness contributes to productivity, loyalty, and quality of work relationships (Oswald et al., 2015). Therefore, psychological interventions based on job happiness are very important to support the welfare of migrant workers, as well as in line with the Sustainable Development Goals (SDGs) agenda of goal 8 regarding decent work.

Ultimately, strengthening the happiness of migrant workers in Malaysia is not only a psychological issue, but also a moral and social one. Improving the welfare of migrant workers means rewarding their contribution to the national economy. This program is a real step in bridging the gap between economic well-being and emotional well-being. Thus, this community service activity is expected to be an inspiration for similar efforts in the future.

LITERATURE REVIEW

Happiness is a central concept in positive psychology and has developed through a variety of theoretical perspectives. Experts use different terms such as subjective well-being (Diener, 1984), psychological well-being (Ryff, 1989), emotional well-being, and authentic happiness (Seligman, 2002). Although they have a variety of focuses, all of these approaches aim to explain how individuals assess their well- being and quality of life both subjectively and objectively. The development of the theory of happiness did not stand alone, but was a continuation of the foundations of humanistic psychology pioneered by Maslow, Rogers, Allport, Jung, and Erikson.

Maslow (1943) through the theory of self-actualization states that happiness arises when basic human needs are met and individuals are able to actualize their potential. This view emphasizes happiness as the culmination of self-development, not just a hedonistic experience. In line with that, Rogers (1961) introduced the concept of a fully functioning person, which is an individual who lives authentically, accepts himself, and is open to experience. Happiness, in Rogers' view, is the result of self-acceptance and psychological freedom.

Allport (1961) through the theory of mature personality explains that happy individuals have emotional stability, healthy social relationships, and a meaningful life orientation. Jung (1953) added an intropsychic dimension through the concept of individuation, which is the process towards self- integrity through the balance of conscious and unconscious aspects. Happiness is seen as the result of integration and harmony in the individual. Meanwhile, Erikson (1959) emphasized the role of the social environment and success in passing the stages of psychosocial development as factors influencing well-being.

Subsequent developments gave birth to the school of positive psychology pioneered by Seligman and Csikszentmihalyi (2000). Positive psychology focuses on human strength and how individuals can develop optimally. Seligman (2002) introduced the concept of Authentic Happiness and then developed the PERMA (Positive emotion, Engagement, Relationships, Meaning, Accomplishment) model as an empirical framework for psychological well-being (Seligman, 2011). This approach affirms that happiness is a combination of positive feelings, meaning, and engagement in worthwhile activities.

Diener (1984) developed the concept of Subjective Well-Being (SWB) as a framework to assess happiness through three main components: life satisfaction, positive affect, and low negative affect. Subjective happiness depends on an individual's evaluation of his or her life as a whole, not just on external conditions such as economic or social status. In the context of work, Ryff (1989) introduced the concept of Psychological Well-Being (PWB) which consists of six dimensions: autonomy, mastery of the environment, personal growth, positive relationships, self-acceptance, and life purpose. PWB views happiness as the result of the realization of potential and self-development.

In the context of organizations and the world of work, happiness is expanded to the concept of happiness at work. Fisher (2010) states that happiness at work includes affective, cognitive, and behavioral dimensions that reflect involvement, affective commitment, and satisfaction with work and social relationships in the work environment. Job happiness has a positive impact on performance and productivity (Oswald et al., 2015), increases creativity and adaptability (Lyubomirsky et al., 2005), and lowers the risk of burnout (Bakker & Oerlemans, 2016).

The concept of job happiness is increasingly relevant in the context of migrant workers. They face emotional distress, social isolation, and cultural differences (Shin & Lee, 2021). Social support, the quality of relationships with superiors, and the meaning of work are key factors that affect their happiness in the destination country (Suud et al., 2023). Chaiprasit and Santidhirarku (2011) emphasized that the quality of interpersonal relationships, a supportive work environment, and leadership style have a significant effect on employee happiness. In migrant workers, these factors determine the level of psychological adaptation and well-being during work.

Thus, happiness theories from humanistic psychology, positive psychology, and work context provide a comprehensive framework for understanding the work happiness of migrant workers. Happiness is not only about positive emotions, but also about meaning, self-acceptance, social relationship support, and a balance between work demands and personal well-being.

METHOD

This community service (PkM) activity uses a participatory action research (PAR) approach that emphasizes the active involvement of participants in all stages of activities. The PAR approach allows participants to be the main subjects in identifying problems, finding solutions, and evaluating the results of activities (Kindon et al., 2007). This approach is considered appropriate because it aims to build the psychological capacity of Indonesian migrant workers (PMI) through collaborative and reflective job happiness training. The activity was carried out in the work area of Indonesian social organizations in Malaysia by involving migrant workers from various informal and formal sectors. The main focus of this activity is to increase job happiness as an effort to strengthen the psychological well- being and productivity of migrant workers.

The stages of the activity are systematically designed from preparation to final evaluation to ensure the effectiveness of the intervention. The methods used include the distribution of pre-test questionnaires, training, interactive lectures, group discussions, focus group discussions (FGDs), and evaluative post- tests. Each method is designed to dig into perceptions, improve understanding, and strengthen participants' emotional skills in creating job happiness. The implementation of activities is carried out by combining psychoeducational and reflective approaches as suggested in psychological well-being.

intervention training (Sin & Lyubomirsky, 2009). The stages of the activity are presented in detail as follows:

Table 1. Stages of Implementation of PMI Work Happiness Strengthening Activities

Session	Purpose	Activity	Form of Activity
1	Opening and	The team opens the event	Discussions and Games
	Introduction	The team gets to know the participants	
		Worries and expectations	
		The team explains the purpose and	
		purpose of the event	
		Contract activity regulations	
2	Understanding the	The team explained the basic concept	Lectures and
	importance of happiness	of happiness in social interaction and	Discussions
	at work	the importance of happiness between	
		all parties in the workplace	
3	Understand how to build	The team explains the pattern	Lectures and
	work happiness with	happiness between PMIs	Discussions
	colleagues and society	Team explains how to create work	
		happiness with fellow colleagues at	
		work	
		The team explains how	
		Creating Happiness at Work	
4	Discussion and Evaluation	The team invited the participants to reflect on their experiences of happiness so far in Malaysia The team invites participants to take steps to build job happiness in Malaysia	FGD, conclusion drawn, and readiness for action

The implementation of the activity is focused on training design developed based on the results of the initial needs assessment of migrant workers. Each stage in training has a strategic role to achieve the goal of strengthening work happiness. The initial stage in the form of a pre-test is used to assess the initial level of knowledge and readiness of participants before training. The results of the pre-test serve as basic data in

determining the appropriate training strategy. This evaluation is also a tool for comparing the results of the post-test at the end of the activity (DeCoster et al., 2008).

The training design was prepared collaboratively by a team of lecturers by considering the theory of job happiness and psychological well-being (Fisher, 2010; Seligman, 2011). The training material covers three main topics, namely (1) understanding the concept of happiness at work, (2) strategies for building positive relationships in the workplace, and (3) how to manage emotions in the context of work. The training was conducted with a participatory approach to encourage participants to actively share experiences and self-reflection. Each session is facilitated by lecturers with expertise in industrial and clinical psychology, supported by students as field assistants. The design aims to create a learning environment that is supportive, interactive, and oriented towards the real experience of participants.

FGD activities are a key component of this approach because they allow for an in-depth exploration of the social and emotional dynamics of PMIs. According to Morgan (1997), FGD is an effective technique to explore participants' perceptions and subjective meanings related to complex psychological issues. In this activity, participants discussed the sources of happiness, work challenges, and adaptation strategies they carried out in the work environment. This qualitative approach enriches understanding of the socio-cultural context of PMI in Malaysia. FGDs also serve as a means of building social support between participants, which is an important factor in improving work well-being (Keyes, 2002).

The duration of the training activities is designed for one day with a total implementation time of four effective hours. This timetable takes into account the physical condition and work schedule of PMIs so as not to cause fatigue or disruption to their obligations. The duration of each session is set at 120 minutes to provide space for deep exploration and reflection without losing the focus of the activity. According to Salas et al. (2012), the effectiveness of psychological training is greatly influenced by the balance between the duration and intensity of activities. Thus, this time plan is considered the most optimal to achieve a sustainable increase in work happiness.

The evaluation of the results of the activity was carried out through a comparison of pre-test and post- test results to assess the effectiveness of the intervention. The measurement was carried out using the Likert scale which adapted the concept of work happiness from Fisher (2010) and psychological well- being from Ryff (1989). Data analysis was carried out using the paired sample t-test to see the significance of changes in participants' scores before and after training (Field, 2013). In addition, qualitative feedback from participants was also analyzed to provide a holistic picture of the impact of training on their affective and social aspects. This triangulative evaluation ensures the validity and reliability of the results of PkM activities.

The final stage involves the preparation of a report on the results of the implementation, reflection with partners, and follow-up in the form of a sustainability plan for activities. Reporting is carried out collaboratively by a team of lecturers and PMI organizational partners to ensure that the results of activities can be implemented in the community's internal policies. The follow-up plan includes further training and the establishment of peer support groups for migrant workers in Malaysia. This strategy aims to strengthen the long-term effects of job happiness interventions and expand the social impact of activities. Thus, this PkM activity is not only interventional, but also transformative for the welfare of PMI.

RESULTS

The implementation of community service activities with the theme of Strengthening Job Happiness for Indonesian Migrant Workers (PMI) in Malaysia was successfully attended by 13 active participants. The activity took place in a conducive atmosphere, with high participation during discussion sessions and focus group discussions (FGD). Participants came from various sectors of work such as domestic helpers, restaurant workers, and cleaners in the public sector. All participants showed enthusiasm and openness in sharing their experiences related to their daily lives at work. The active participation of participants reflects the importance of job happiness as an aspect of psychological well-being that has not been paid much attention in the context of migrant workers (Fisher, 2010; Seligman, 2011).

1. Demographic Characteristics of Participants

Demographic data showed that the age range of participants was between 30 and 60 years old, with an average age of 44.6 years. The majority of participants were female as many as 10 people (76.9%), while men amounted to 3 people (23.1%). This composition is in line with the demographic trend of migrant workers in Malaysia, where the majority of migrant workers come from women working in the domestic sector (World Bank, 2017). Participants' length of employment varied between 5 to 35 years, with an average work experience of 14.3 years. These variations provide a rich picture of the participants' psychological and social conditions based on the length of their adaptation in the destination country.

2. Pre-Test and Post-Test Results

The evaluation of the training results was carried out through a comparison of pre-test and post- test scores to measure the increase in participants' knowledge and understanding of the concept of job happiness. The instrument used was adapted from the Work Happiness Scale (Fisher, 2010), consisting of 15 items with a Likert scale of 1–5. The total score describes participants' level of understanding of factors of happiness at work, such as the meaning of work, social relationships, and emotional balance. Based on the results of the analysis, there was an increase in the average score from 61.5 in the pre-test to 84.6 in the post-test. The results of the paired-sample t-test showed a significant increase ($p < 0.01$), indicating that training had a positive effect on increasing participants' job happiness.

Table 4. Pre-Test and Post-Test Results for Strengthening Job Happiness

No	Initials	Score *Pre-Test*	Post-Test *Scores*	Difference
1	AN	58	80	+22
2	SR	60	86	+26
3	MH	63	83	+20
4	DT	64	85	+21
5	NR	59	83	+24
6	LP	61	88	+27
7	YS	62	84	+22
8	RH	60	81	+21
9	WT	57	85	+28
10	SK	65	88	+23
11	AR	62	82	+20
12	DN	59	83	+24
13	HK	63	87	+24
Average		61.5	84.6	+23.1

These results show a significant improvement in the understanding of the concept of job happiness and its application in the workplace. Participants showed improved self-reflection skills, emotional awareness, and understanding of the importance of healthy social relationships in the work environment. The greatest score improvement was achieved by participants with a working life of more than 10 years, suggesting that long work experience provided greater sensitivity to the importance of job happiness (Lyubomirsky et al., 2005). In general, these results reinforce the finding that psychoeducational training is effective in improving the subjective well-being and work motivation of individuals (Sin & Lyubomirsky, 2009).

3. Results of Qualitative Notes from Trainees

In addition to quantitative results, this activity also produced qualitative data obtained from facilitators' notes during FGD and reflection sessions. These records show positive changes in the emotional, social, and cognitive aspects of the participants. The majority of participants reported an increased sense of optimism, awareness of the importance of social support, and an understanding of the meaning of work. Some participants also expressed a desire to apply the happiness strategies learned in daily life. A summary of qualitative results is presented in the following table:

Table 3. Qualitative Notes of Subjects' Responses During PkM Activities

Main	Subthemes and Description of Findings	Snippets of Participants' Speeches	Psychological Interpretation	Implications for Job Happiness
Pleasure	Increased positive feelings towards work after training. Participants showed a decrease in negative emotions such as saturation, anger, and anxiety.	"I just realized that I often forget to be grateful for this work." "Now I can smile when I start work, it feels lighter."	There is an increase in self-awareness of positive emotions and acceptance of work. Participants learn to balance expectations and the reality of work.	Increased positive affectivity in the workplace encourages a more harmonious work atmosphere and strengthens social relationships between workers (Lyubomirsky et al., 2005).

	Stress reduction and increased calmness through emotion regulation techniques learned during training.	"If the boss gets angry, I'll try to catch my breath first and calm down."	There is an increase in the ability to regulate emotions and self-compassion. Participants began to practice adaptive coping strategies.	Effective emotion regulation has been shown to be associated with reduced burnout rates and improved subjective well-being (Gross & John, 2003).
	Increased gratitude for work and life overseas.	"I feel happier because I realize that there are still many things to be grateful for here."	Strengthening of positive affects that come from spiritual experiences and personal reflection.	Gratitude improves subjective well-being and job satisfaction (Emmons & McCullough, 2003).
Involvement	Participants were more active in discussion sessions and shared experiences after understanding the concept of job happiness.	Participants were more active in discussion sessions and shared experiences after understanding the concept of job happiness.	Participants were more active in discussion sessions and shared experiences after understanding the concept of job happiness.	Participants were more active in discussion sessions and shared experiences after understanding the concept of job happiness.
	Increased intrinsic motivation to carry out work with new enthusiasm.	"I am excited again, especially knowing that happiness can be built on its own."	Participants demonstrate the transition from external motivation (salary, contract) to motivation intrinsic (satisfaction, meaning of work).	Intrinsic motivation plays an important role in increasing *work engagement* and organizational commitment (Ryan & Deci, 2000).
	Active participation in FGDs shows increased confidence and interpersonal communication.	"I used to be quiet, now I dare to speak up and listen to other people's opinions."	Training helps build confidence and interpersonal skills.	Activeness in social interactions increases feelings of competence and autonomy at work (Bakker & Demerouti, 2008)
Significance	Redefinition of work goals and personal contributions.	"Now I can see my job as not only about salary, but also pride."	Participants showed a cognitive shift from economic meaning to existential meaning.	Positive meaning of work strengthens psychological resilience (Frankl, 2006).
	Awareness that work is an important part of social and family life.	"I want to keep working well because my family at home is also proud."	Participants associated the meaning of work with moral responsibility to the family.	Meaningfulness increases *life satisfaction* and *work commitment* (Steger et al., 2012).

DISCUSSION AND/OR CONCLUSION

Discussion

Positive emotional changes are the first impact that appears after training. PMI stated that they were better able to manage negative emotions such as anger and anxiety, as well as experienced increased calmness, gratitude, and other positive feelings. The gratitude practice intervention carried out in the activity has been proven to help participants change their perspective on their work. These findings are consistent with Emmons and McCullough (2003), who found that the practice of gratitude can significantly increase an individual's happiness and life

satisfaction. Training also helps to improve the ability to regulate emotions, which according to Gross and John (2003), is at the core of subjective well- being.

In addition to emotional changes, increased engagement is also clearly illustrated during the training process. PMI showed higher enthusiasm in discussing, sharing experiences, and providing support between participants. This social involvement indicates the emergence of intrinsic motivation to the processes and activities followed. Schaufeli and Bakker (2004) state that high work engagement is associated with increased commitment, psychological energy, and productivity. For PMI, the existence of a supportive community helps reduce the psychological burden and loneliness while working abroad.

The shift in motivation from economic orientation to intrinsic motivation and self-actualization are other important impacts of this training. Before training, most PMIs saw work as a means of financial fulfillment. However, after participating in activities, they began to interpret work as a means to develop and contribute to their families. This change reflects the principle of Self-Determination Theory from Ryan and Deci (2000), which states that intrinsic motivation grows when individuals feel that their work is meaningful, has autonomy, and is accompanied by self-capacity development. Participants show a change in the way they view themselves no longer as "breadwinners," but as individuals who have values and purpose in their work.

The increased meaning of work also has an impact on the quality of social relationships. Participants show greater empathy for fellow migrant workers, help colleagues who are struggling, and expand their support network. The existence of a positive work relationship reinforces the feeling of being accepted, loved, and valued as a human being, not just as a workforce. Hakanen and Schaufeli (2012) stated that positive interpersonal relationships can reduce the risk of burnout and increase job satisfaction. In the context of PMI, these social relationships are an important source of emotional support to overcome feelings of isolation while in a foreign country.

The effectiveness of psychoeducational training methods is also a key factor in the success of the program. The combination of interactive lectures, group discussions, and Focus Group Discussions (FGDs) allows participants to explore personal experiences, share coping strategies, and build insights together. Donaldson et al. (2021) emphasized that positive psychology interventions are more effective when they encourage active participation, rather than simply one-way delivery. With active engagement, participants not only understand the concept of job happiness cognitively but also internalize it in real practice.

Overall, this training has opened up a space for reflection for PMIs to reassess the purpose and meaning of their work, build emotional and social capacity, and strengthen internal motivation that supports the sustainability of work happiness. These interventions also make an important contribution to addressing the lack of psychological support for migrant workers—an aspect that has been under- addressed in migrant worker protection programs. With increased job happiness, migrant workers in Malaysia have a greater chance of achieving stable psychological well-being, increased productivity, and a better quality of relationship with the work environment.

As a practical implication, similar activities can be adopted as a model of sustainable intervention through collaboration between academics, social organizations, and governments. This training not only has a positive impact on PMI individuals, but also has the potential to improve the image of the professionalism of the Indonesian workforce in the global arena. This program can be replicated in other migrant worker destination countries, so that strengthening job happiness can be part of the national strategy in protecting migrant workers.

Conclusion

The Strengthening Job Happiness for Indonesian Migrant Workers (PMI) activities in Malaysia have succeeded in improving the psychological well-being and quality of social relationships of participants. Based on the results of the pre-test and post-test, there was a significant increase in the understanding and application of the concept of job happiness. Participants become better able to recognize the source of happiness, manage stress, and build positive relationships in the workplace. Psychoeducational interventions based on discussion, reflection, and focus group discussion have been shown to be effective in fostering a sense of involvement, pleasure, and meaning at work. Overall, this activity shows that job happiness is not only an emotional aspect, but also an important element in creating sustainable performance and psychological resilience of PMIs abroad.

In addition to contributing to the improvement of individual well-being, the program also strengthens social solidarity between PMIs and builds collective awareness of the importance of mental well-being in the workplace. This training emphasizes that human resource management in the migrant worker sector must pay attention to psychological aspects, not purely technical or administrative. With a positive psychology-based approach, PMI can be more adaptive, resilient, and productive in dealing with work pressure in a multicultural environment. Therefore, this activity not only has a short-term impact on individual happiness, but also has the potential to strengthen the reputation and competitiveness of Indonesian workers in the global arena.

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STRENGTHENING RESILIENCE AS THE KEY TO EMPLOYEE HAPPINESS WORKING REMOTELY

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Abstract: The resilience strengthening training as a key to job happiness for workers in remote areas was designed to enhance the psychological adaptation ability and emotional well-being of individuals in the face of high work pressure.

This program was conducted online, involving 20 participants from various site locations at PT ABC who have different job characteristics. The training approach included a combination of psychoeducation, self-reflection, and interactive discussion, focusing on the seven dimensions of resilience according to Reivich and Shatté (2002) and three aspects of job happiness, namely pleasure, engagement, and meaningfulness.

The results of the activity show that despite a decrease in the quantitative scores between the pre-test and post-test, the qualitative data revealed an increase in the participants' emotional awareness, self-control, and their ability to interpret work experiences more positively.

Keywords: strengthening, resilience, work happiness, remote area workers

INTRODUCTION

Global changes in the scope of work and industry have brought significant psychological challenges, especially for individuals working in extreme environments such as remote mining areas. The work environment in these areas is often characterized by limited facilities, harsh geographical conditions, and social separation from family and community. Psychological endurance or resilience becomes a crucial aspect that determines workers' ability to adapt and maintain their emotional well-being. Strong resilience allows individuals to continue functioning optimally despite facing high work pressure and job uncertainty (Luthar et al., 2000). Strengthening resilience is one of the important strategies for increasing job happiness among workers in remote areas.

The mining sector is an industry that entails high occupational risks, both physically and psychologically. Mining workers are often confronted with long working hours, hazardous working conditions, and high productivity demands (Tse et al., 2020). Furthermore, their presence in areas far from settlements results in limited access to social support, psychological services, and recreational activities. These conditions can cause chronic stress, emotional exhaustion, and even burnout if not managed properly (Maslach & Leiter, 2016). In the long run, unmanaged psychological pressure can reduce work motivation and subjective well-being. Workers at PT ABC are among the mining company employees who work in remote areas and experience these issues.

Psychological well-being or workplace happiness is an important indicator for performance and workforce sustainability in the mining sector. Happiness at work is not only understood as a feeling of pleasure or satisfaction with the job but also encompasses meaning, engagement, and positive relationships with colleagues (Fisher, 2010). Studies show that happy workers have higher levels of productivity and organizational commitment, and tend to exhibit prosocial behavior within the team (Lyubomirsky et al., 2005). Work happiness needs to be approached psychologically, not merely from an economic or material compensation perspective.

Resilience, as the psychological capacity to recover from stress and adapt to change, plays a central role in building work happiness. Resilient individuals tend to be able to interpret difficult situations positively and develop adaptive coping strategies (Connor & Davidson, 2003). In the context of mining workers who face social limitations and extreme environments, resilience acts as a protective factor that enables them to maintain emotional balance. Workers with high levels of resilience are also reported to be better able to maintain healthy social relationships and manage interpersonal conflicts in the workplace (Robertson et al., 2015). Moreover, the concepts of work happiness and resilience are rooted in the positive psychology approach that emphasizes the development of individual strengths (character strengths) and positive emotions. Seligman (2011) states that happiness can be achieved through positive emotion, engagement, relationships, meaning, and accomplishment. Resilience serves as the foundation that allows individuals to build these five aspects sustainably. Resilient

workers have the ability to remain engaged, maintain positive relations, and find meaning in their jobs despite facing limitations.

This resilience training is expected not only to have a direct impact on individual well-being but also to strengthen a positive work culture within the organization. When workers are able to manage stress, demonstrate optimism, and perceive their work positively, the organizational climate will become more supportive and productive (Hartmann et al., 2020). The impact of increased individual happiness can create a more harmonious and collaborative work environment. This is especially important in the mining sector, where teamwork and effective communication are key to safety and performance.

Furthermore, this activity is expected to become an intervention model that can be replicated in other companies with similar characteristics. With systematic documentation and evaluation results, this training has the potential to become a basis for developing mental strengthening programs in other industries such as energy, construction, and transportation. Besides its practical benefits, this activity also provides a scientific contribution to the industrial and organizational psychology literature in Indonesia. Empirical studies related to resilience in the context of remote area workers are still relatively limited and require further exploration (Tse et al., 2020).

Literature Review

Resilience is the ability of an individual to adapt effectively to the pressure, challenges, and difficulties encountered in daily life. The American Psychological Association (2005) defines resilience as an adaptive process that allows individuals to bounce back from traumatic or severe stressful experiences. Resilient individuals are not free from emotional pain or suffering but are capable of interpreting negative experiences constructively. Resilience is not an innate trait but rather the result of the interaction between internal and external factors that support the process of psychological adaptation. This process involves self-awareness, cognitive flexibility, and adequate social support.

Reivich and Shatté (2002) developed a resilience model consisting of seven main aspects: emotion regulation, impulse control, optimism, self-efficacy, causal analysis, empathy, and reaching out. These seven aspects function synergistically in forming individuals who are resistant to life's pressures. This model provides a strong theoretical framework for understanding how individuals can maintain psychological balance amidst difficult conditions. In the context of work, these aspects play a vital role in maintaining employee performance and motivation. Therefore, strengthening resilience becomes an integral part of human resource development strategies across various organizations.

The first aspect, emotion regulation, refers to an individual's ability to manage and express emotions adaptively. Individuals who are capable of regulating their emotions tend to be calmer in facing work pressure and able to think rationally when making decisions. Research shows that emotion regulation ability is positively related to job satisfaction and organizational commitment (Gross, 2015). Conversely, the failure to regulate emotions often triggers interpersonal conflicts and prolonged work stress. Emotion regulation training is one of the effective approaches in building psychological endurance in the workplace.

The second aspect is impulse control, which is the ability of individuals to delay gratification and manage momentary urges. Individuals with high impulse control capabilities are better able to maintain professional relationships and avoid reactive behavior. A study by Tangney et al. (2004) shows that self- control contributes to academic and professional success through disciplined and consistent behavior. For workers in remote areas like mining, impulse control is crucial for maintaining social harmony within a small, interdependent work community. Impulse control also prevents conflicts arising from work pressure.

The third aspect is optimism, which reflects the belief that the future will bring positive outcomes despite current challenges. Optimistic individuals are more likely to view problems as opportunities to learn and grow. Seligman's research (2011) indicates that optimism correlates with improved mental health and job happiness. In the mining environment, optimism acts as a protective factor against emotional exhaustion (burnout). This positive attitude also fosters a resilient and productive work culture.

Self-efficacy, the fourth aspect, relates to an individual's belief in their ability to achieve specific goals. Bandura (1997) explains that self-efficacy determines how individuals perceive challenges and their persistence in facing them. Workers with high self-efficacy demonstrate more stable performance because they possess a sense of control over the work situation. Self-efficacy helps individuals navigate demanding physical and psychological work requirements. Strong self-efficacy also reinforces a sense of competence and professional pride.

The fifth aspect is causal analysis, which is the ability to accurately identify the root of a problem. This ability is important so that individuals can make decisions based on reflection rather than emotional reaction. According to Reivich and Shatté (2002), individuals who can accurately analyze the cause of problems are more likely to avoid repeating mistakes. Good analytical skills support the problem- solving process and improve work efficiency. This aspect is often developed in leadership and management training programs.

Empathy is the sixth aspect of resilience, emphasizing the ability to understand and respond to the feelings of others. Empathy strengthens interpersonal relationships and builds a supportive work environment. Studies by Decety and Cowell (2014) show that empathy plays an important role in the formation of morality and prosocial behavior in the workplace. Empathy helps maintain cooperation and group solidarity, thereby enhancing the sense of togetherness and collective happiness.

The seventh aspect is reaching out, which is the courage to take positive risks and seek new opportunities after facing failure. Individuals who possess this ability tend to view failure as a learning experience. According to Tugade and Fredrickson (2004), resilient individuals use positive emotions to recover from negative experiences and expand their adaptive capacity. The ability to reach out strengthens the spirit of innovation and continuous learning. Resilience not only functions as a protective mechanism but also as a catalyst for professional growth.

The concept of workplace happiness has become an important focus in employee well-being studies. Fisher (2010) emphasizes that happiness at work includes emotional involvement, job satisfaction, and affective commitment to the organization. Work happiness functions as a motivational factor that encourages individuals to contribute better towards company goals. Work happiness can strengthen resistance to stress caused by social isolation and harsh environmental conditions. Strategies for improving work happiness have a direct impact on employee productivity and retention.

Several studies show that work happiness has a significant influence on mental health and work performance. Harrison et al. (2006) found that happy employees show lower rates of absenteeism and higher work engagement. Riketta's research (2008) confirms that work happiness is closely linked to organizational loyalty. Happiness also plays a role in building positive social relationships among colleagues, which increases team effectiveness. Therefore, companies need to pay attention to the psychological well-being of employees as part of their HR management strategy.

Work happiness is not only related to external factors such as salary and facilities but also to internal factors such as meaning and work purpose. Anggoro and Widhiharso (2010) state that happiness is a contextual construct that is highly influenced by individual values and experiences. Research by Gupta (2012) reinforces this view by finding that happy individuals tend to be more innovative and productive. The relationship between work happiness and productivity shows that emotional well- being is a major asset in human capital. Organizations that invest in employee happiness are essentially increasing their long-term competitiveness.

Furthermore, Seligman's study (2011) shows that work happiness consists of five main components: positive emotion, engagement, positive relationships, meaning, and accomplishment. Workers who feel a balance between these five aspects tend to exhibit higher performance and commitment. In the context of the mining industry, resilience and work happiness complement each other as two mutually reinforcing psychological constructs. Research by Tse et al. (2020) shows that emotional intelligence and resilience play an important role in maintaining work motivation under extreme pressure. Resilient workers are not only able to cope with stress but also foster a sense of satisfaction with the work they do. Positive psychology-based training is a strategic necessity for mining companies. Such programs can reduce levels of psychological exhaustion while strengthening the sense of work meaning. Work happiness also has a dual effect on organizational efficiency and interpersonal relationships in the workplace. Chaiprasit and Santidhirarku (2011) identified that good social relationships, quality of work life, and a participative leadership style are strong predictors of work happiness in the industrial sector. The role of social support becomes a key factor that balances psychological pressure due to remoteness. It is important for organizations to build inclusive communication and social support systems. This effort simultaneously strengthens the culture of collective happiness within the organization.

METHOD

This community service activity (Pengabdian kepada Masyarakat/PkM) uses a psychological training approach based on online psychoeducation. This method was chosen because it has proven effective in enhancing individuals' psychological capacity through reflective interaction and participatory learning (Newman et al., 2021). The main focus of the training was to strengthen resilience and job happiness among workers in PT ABC's remote areas. Isolated geographical conditions often cause psychological stress, emotional exhaustion, and a sense of social isolation. Therefore, the training was designed to provide a space for participants to understand, reflect on, and develop adaptive skills to the challenges of working in remote locations.

The activity stages were systematically designed, ranging from preparation to final evaluation, to ensure the effectiveness of the intervention. The methods utilized included the distribution of a pre-test questionnaire, training sessions, interactive lectures, group discussions, focus group discussions (FGD), and an evaluative post-test. Each method was designed to explore perceptions, enhance understanding, and reinforce participants' emotional skills in creating job happiness. The activity execution combined psychoeducational and reflective approaches, as recommended in psychological well-being intervention training (Sin & Lyubomirsky, 2009).

The implementation of the activity focused on a training design developed based on the results of an initial needs assessment of workers in the remote area. Each stage in the training had a strategic role in achieving the

goal of strengthening resilience and job happiness. The initial stage, a pre-test, was used to assess participants' initial knowledge level and readiness before the training. The pre-test results served as baseline data in determining the appropriate training strategy. This evaluation also became a comparative tool against the post-test results at the end of the activity (DeCoster et al., 2008).

The activity also involved the active participation of partners from PT ABC who provided support for this training activity to the participants. Partner involvement is a key element of PkM success as it reinforces the program's relevance to real needs in the field. The company also served as a strategic partner in the sustainability of the program post-training. This collaboration demonstrates the synergy between academia and industry in applying positive psychology principles for worker well-being. This type of partnership model is also in line with the principles of a community-based participatory approach in PkM.

Evaluation of the activity results was conducted by comparing the pre-test and post-test scores to assess the effectiveness of the intervention. Measurement was performed using 10 true-or-false questions referring to resilience and job happiness. Data analysis was carried out using a paired sample t-test to determine the significance of the change in participants' scores before and after the training (Field, 2013). Furthermore, qualitative feedback from participants was also analyzed to provide a holistic overview of the training's impact on their affective and social aspects. This triangulated evaluation ensured the validity and reliability of the PkM activity results.

RESULTS

In terms of demographics, the training participants consisted of 15 men and 5 women. This composition reflects the general characteristics of the workforce in the mining sector, which is dominated by male workers, particularly in technical and field supervision positions. Based on age categories, the majority of participants were in the productive age range of 25–30 years, totaling 12 individuals (60%), followed by the 31–40 age group with 4 individuals (20%), <25 years with 1

individual (5%), 41–50 years with 2 individuals (10%), and >50 years with 1 individual (5%). The dominance of the younger age group reflects significant potential for building resilience capacity and strengthening future job happiness. The age factor also influences the perception of stress and the ability to adapt to work pressure in remote areas.

Regarding work locations, participants came from seven operational areas of PT ABC, namely DTA (7 individuals), KDA (3 individuals), MBA (3 individuals), BDA (2 individuals), KJA (2 individuals), OBI (1 individual), SAB (1 individual), and DMI (1 individual). This distribution shows the diversity of work contexts and social environments among participants. Different site locations contribute to varying exposure to work stress, as geographical conditions and the level of isolation determine the intensity of social interaction and the availability of supporting facilities. Some participants working in isolated sites admitted to experiencing limited communication access with family, while participants from sites closer to the city center reported lower stress levels.

Based on job titles, the participants consisted of mechanics (3 individuals), office supervisors (14 individuals), field supervisors (2 individuals), and department heads (1 individual). This composition indicates that the majority of participants were in administrative and supervisory positions. In terms of education, most participants had an S1 (Bachelor's degree) background, totaling 11 individuals (55%), followed by SMK (Vocational High School) with 7 individuals (35%), D III (Diploma III) with 1 individual (5%), and D IV (Diploma IV) with 1 individual (5%). The heterogeneous educational background provided variation in how participants interpreted the concepts of resilience and job happiness.

Tabel 3. Data Demografi Peserta

Variable	Category	Quantity (n=20)	Percentage (%)
Age	<25	1	5%
	25–30	12	60%
	31–40	4	20%
	41–50	2	10%
	>50	1	5%
Gender	Male	15	75%
	Female	5	25%
	DTA	7	35%
	KDA	3	15%
	MBA	3	15%
	BDA	2	10%

Site	KJA	2	10%
	OBI	1	5%
	SAB	1	5%
	DMI	1	5%
Position	Mechanic	3	15%
	Office Supervisor	14	70%
	Field supervisor	2	10%
	Head of Division	1	5%
Education	SMK	7	35%
	D III	1	5%
	D IV	1	5%
	S1	11	55%

The quantitative measurement results through the pre-test and post-test show interesting findings. The average pre-test score was 5.50, while the post-test decreased to 5.40. This decrease reflects a phenomenon of post-training reflection, where participants became more aware of the complexity of the psychological challenges they face, leading them to assess their resilience condition more realistically. This aligns with the findings of Bianchi and Schonfeld (2020), who suggest that an increase in psychological awareness following training is often followed by a lower self-assessment of emotional competence, before subsequently experiencing a stable increase in the follow-up period.

DISCUSSION AND/OR CONCLUSION

The resilience strengthening training as a key to job happiness for workers in remote areas showed psychologically significant results. Participants experienced increased awareness of the importance of emotion regulation in maintaining mental balance while working away from family. Resilience became a protective factor that enabled individuals to adjust to extreme working conditions such as limited facilities and high-target pressure. Observations showed that participants who were able to calm themselves down quickly were better able to think rationally and work more effectively. This finding is consistent with the emotion regulation theory, which states that adaptive emotion management strengthens executive functions in decision-making (Gross, 2015).

Impulse control ability also became an important component of resilience that developed during the training. Participants showed a decrease in negative emotional reactions, such as spontaneous anger when facing technical problems in the field. Impulse control encourages individuals to process information before reacting and minimizes destructive behavior. This condition strengthened interpersonal stability among workers, which is the foundation of cooperation in the mining environment. Previous studies confirm that impulse control is positively related to performance and job well-being because it suppresses social conflict and chronic stress (Tangney et al., 2004).

The aspect of optimism showed a strong influence on the change in participants' attitudes toward working in remote locations. Many participants began to develop a positive outlook on challenges and saw difficulties as opportunities for growth. Optimism expands the individual's cognitive capacity in seeking solutions and strengthens hope for the future. This aligns with the broaden-and-build theory, which states that positive emotions expand an individual's psychological resources (Fredrickson, 2001). A positive view of working conditions also correlates with increased life satisfaction and work engagement.

The increase in self-efficacy was one of the important achievements of this training. Participants reported being more confident in facing operational challenges and felt they had the capacity to overcome difficulties in the workplace. Confidence in one's ability strengthens goal orientation and improves individual performance. Self-efficacy is an internal mechanism that allows workers to remain productive under high pressure. Bandura (1997) explained that high self-efficacy plays a vital role in perseverance and adaptation to difficult situations in high-risk work environments.

Causal analysis ability also experienced significant development after the training. Participants showed an improved capacity for reflective thinking to objectively identify the source of problems. This analytical approach changed reactive mindsets into proactive ones, thereby minimizing recurring mistakes. This competence is essential in the context of mining work, which requires quick and accurate assessment. Reivich and Shatté (2002) state that causal analysis ability is at the core of the cognitive resilience process because it helps individuals understand patterns of failure and correct them.

Empathy became one of the most prominent social resilience dimensions after the training. Participants began showing concern for the emotional state of colleagues experiencing pressure. They more frequently provided

simple emotional support, such as listening and encouraging. Empathy helped reduce the psychological distance between workers and created a supportive work atmosphere. Decety and Cowell (2014) found that empathy plays a role in the formation of healthy social relationships and the reduction of burnout levels in high-risk organizations.

The dimension of reaching out became a form of social adaptation that developed through the training. Participants began daring to ask for help and share experiences with colleagues without feeling weak. This interaction strengthened social support and fostered mutual trust among team members. In the context of remote area work, the ability to reach out is a survival strategy against psychological isolation. Southwick and Charney (2018) asserted that social support is a major predictor of psychological endurance in individuals working in high-stress environments.

In terms of job happiness, the aspect of pleasure emerged through positive social interaction during the training. Participants felt emotionally lighter because the activities were structured with a humanistic approach that fostered warmth and shared laughter. Such activities activate positive emotional experiences that support stress recovery. Simple pleasure acts as a psychological buffer against chronic exhaustion due to monotonous routines. This aligns with research by Bakker and Demerouti (2007), which explains that positive emotions strengthen work engagement and reduce the risk of burnout.

Work engagement became the second indicator of happiness that increased after the training. Participants reported increased intrinsic motivation and a desire to contribute more to the team. Workers who feel emotionally engaged show proactive behavior and higher initiative in solving operational problems. This condition indicates the formation of a stronger affective commitment to the job. Schaufeli and Bakker (2004) explained that work engagement reflects a positive psychological state characterized by vigor, dedication, and absorption.

The dimension of meaningfulness became the most strongly felt element of happiness by participants after group reflection. They began to understand the value of their work for the wider community, such as their contribution to energy provision and local welfare. This awareness shifted the view of work from a mere routine to a moral calling. High work meaning provides a sense of satisfaction and a positive identity towards the profession. Steger, Dik, and Duffy (2012) confirmed that meaningfulness in work is related to subjective well-being and sustained organizational commitment.

The phenomenon of the post-test score decrease compared to the pre-test indicates the presence of reflective learning dynamics. Participants became more aware of their own limitations after gaining new knowledge. This awareness is an early phase of deep and sustainable behavioral change. Such a reaction is common in psychological-based training as it marks a shift from unconscious incompetence to conscious incompetence. Dweck (2006) explained that individuals entering this type of reflective phase are more likely to develop a growth mindset in the future.

Overall, this training contributed to strengthening the psychological capital of workers in remote areas. The online program proved effective in stimulating self-reflection, developing social resilience, and fostering work meaning. The success factor of the training lay in the participatory approach and empathetic facilitation that allowed participants to build emotional connections with each other. This activity demonstrated that psychological interventions do not always require direct face-to-face interaction to produce significant impact. These findings support the research by Newman et al. (2014) that online-based psychological capital training can enhance psychological well-being and work engagement.

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ENHANCING ELEMENTARY SCHOOL TEACHERS' INNOVATIVE TEACHING COMPETENCE THROUGH A DEEP LEARNING–BASED PROFESSIONAL DEVELOPMENT PROGRAM

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Abstract. The role of elementary school teachers has shifted toward facilitating innovative, student-centered learning aligned with 21st-century competencies. However, many teachers continue to face challenges in translating innovative pedagogical concepts into classroom practice, particularly in contexts with limited access to sustained professional development and technological resources. This study aims to examine the effectiveness of a deep learning–based professional development program in enhancing elementary school teachers' innovative teaching competence. Employing a pre- experimental one-group pre-test–post-test design, the study involved 32 elementary school teachers from two Madrasah Ibtidaiyah in Godean District, Indonesia. The intervention consisted of an in- house training workshop, followed by online mentoring through a professional learning community and supervision activities. Data were collected using a 15-item questionnaire measuring innovative teaching competence and were supported by observations and participant reflections. The results indicate a significant improvement in teachers' innovative teaching competence, with the mean score increasing from 3.40 in the pre-test to 3.96 in the post-test. Improvements were observed across instructional planning, teaching strategies, student engagement, and reflective practice, although technology integration remained the lowest-scoring aspect. Qualitative findings further reveal increased teacher confidence, engagement, and willingness to experiment with innovative and deep learning–oriented instructional practices. The study concludes that deep learning–based professional development, when combined with sustained mentoring and contextual support, can effectively strengthen teachers' innovative teaching competence. These findings contribute empirical evidence to the literature on teacher professional development and offer practical implications for designing sustainable training models in elementary education settings with limited resources.

Keywords: Deep learning; professional development; innovative teaching; elementary school teachers; teacher competence

INTRODUCTION

The role of elementary school teachers has undergone a fundamental shift from being mere transmitters of knowledge to facilitators of 21st-century learning who function as agents of change in systematically developing students' cognitive, social, and character foundations. Global educational reforms and the growing demands of 21st-century competencies position teachers as designers of learning environments that promote active engagement, creativity, critical thinking, collaboration, and meaningful learning experiences through the implementation of innovative and learner-centered pedagogy (Harris & Jones, 2019). In practice, teachers are expected not only to act as learning facilitators but also as motivators, mentors, and evaluators who provide constructive feedback and adapt curricula to students' needs and contextual realities (Chand & Kumar, 2025; Leeuwen & Janssen, 2019). Nevertheless, the optimization of these roles continues to face various challenges, including limited access to sustained professional development, time constraints, student diversity, and restricted facilities and technological resources, particularly in elementary school contexts with limited resources (Menezes et al., 2025; Saputra et al., 2025). This condition indicates that the increasing demands placed on teachers as facilitators of innovative learning have not yet been fully accompanied by sufficient readiness in classroom-level instructional practices.

In line with this condition, rapid technological advancement and the growing demands of 21st-century competencies further intensify expectations for teachers to implement innovative learning practices that foster students' creativity, critical thinking, collaboration, and problem- solving skills. Nevertheless, numerous studies indicate that classroom practices remain largely dominated by conventional, teacher-centered, and procedural approaches, and therefore have not yet fully aligned with curricular expectations and 21st-century educational frameworks (Indah, 2025; Junedi et al., 2020; Sunarto et al., 2023). This gap is influenced by teachers' limited knowledge and skills in implementing innovative learning models and integrating technology, the lack of opportunities for exploration, discussion, and collaboration in classrooms, as well as structural barriers such as

insufficient professional training, inadequate infrastructure, and resistance to changes in instructional methods (Junedi et al., 2020; Sudibjo et al., 2021; Sunarto et al., 2023). Therefore, strengthening sustainable teacher professional development, practice-based mentoring such as lesson study and workshops, and the cultivation of reflective and collaborative professional cultures among teachers are essential strategies for bridging the gap between curricular expectations and classroom realities, thereby enabling a more effective transformation of 21st-century learning (Ahyan et al., 2025; Arfin et al., 2020).

In the Indonesian context, educational reforms such as the Merdeka Belajar policy have sought to reposition teachers as autonomous and reflective practitioners capable of designing flexible and meaningful learning experiences. Despite these policy initiatives, numerous studies report persistent challenges in implementation. Teachers frequently encounter difficulties related to limited pedagogical training, inadequate access to professional learning opportunities, and insufficient exposure to innovative instructional models. As a result, many teachers continue to rely on conventional teaching strategies, such as lecturing and routine assignments, which offer limited opportunities for student interaction, exploration, and critical engagement.

Research conducted in Indonesian schools has consistently demonstrated that teacher innovation remains constrained by structural and contextual factors. These include limited professional development programs, especially for teachers working in non-public or faith-based schools, as well as disparities in access to technological resources. Teachers in such contexts often receive fewer opportunities to participate in structured training programs that focus on innovative pedagogy and instructional design. This condition contributes to a noticeable gap between teachers' conceptual understanding of innovative learning and their ability to implement it effectively in classroom practice.

The persistence of teacher-centered instruction is not merely a technical issue but also reflects deeper pedagogical orientations. Many teachers perceive innovation as an additional burden rather than an integral component of effective teaching. This perception is often reinforced by administrative demands, rigid instructional systems, and limited time for reflection and experimentation. Consequently, teachers may demonstrate awareness of innovative learning concepts while struggling to translate these ideas into practical classroom strategies that are systematic, measurable, and aligned with learning objectives.

Professional development has long been identified as a critical mechanism for enhancing teachers' instructional competence and supporting pedagogical transformation. Effective professional development programs are characterized by their relevance to teachers' contextual realities, opportunities for active participation, and sustained support beyond one-off training sessions. However, conventional teacher training programs frequently emphasize theoretical knowledge without sufficient emphasis on practice, reflection, and follow-up support. This limitation reduces the long-term impact of training and undermines efforts to foster sustainable changes in teaching practices.

In response to these challenges, educational scholars have increasingly advocated for professional development models that integrate deep learning principles. Deep learning in education refers to learning experiences that are meaningful, mindful, and joyful, enabling learners to engage deeply with content, connect new knowledge to prior understanding, and apply learning in authentic contexts. Within the context of teacher professional development, a deep learning approach emphasizes reflective practice, collaborative learning, and experiential engagement, allowing teachers to internalize innovative pedagogical principles and adapt them to their instructional contexts.

Despite the growing interest in deep learning–oriented pedagogy, empirical studies examining its application within teacher professional development programs remain limited, particularly in elementary education settings in developing countries. Existing research has predominantly focused on student outcomes, with less attention given to how deep learning principles can be systematically integrated into training programs aimed at enhancing teachers' instructional competence. Moreover, few studies have employed evidence-based approaches, such as pre-test and post-test designs, to examine changes in teachers' pedagogical practices following participation in structured professional development interventions.

This gap is particularly evident in community-based professional development initiatives, where training programs are often implemented to address local educational needs but are rarely documented in a manner that contributes to the broader academic discourse. As a result, valuable insights into the effectiveness of such interventions remain underrepresented in international scholarly literature. Addressing this gap is essential for advancing knowledge on how professional development programs can be designed to support innovative teaching practices in diverse educational contexts.

Therefore, this study aims to examine the effectiveness of a deep learning–based professional development program in enhancing elementary school teachers' innovative teaching competence. Using a pre-test and post-test design complemented by participant reflections, the study explores changes in teachers' pedagogical practices following participation in a structured training program. By providing empirical evidence from a localized educational context in Indonesia, this study contributes to the literature on teacher professional development and innovative pedagogy, offering practical and theoretical implications for the design of sustainable training models in similar educational settings.

METHOD

This study employed a pre-experimental research design using a one-group pre-test–post- test approach to examine the effectiveness of a deep learning–based professional development program in enhancing elementary school teachers' innovative teaching competence. This design was chosen to capture measurable changes in teachers' pedagogical readiness and instructional practices before and after participation in a structured training intervention, particularly within a context where access to continuous professional development is limited.

The participants of the study were 32 elementary school teachers from two Madrasah Ibtidaiyah located in Godean District, Sleman Regency, Indonesia. Participants were selected through purposive sampling, targeting schools and teachers who had limited opportunities to participate in formal professional development programs. Most of the teachers were non-civil servant educators working under foundation-based school management, with diverse teaching experiences and varying levels of access to instructional technology. This context provided a relevant setting for examining the impact of a targeted professional development intervention.

The professional development program was implemented through an in-house training model that integrated deep learning principles. The program began with a face-to-face workshop focused on enhancing teachers' understanding of creativity development, innovative learning models, and the application of deep learning in classroom instruction. This was followed by hands- on practice in developing lesson plans and instructional modules aligned with deep learning principles. To support sustained learning and practical application, the training was extended through an online professional learning community using Google Classroom, where participants engaged in collaborative discussions, submitted instructional tasks, and received feedback from the training team. In addition, the program included follow-up supervision conducted through online monitoring and on-site school visits to support teachers during the implementation phase and to reinforce reflective practice.

Data were collected using a questionnaire consisting of 15 items designed to assess teachers' innovative teaching competence. The instrument measured key dimensions of innovative instruction,
including lesson planning, instructional strategies, student engagement, use of learning media, integration of technology, collaboration, and reflective practice. The questionnaire was administered as both a pre-test and a post-test using a four-point Likert scale. To complement the quantitative data, qualitative information was gathered through observational notes and participant reflections during workshops, mentoring sessions, and supervision activities.

The data collection process began with the administration of the pre-test prior to the implementation of the training program to establish baseline competence levels. After participants completed the workshop, online mentoring, and supervision phases, the post-test was administered using the same instrument. The data collection period spanned approximately one month, allowing participants sufficient time to engage with the training materials, complete assigned tasks, and begin applying innovative teaching practices in their classrooms.

Quantitative data were analyzed using descriptive statistical techniques by comparing mean scores from the pre-test and post-test to identify changes in teachers' innovative teaching competence following the intervention. Improvements were interpreted based on differences in average scores across measurement points. Qualitative data from observations and reflections were analyzed thematically to provide contextual insights and to support the interpretation of quantitative findings, particularly in relation to teachers' experiences, challenges, and perceived benefits of the training program.

RESULTS AND DISCUSSION

Results

The findings of this study reveal several important results related to the implementation and impact of a deep learning–based professional development program for elementary school teachers. Prior to the intervention, a needs assessment conducted in two Madrasah Ibtidaiyah—MI Chandran and MI Blendangan, Godean District—indicated that teachers had limited access to professional development opportunities, particularly free or institutionally supported training programs. Most participants were non-civil servant teachers employed by school foundations, with limited financial capacity and restricted access to instructional facilities, including personal laptops and school-based information and communication technology resources. These conditions contributed to constraints in implementing innovative and technology-integrated learning practices, despite increasing administrative and instructional demands related to digital systems.

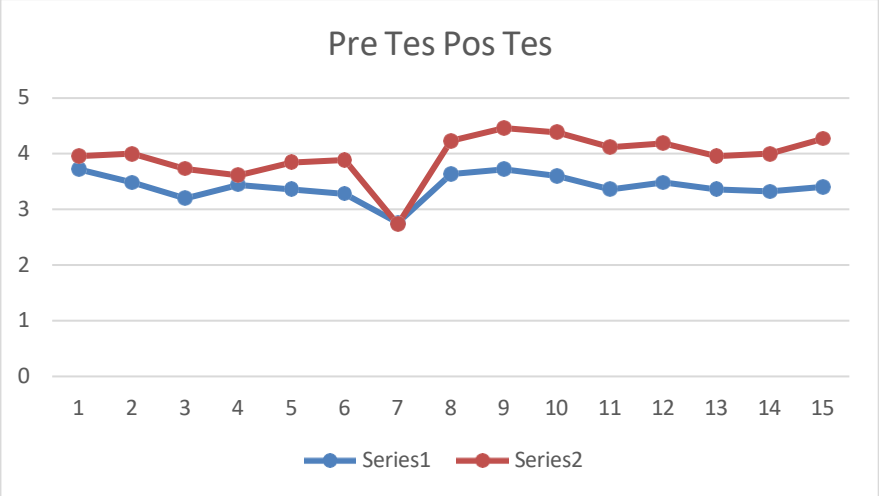

Figure 1. Pre-test and Post-test Results

The pre-test results showed that teachers' innovative teaching competence was generally at a high level, with a mean score of 3.40. This finding suggests that teachers possessed a positive conceptual understanding of innovative and student-centered learning approaches. However, analysis at the item level revealed notable variation across aspects. The lowest scores were found in items related to the varied use of technology in learning activities and the integration of information and communication technology into instructional practices. These results indicate a gap between teachers' pedagogical awareness and their practical capacity to implement technology-supported innovative learning in classroom settings.

Following participation in the workshop, mentoring activities, and supervised practice, the post-test results demonstrated a clear improvement in teachers' innovative teaching competence. The mean post-test score increased to 3.96, representing an average gain of 0.56 points compared to the pre-test results. Improvements were observed across all measured aspects, including lesson planning, instructional strategies, student engagement, and reflective practice. Despite this overall improvement, the use of technology in learning activities remained the lowest-scoring aspect, although it showed progress compared to the pre-intervention condition.

Qualitative observations during workshop sessions and discussions further supported the quantitative findings. Most teachers actively engaged in question-and-answer sessions and expressed strong interest in understanding how innovative and deep learning–oriented approaches could be adapted to their instructional contexts. Teachers' questions primarily focused on aligning innovative learning practices with existing administrative systems, managing instructional time, and addressing diverse student characteristics, particularly students who were physically active but less cognitively engaged. These discussions indicate that teachers were beginning to reflect critically on their instructional practices and classroom dynamics.

The results of the task-based assignments conducted through the Google Classroom professional learning community showed varying levels of readiness among participants. Most teachers were able to develop lesson plans or instructional modules that reflected elements of innovative and deep learning–oriented pedagogy. However, several challenges persisted, including limited understanding of the full range of innovative learning models, difficulties in integrating technology due to infrastructural constraints, and the need for further adaptation to existing administrative systems. Analysis of submitted lesson plans also revealed that assessment strategies within deep learning–oriented instruction required additional strengthening.

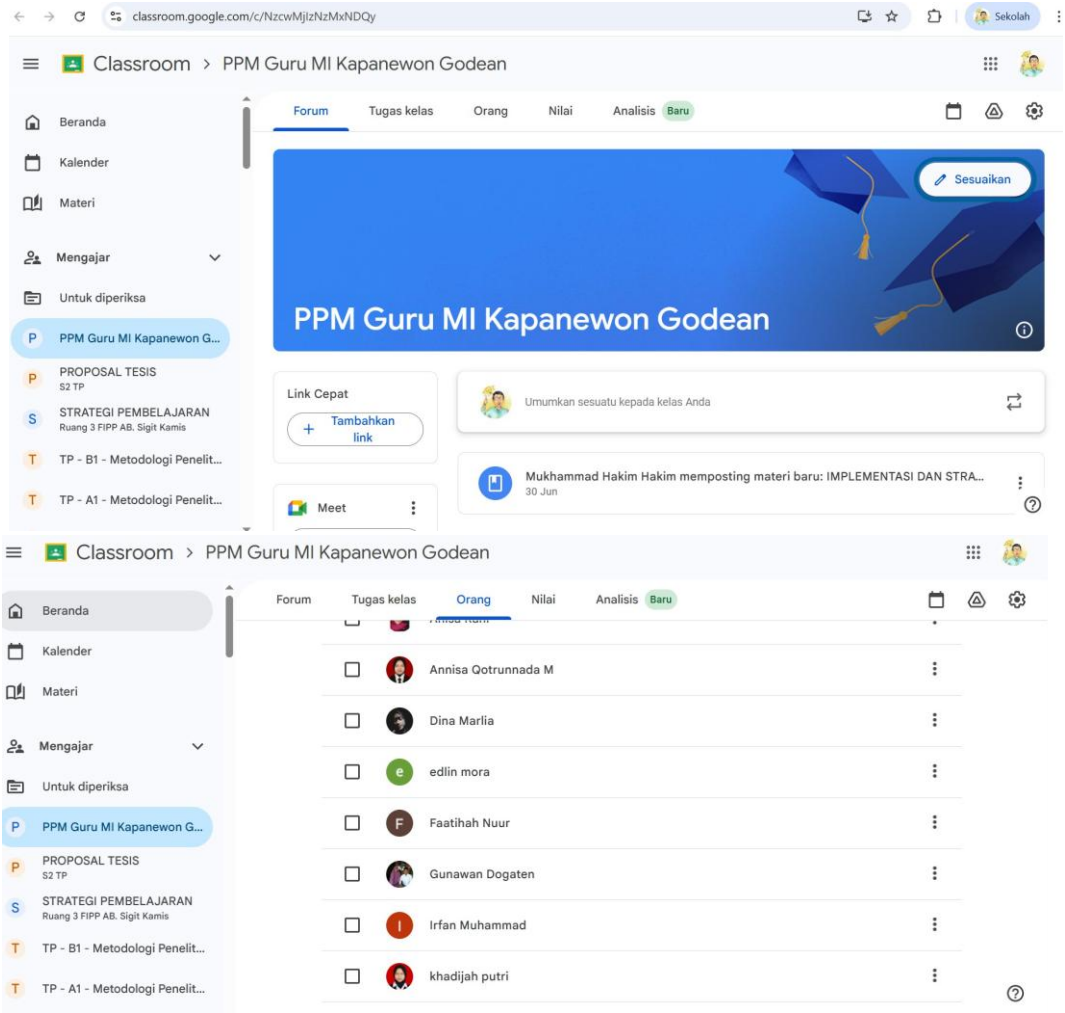

Figure 2. Assignments on Google Classroom

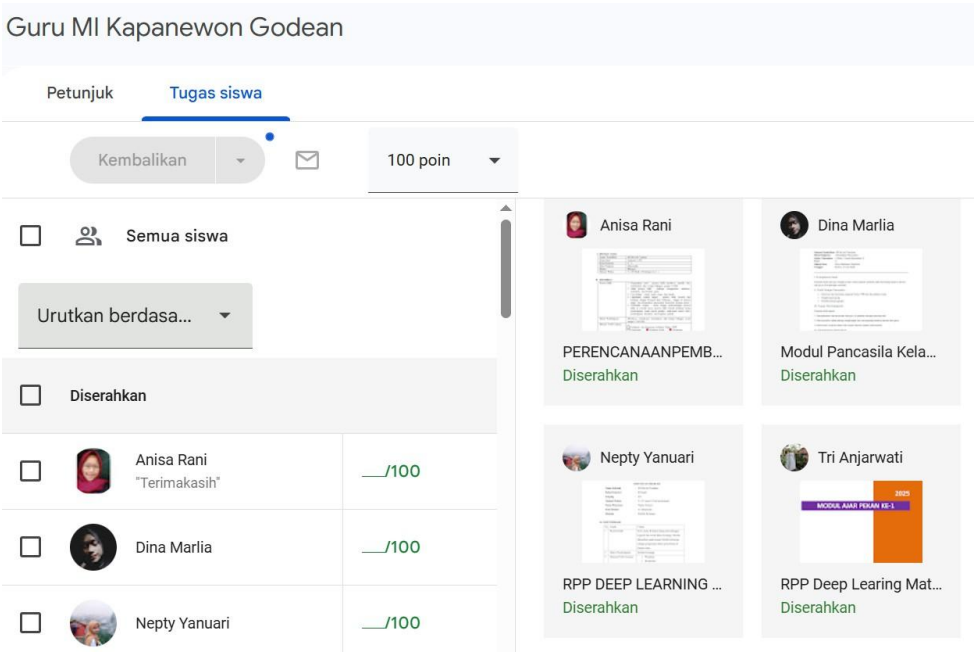

Figure 3. Presentation of RPS on Google Classroom

Follow-up monitoring and school visits conducted after the training provided further evidence of the program's impact and ongoing challenges. During the first monitoring phase, teachers demonstrated increased motivation and willingness to experiment with innovative learning practices, although many still required guidance in implementing mindful, meaningful, and joyful learning activities within limited instructional time. The second monitoring phase indicated gradual improvement in teachers' confidence and instructional planning, supported by feedback, collaborative reflection, and encouragement from school leadership. These findings suggest that sustained mentoring and contextual support played an important role in reinforcing the initial outcomes of the professional development program.

Figure 4. Monitoring and Visits

DISCUSSION

The findings of this study demonstrate that a deep learning–based professional development program can effectively enhance elementary school teachers' innovative teaching competence, as evidenced by the increase in mean scores from the pre-test to the post-test. Although teachers initially showed relatively high conceptual awareness of innovative and student-centered learning, the intervention played a critical role in strengthening their instructional readiness and confidence to apply these principles in practice. This finding confirms that professional development is not merely a process of introducing new pedagogical concepts, but a mechanism for transforming teachers' pedagogical orientations and classroom practices.

The observed improvement supports previous studies emphasizing that sustained, practice- oriented professional development contributes significantly to changes in teachers' instructional behavior. The integration of workshops, mentoring, collaborative learning, and supervision aligns with the characteristics of effective professional development, which emphasize relevance, active participation, reflection, and continuity. In this study, the use of a professional learning community through Google Classroom provided teachers with opportunities to engage in collaborative reflection, receive feedback, and gradually internalize innovative teaching strategies. This finding is consistent with research suggesting that collaborative and reflective learning environments strengthen the transfer of professional development outcomes into classroom practice.

Despite the overall positive outcomes, the results also reveal persistent challenges, particularly in the integration of information and communication technology into instructional practices. Although teachers' competence in technology use improved after the intervention, it remained the lowest-scoring aspect. This finding highlights the complex interplay between pedagogical readiness and contextual constraints, such as limited access to technological infrastructure and unequal availability of digital devices. Similar findings have been reported in previous studies, which indicate that teachers' willingness to innovate does not always translate into practice when structural barriers remain unaddressed.

Qualitative observations further indicate that teachers' questions and reflections during the training focused on practical concerns, including time management, alignment with administrative systems, and strategies for engaging diverse student characteristics. These concerns suggest that innovation in teaching is not solely a matter of adopting new methods, but also requires reorientation of teachers' professional identities and classroom

management strategies. The emphasis on mindful, meaningful, and joyful learning within the deep learning framework helped teachers reconceptualize student engagement, particularly in addressing students who are physically active but not cognitively involved. This supports the argument that deep learning–oriented pedagogy encourages teachers to view learner diversity as a pedagogical resource rather than a constraint.

The task-based assignments and follow-up supervision revealed varying levels of readiness among teachers in designing deep learning–oriented lesson plans, especially in relation to assessment practices. While most teachers were able to incorporate innovative instructional strategies, assessment design emerged as a critical area requiring further support. This finding aligns with previous literature indicating that assessment is often the most challenging component of pedagogical innovation, as it requires alignment between learning objectives, instructional activities, and evaluation methods. The results suggest that future professional development programs should place greater emphasis on assessment literacy within innovative and deep learning–based instructional frameworks.

Overall, the findings indicate that the effectiveness of professional development programs is strongly influenced by sustained mentoring, contextual sensitivity, and institutional support. The involvement of school leadership during follow-up visits played an important role in encouraging teachers to experiment with innovative practices and to gradually adopt new pedagogical paradigms. This highlights the importance of embedding professional development initiatives within broader school-level support systems to ensure long-term sustainability.

CONCLUSION

This study concludes that a deep learning–based professional development program has a positive impact on enhancing elementary school teachers' innovative teaching competence. The findings indicate measurable improvements in teachers' instructional readiness, confidence, and engagement with student-centered and innovative learning practices following participation in structured training, mentoring, and supervision activities. Although teachers initially demonstrated relatively high conceptual understanding, the intervention effectively strengthened their ability to translate pedagogical concepts into practical classroom strategies. Nevertheless, challenges related to technology integration and assessment design persist, reflecting the influence of structural and contextual constraints on instructional innovation. These findings suggest that professional development programs should be designed as sustained and practice-oriented processes that address both pedagogical and infrastructural dimensions. Future initiatives should prioritize continuous mentoring, collaborative professional learning communities, and stronger support for assessment practices within deep learning–oriented instruction. By providing empirical evidence from a localized educational context, this study contributes to the growing literature on teacher professional development and innovative pedagogy, particularly in elementary education settings with limited resources. The findings offer practical implications for educators, school leaders, and policymakers in designing professional development models that are responsive, sustainable, and aligned with the demands of 21st-century learning.

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Training in Tuned Percussion Instruments in the Cultural Village of Glondong Tirtomartani Kalasan

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Abstract. The second phase of the PkM Assignment for Professors and Structural Lecturers, entitled Training in Tuned Percussion Instruments in the Cultural Village of Glondong Tirtomartani Kalasan, aims to provide musical skills and experience to the residents of the Cultural Village of Glondong, especially the women members of the Cultural Village of Glondong. The methods used in this activity include sectional and combined training. Sectional training covers the playing of musical instruments, including bellyra and several bellyra made from glass. Imitation and drill methods are applied in this training. Combined exercises are carried out to harmonize the playing of other musical instruments, namely the keyboard, angklung, kendang, and vocals. The result achieved was the performance of four songs, namely Sorak-sorak bergembira, Lir-ilir, Yang Pertama Kali, and Suket Teki. The women members of the Glondong Cultural Village were able to play the pitched percussion instruments well and in unison.

INTRODUCTION

Glondong Village, Tirtomartani Kalasan Subdistrict, has a long-standing tradition of Gejog Lesung and Kethoprak arts. This village has strategic tourism potential in terms of cultural heritage and geographical location. The village has a Cultural Heritage Site, Rumah Indis, which has been restored and inaugurated by Sri Sultan Hamengkubuwono X. Within a radius of about 1.5 kilometers around Glondong Village, there are three temple ruins, 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. Prambanan Temple, which has enormous tourism potential, is located about 4 km from this village, while Sambisari Temple is located about 7 km to the west. To the north, beyond the houses of Glondong Village, there is a rice field area with beautiful scenery. The village is strategically located on the Yogyakarta-Solo Highway at Km 13.5, making it easily accessible to domestic and foreign tourists. The Raden Ronggo Field in Glondong Village is also used as a venue for cultural performances and carnivals in the Tirtomartani sub-district. The carnival cultural performances take place along the route from Raden Ronggo Field to the Tirtomartani sub-district in Sleman.

Glondong Village has a Gejog Lesung art form with musical instruments consisting of 2 ancient Lesung, 16 Gejog, one Drum Set, and guitar and keyboard equipment. The name of the Gejok Lesung group is Roro Jonggrang, with 34 members and musicians. Gejog Lesung Roro Jonggrang has participated in activities at the village, regency, and provincial levels. Its activities include participating in cultural parades on village anniversaries, providing entertainment at cultural seminars, and enlivening the Clean and Healthy Lifestyle competition at the DIY provincial level.

The women of Glondong Cultural Village also often hold monthly exercise sessions. The potential for tourism in the form of dance and music performances will be further enhanced if training in pitched percussion instruments is provided. Following the training in each neighborhood unit (RT), performances using tuned percussion instruments will be held, thereby enhancing the skills of Glondong Village residents for performances that could eventually lead to independent productions for tourism-related shows.

The purpose of this community service activity is to equip the women of Glondong tourist village with the skills to play percussion instruments such as metal and glass bellyra, tuned kentongan, and bamboo kulintang as an effort to enhance and develop the appeal of Glondong tourist village. This is closely related to the students involved in this community service activity, as it can provide valuable experience for students in applying their knowledge, collaborating, and adapting to the community, which of course supports IKU 2. Student involvement in this community service is part of the implementation of MBKM UNY. Lecturers conducting activities 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 both domestic and international tourists, thereby

supporting IKU 6. This community service activity focuses on training in angklung and gejog lesung, which culminate in a music performance parade.

Much of the wealth of knowledge about traditional angklung has yet to be revealed, classified, and categorized, and remains stored in the minds of individuals and indigenous communities who remain loyal supporters of this art form. Efforts are needed to immediately collect this wealth of knowledge. This is even more crucial after the angklung was recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as Indonesia's Intangible Cultural Heritage of Humanity. (1) This recognition carries a heavy burden of responsibility, because within four years, if Indonesia does not preserve and develop the angklung, UNESCO's recognition could be revoked (2). According to Anis Jati Sunda in (3), the angklung in Sunda symbolizes love, meaning that the elderly must care for the young, but the young always turn their backs on the elderly.

This implies that the elderly always serve as guardians for the young, with parents being the source of proverbs and life lessons for the young (a source of information related to advice, behavior, and life actions). As for Atik Soepandi's opinion in Masunah (3), the essence of angklung is related to proverbs in life. The Sundanese people say: "ulah (ng)elmu angklung," which means that in terms of organology, the small angklung (representing children) always stands behind the large angklung (representing parents), meaning that parents' love is very great, but their children do not pay much attention to them and even pay more attention to their own children. This proverb advises young people in particular not to neglect their parents.

The name Gejog Lesung is a term that comes from the Javanese language. According to S. Prawiro in his book Bausastra Jawa (4), gejog is kothekan nganggo lesung. Meanwhile, lesung is a piranti nganggo nutu pari. Gejog is pounding using a mortar, while a mortar is a place for pounding rice. In the diversity of arts found in the cultural region of Indonesia, gejog lesung is a type of traditional art in the form of music (5).

METHOD

Problem Solving Framework

The geographical and cultural potential of the Glondong Tirtomartani Kalasan community is highly relevant for development into a tourist village, while the academic strengths of UNY lecturers in the fields of drama, dance, and music are undoubtedly capable of applying their knowledge and skills in the community in accordance with the theme of this Community Service Program, which refers to the Community Service Program Strategic Plan and follows strategic issues and national policies.

The solutions related to the development of the tourism potential of Glondong Cultural Village are as follows:

1. Training in the skills of playing metal and glass bellyra, pitched kentongan, and bamboo kulintang for the women of Glondong Cultural Village.
2. Training in rhythm through playing metal and glass bellyra, pitched kentongan, and bamboo kulintang.

UNY's collaboration in this matter, namely the Music and Dance Study Program, has been initiated for a long time. In 2018, the Ketoprak performance accompanied by Gejog Lesung - Angklung was attended by the Dean of FBS and the Deputy Regent of Sleman. In 2018, a performance was also held in the village, concurrently with the signing of an MOU between the FBS UNY and Tirtomartani Village, initiated by the Glondong Cultural Village. Training in metal and glass bellyra, tuned gongs, and bamboo kulintang can become a tourist attraction once the cultural resources of Glondong Village are sufficiently developed in musical skills.

Target audience

The target audience for this activity is the women of Glondong tourist village, who will be taught how to play percussion instruments such as metal and glass bellyra, tuned kentongan, and bamboo kulintang, in an effort to enhance and develop the appeal of Glondong tourist village.

Activity Method

The implementation of the Gejog Lesung and angklung training with a Parade Performance between RTs in the Glondong Cultural Village enables human resources to play gejog lesung and angklung music using the following method:

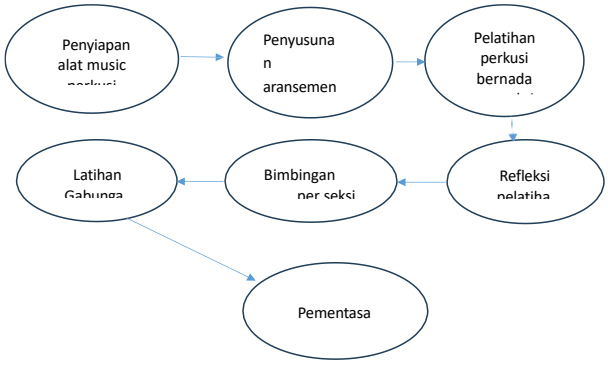

Figure 1. Method of conducting training on bellyra, tuned kentongan, bamboo kulintang, plus gejog lesung and angklung

The operational steps for the training target begin with the preparation of tuned percussion instruments, including bellyra, tuned kentongan, bamboo kulintang, plus gejog lesung and angklung. Next is arranging several songs to be played. The next stage is sectional training, which is training in playing pitched percussion instruments. During several training sessions, training reflections are held. The results of the reflections are then followed by sectional guidance in the form of further training. The results of the sectional training are then combined in the final training session, which culminates in a pitched percussion music performance.

Implementation of Community Service Activities

Overall, the music performance in the context of the GBDS phase 2 PkM assignment went well and smoothly. There was a slight evaluation of the kendang percussion instruments, which were still not very consistent in tempo. This was due to the lack of practice time for the kendang players in joint rehearsals.

Supporting and inhibiting factors for activities

Supporting Factors

a. Solidarity among the residents of Budaya Glondong village

The residents of Budaya Glondong village have a strong sense of solidarity. This has been proven on several occasions when the UNY PkM team collaborated with the residents of Budaya Glondong village, who were very enthusiastic and welcomed the PkM activities with a spirit of togetherness. This was evident in the support shown by the head of Glondong hamlet, Mr. Nurkholis, in welcoming the UNY PkM team. Through the guidance of the head of the hamlet, the residents of Budaya Glondong village worked together to support the UNY PkM program activities.

b. Facilities and infrastructure

The 2025 UNY PkM activities cannot be separated from the need for facilities and infrastructure in implementing its programs. The availability of musical equipment greatly supports the implementation of the program. Adequate training facilities are able to facilitate the smooth running of both sectional and joint training processes.

The existence of the Opa Oma cafe also greatly supports the infrastructure for joint music performances. As the highlight of the 2025 UNY PkM activities, a music performance was held at the Opa Oma cafe, playing four songs, namely Sorak-Sorak Bergembira, Lir-ilir, Yang pertama, and Suket Teki.

c. Enthusiasm for practicing

The women of Budaya Glondong village have a high spirit for practice. Despite their busy schedules as homemakers and diverse professional backgrounds, their enthusiasm for practice remains undiminished. This was evident during evening practices, where they participated diligently and with discipline.

Figure 2. Practicing pitched percussion instruments

Barriers

a. Activity schedule

The residents of Budaya Glondong village have very busy schedules, making it difficult to arrange rehearsal and performance schedules. The only time available for rehearsals is in the evening, as a solution to their busy schedules in the afternoon and evening, when they have to work.

In addition to unavoidable work commitments, the residents of Budaya Glondong village also have other activities that keep them quite busy. This can be seen from the initial plan for the men to participate in rehearsals, but because it coincided with other activities, the men who were supposed to play the drums were unable to join the rehearsals, so the rehearsals did not achieve maximum results.

b. Practice time

The agreed practice time is in the evening from 7:30 PM to 9:30 PM. Due to the limited practice time, the skills developed have not been fully successful. Musical instrument playing skills are also determined by how often they practice, how effectively they practice, and how effectively they learn independently.

i)

Figure 3. Joint performance of pitched percussion instruments with angklung

CONCLUSION

The second phase of the GBDS Community Service Program, entitled ..., ran smoothly and successfully. This was evident from the ability of the women of Glondong Cultural Village to play percussion instruments, both metal and glass bellyra, well. Four songs titled Sorak-Sorak Bergembira, Lir-ilir, Yang pertama, and Suket Teki were performed well and in unison, supported by other musical instruments such as angklung, keyboard, and kendang.

ACKNOWLEDGMENTS

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STRENGTHENING PRIMARY SCHOOL TEACHERS' PEDAGOGICAL COMPETENCE THROUGH DIGITAL INNOVATION AND COLLABORATIVE-BASED DEEP LEARNING TRAINING

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Abstract. This article examines the strengthening of pedagogical competence among primary school teachers in Bantul Regency through a deep learning training program that integrates digital innovation and collaborative approaches. The aim of this training program is to strengthen teachers' pedagogical competence with the knowledge and skills necessary to implement learning principles within deep learning. The program was conducted by a team of lecturers from Yogyakarta State University in collaboration with the Bantul Regency Education Office, involving 33 teachers from two partner primary schools: SDN 2 Sumberagung and SDN 2 Patalan. Considering the participants' characteristics, the training was conducted interactively through lectures, simulations, and collaborative discussions, utilizing digital media such as Google Forms and Google Classroom for initial assessments and participant reflection. Qualitative descriptive analysis of observations, participant reflections, and documentation indicates that this training can improve teachers' ability to design deep learning, use simple technology for idea exploration, and strengthen inter-teacher collaboration in creating learning innovations. Teachers demonstrated an increased ability to apply deep learning by adhering to principles of enjoyable, meaningful, and mindful learning. Furthermore, the use of digital technology and collaborative approaches facilitated teachers in managing the processes and requirements of deep learning. This training model proves that the integration of collaborative and digital approaches can be an effective strategy for strengthening teacher competence in the 21st-century educational transformation era. However, field challenges such as school facility support and learning time constraints were identified as barriers to full implementation. This study concludes that although the training program proved effective in improving teachers' pedagogical abilities in implementing deep learning, sustainability support is needed to maintain this improvement. Further efforts involving schools and parents are required to support teachers' collaborative innovations in sharing ideas and best practices of deep learning to ensure long-term success.

Keywords: pedagogical competence, deep learning, digital innovation, collaboration, teacher training

INTRODUCTION

The educational paradigm shift in the 21st century demands teachers to transform in carrying out their roles. Teachers, who initially played the role only as instructors with a primary focus on material delivery, are changing into learning facilitators who empower students. This transformation is crucial amidst the rapid development of digital technology and national policies such as Merdeka Belajar, which emphasize independence, creativity, and collaboration in the learning process (Kemendikbudristek, 2023).

However, in practice, these changes have not been fully realized in primary education units. In reality, there are still many primary school classrooms that exhibit conventional learning patterns that place the teacher at the center of learning activities. The teacher acts as the full controller of the learning flow, ranging from determining content to having full control over assessment, while students play a passive role only as information recipients. This teacher-oriented learning phenomenon is evident from the still-dominant use of one-way lectures, practice questions, and Q&A directed as primary strategies.

Student learning activities are mostly directed only toward remembering and repeating information, not interpreting it or relating it to real-life contexts. Learning takes place with a focus on completing material delivery and cognitive achievement, rather than on meaningful learning experiences. This condition is certainly concerning, making the space for exploration of ideas and student reflection limited. Consequently, the learning that occurs in primary schools often runs mechanistically and lacks the cultivation of self-awareness, empathy, or reflective thinking skills that form the basis for deep learning.

National reports also show that most primary school teachers still evaluate learning success based on cognitive test results or students' ability to answer questions correctly (Kemendikbudristek, 2023). This type of assessment pattern places cognitive learning outcomes as the final goal, rather than as the learning process itself. International

assessment results such as the Programme for International Student Assessment (PISA) in 2019 show that Indonesian students are still low in terms of literacy, numeracy, and critical thinking skills (OECD, 2019).

These conditions can be traced back to learning practices that have not provided opportunities for students to build meaning, collaborate, or reflect on their learning experiences. Learning oriented toward final results also tends to ignore students' social-emotional dimensions and self-awareness, even though both aspects are important foundations for deep and sustainable learning. In addition to learning orientation issues, another dominant challenge at the primary school level is the weak culture of professional collaboration among teachers.

Teachers often work individually in preparing learning materials, carrying out learning activities, and conducting evaluations. Collaboration that occurs is generally limited to administrative activities, such as preparing curriculum documents or learning reports, and has not touched upon shared reflection on pedagogical practices. Consequently, the space for teachers to learn from each other and share innovations becomes very limited. Yet, professional collaboration is one of the important factors determining the success of learning innovations and the improvement of teachers' pedagogical competence (World Bank, 2022; Supriyanto & Mustakim, 2021).

Several studies in the context of primary schools also show that learning practices that are still teacher-oriented cause the learning process to lose personal meaning for students. In such situations, learning runs one-way and passively, and students tend to only follow instructions without understanding the relevance of the activities to daily life. Students are rarely invited to reflect on their learning experiences or understand their own thinking processes.

As a result, the dimension of mindfulness (namely full awareness of what is learned, felt, and done) has not become part of the learning experience in primary schools. Such learning provides little room for the development of empathy, minimal self-regulation, or social awareness, which are actually important foundations in character development and deep learning at the primary school age. In the context of current educational transformation, the need for meaningful, reflective, and collaborative learning models is becoming increasingly urgent.

One approach that offers a new paradigm is Deep Learning. This concept was developed by Fullan, Quinn, and McEachen (2018) as a learning strategy that places students as meaning-builders and discoverers of relationships between knowledge. This approach is oriented toward the development of six key competencies (6C): character, collaboration, creativity, critical thinking, communication, and citizenship. Deep learning does not merely guide students to understand the material, but invites them to think reflectively, find social relevance, and act based on that understanding.

Thus, Deep Learning emphasizes a conscious, meaningful, and contextual learning process (learning that matters). The OECD Future of Education and Skills 2030 (2023) also assert that the future of education demands the development of transformational competencies that include the ability to act reflectively, collaboratively, and with social awareness. These competencies cannot grow through surface learning, but through learning experiences allow students to construct meaning, interpret reality, and connect it with real actions.

Therefore, Deep Learning becomes a relevant approach to answer the challenges of the 21st century and aligns with the direction of the Kurikulum Merdeka policy in Indonesia, which positions students as active subjects of learning. National education policy has now also adopted Deep Learning principles as the core of meaningful learning. The Deep Learning Guide for Primary School Teachers (Kemendikbudristek, 2024) emphasizes that the goal of learning is not only to increase academic results but also to foster reflective abilities, social awareness, and collaboration among students.

In this policy, teachers are expected to be able to design meaningful learning, challenging students to think critically, find relationships between concepts, and relate them to real life. However, many teachers in the field still face difficulties in applying these principles due to limited conceptual understanding, digital literacy, and opportunities for collaboration (Tanoto Foundation, 2024). Various studies related to teacher training show that when teachers are given the opportunity to learn collaboratively and are supported by simple digital technology, their ability to design and implement meaningful learning can increase significantly.

Training based on reflective practice, simulations, and peer discussions is proven to strengthen teachers' understanding of deep learning principles and foster a culture of sharing ideas and best practices. Through this process, teachers not only acquire new pedagogical skills but also develop self-awareness and social sensitivity as part of their own learning process. The training program implemented in the Community Service (PkM) activities of Yogyakarta State University in Bantul Regency is one concrete form of effort to strengthen the pedagogical competence of primary school teachers through the integration of digital innovation and collaborative approaches.

This program aims not only to increase knowledge about Deep Learning but also to encourage teachers to apply it in a contextual, reflective, and mindful learning context. Through the support of digital media such as Google Forms and Google Classroom, teachers are given space to practice, evaluate themselves, and collaborate in designing meaningful learning. Thus, the implementation of Deep Learning in primary schools is not just a methodological innovation, but a systemic need in efforts to strengthen the character and learning awareness of students.

Deep learning is the key to building a generation that thinks critically, empathizes, and is adaptive to the changes of the times. Furthermore, this effort also becomes the foundation for strengthening teacher competence so that they are able to create a learning ecosystem that is inclusive, collaborative, and oriented toward meaning. This research is expected to provide empirical evidence that collaboration-based training and digital innovation can be an effective strategy in strengthening the pedagogical competence of primary school teachers and accelerating the transformation of learning toward the Deep Learning paradigm.

METHOD

This digital innovation and collaborative-based deep learning training was implemented using a participatory and reflective approach with a Blended Reflective Workshop model. The training design includes 4 stages, starting from Define, Design, Implementation, and Evaluation. These four stages are carried out sequentially and systematically, where each stage has sub-stages implemented in the training. These stages are presented in Figure 1.

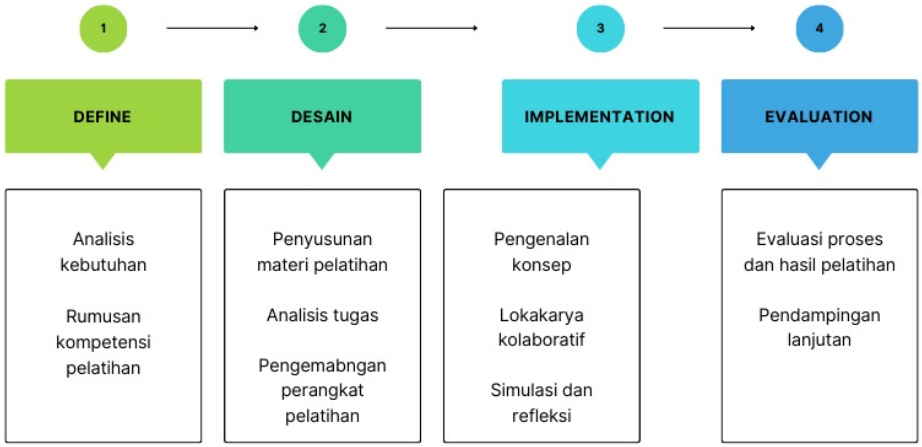

Figure 1. Design of training stages for deep learning based on digital innovation and collaboration

Figure 1 shows each stage and sub-stage in the training design. The Define stage is the initial and key stage in this training program. This stage aims to find gaps in knowledge and abilities which represent a competency need for the training participants. The community service team, in collaboration with the Bantul Regency Education Office, performed a needs mapping and digital Pre-test (filling out Google Forms) at this stage to identify the initial level of understanding of Deep Learning and digital readiness.

The Design stage is the stage of planning the training based on the results of the needs analysis. The design stage includes the preparation of training materials, task analysis, and development of training tools including teaching materials and evaluations. In this stage, a digital innovation and collaborative-based deep learning training curriculum was produced as a guide in implementing the training. The implementation stage is the execution of digital innovation and collaborative-based deep learning training. This stage includes three activities, namely: 1) conceptual introduction activities, 2) collaborative workshops, 3) simulation and reflection.

RESULTS AND DISCUSSION

The digital innovation and collaborative-based deep learning training program was implemented through four main stages referring to a systematic development model, namely Define, Design, Implementation, and Evaluation. Each stage has an interrelated role in ensuring the training runs effectively, contextually, and provides a real impact on increasing the pedagogical competence of primary school teachers. The Define stage is the initial step aimed at identifying the real needs of primary school teachers regarding deep learning training.

The needs analysis was conducted by the Yogyakarta State University service team together with the Bantul Regency Education Office involving 33 teachers from two partner primary schools (SDN 2 Sumberagung and SDN 2 Patalan). Data were collected through questionnaires, guided interviews, and focus group discussions. The results of the analysis in the Define stage showed that most teachers still had limited understanding of the Deep Learning concept. Many teachers considered deep learning as a process of "deepening the material," rather than as an approach that fosters reflective awareness, critical thinking, and interconnectedness of meaning between concepts.

Teachers also did not fully understand the six core competencies (6C) that form the basis of 21st-century learning: character, collaboration, creativity, critical thinking, communication, and citizenship. The needs analysis

was strengthened by quantitative data collection through a questionnaire on a scale of 1–5 covering four main aspects: understanding deep learning concepts, the ability to design learning, the utilization of digital innovation, and professional teacher collaboration. The achievements of each training need aspect are presented in Figure 2.

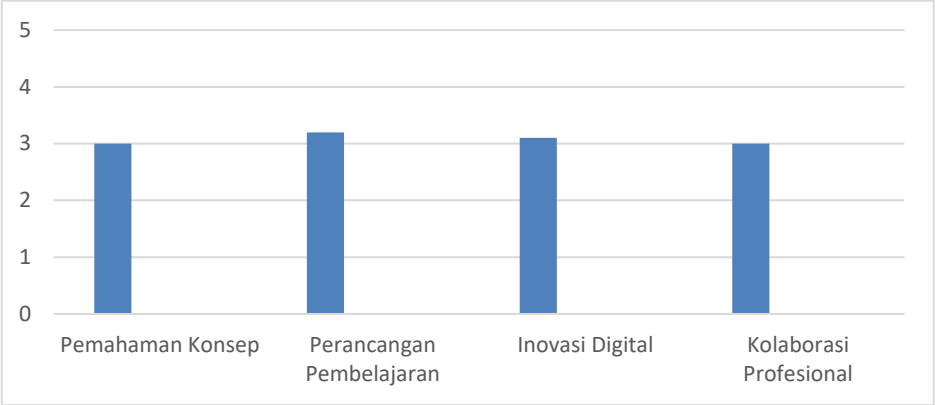

Figure 2. Average teacher competency needs prior to training

Figure 2. shows that the questionnaire results had an overall average score of 3.15 (moderate category). As shown in Figure 2, the four aspects of teachers' pedagogical competence were in the moderate category, confirming that teachers have initial readiness for learning innovation but still require conceptual and operational reinforcement. These results illustrate that teachers already have positive motivation toward learning innovation but still require operational training support. Teachers desire training that does not only explain theory but provides concrete guidance on the implementation of deep learning in the classroom.

In the aspect of technology utilization, teachers showed high enthusiasm although their digital abilities varied. Some teachers had used Google Forms, Canva, or Quizizz, but were limited to evaluation and assignment functions. Additionally, the teacher collaboration culture was still administrative, such as preparing lesson plans, rather than pedagogical reflection. Therefore, the Define stage produced a picture that training needs to be focused on strengthening applicative understanding, the utilization of digital learning tools, and the development of collaborative communities among teachers.

The Design stage is the training design phase that responds to the teacher needs identified in the previous stage. The design was carried out with the principles of learning by doing and reflective collaboration, so that training participants do not only receive material but also experience a deep and reflective learning process as they will apply it in class. The training design consists of four main components, namely: teacher task analysis, training material design, training tool development, and evaluation design.

Task analysis resulted in four target competencies, namely: (1) understanding the principles of deep learning based on 6C; (2) designing contextual and reflective learning; (3) utilizing digital innovation in the learning process; and (4) building professional collaboration among teachers. Training materials were designed in four main topics: (1) concepts and principles of deep learning, (2) learning strategies based on projects, inquiry, and reflection, (3) utilization of digital innovations (Padlet, Canva, Quizizz, Google Forms), and (4) collaboration and reflection of teachers based on practice communities.

The training tools developed included training modules, teaching materials, participant worksheets, assessment rubrics, and Google Classroom as a medium for online interaction. Evaluation was designed to measure three aspects: conceptual understanding, learning design skills, and professional reflection. The result of this stage is the digital innovation and collaborative-based deep learning training curriculum, which consists of three main sessions and one final reflection session. The training was designed so that participants progress from theoretical understanding toward actual practice and peer reflection, with outputs in the form of Deep Learning-based Lesson Plans (RPP) and digital learning media prototypes.

The Implementation stage is the direct execution of the training design. The activities were carried out over two days of intensive face-to-face sessions and three days of online follow-up through Google Classroom. The training involved 33 teachers from two partner schools and covered three main activities: (1) conceptual introduction, (2) collaborative workshops, and (3) simulation and reflection. In the conceptual introduction activity, participants gained a deep understanding of Deep Learning principles through presentations, case studies, and reflective discussions. Pre-test and post-test results showed an increase in conceptual understanding from 61% to 86%. Teachers began to understand the difference between conventional learning and deep learning that fosters meaning, reflection, and collaboration.

The Evaluation stage is the final stage covering process, result, and training sustainability evaluation. Process evaluation was carried out during the activities through facilitator observation and daily participant reflection. Participant attendance was very high, with an average attendance of 97% and a high level of active involvement in all training sessions. Result evaluation showed significant improvements in the knowledge and skills of teachers. This improvement can be observed in Figure 3 regarding the increase in teachers' conceptual understanding.

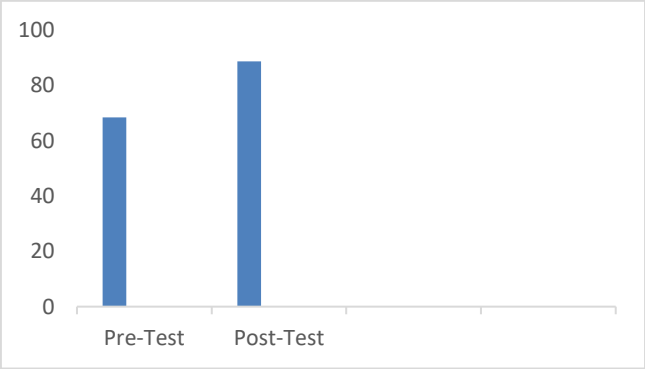

Figure 3. Comparison of pre-test and post-test results of deep learning conceptual understanding

Figure 3 shows a significant increase in teachers' conceptual understanding from a pre-test average of 68.4 to a post-test average of 88.7, indicating the effectiveness of reflection and collaboration-based training. Digital reflection via Google Classroom showed changes in teachers' perspectives on learning: from being oriented toward material delivery to learning that emphasizes meaning, reflection, and collaboration. The collaborative workshop stage focused on 6C-based learning design with digital tool support.

Participants worked in cross-school groups to design learning and project-based activities. Observation results showed that participants succeeded in preparing learning designs based on the deep learning approach with the integration of digital innovation. Teachers also succeeded in integrating at least one digital tool in their learning design. This training process also fostered a collaborative spirit among teachers that had not previously developed. The simulation and reflection stage was carried out through microteaching and peer assessment using rubrics.

Teachers showed significant improvement in the ability to design meaningful activities and facilitate student reflection. As many as 82% of participants showed an increase in ability in developing project-based learning and student self-reflection. Teachers also stated that the training helped them understand the importance of reflective thinking and professional collaboration in teaching. Mentoring activities resulted in a sustainability plan in the form of the formation of a teacher reflection community in the two partner schools, which became a forum for sharing best practices and continuous deep learning innovation.

Overall, the Evaluation stage showed that the training not only improved teachers' individual competence but also fostered a professional learning culture in the primary school environment. These results reinforce that digital innovation and collaborative-based deep learning training can be an effective strategy in encouraging the transformation of learning practices in primary schools.

CONCLUSION

The implementation of the digital innovation and collaborative-based deep learning training program provides a tangible contribution to the improvement of primary school teachers' pedagogical competence. The four stages of training design (Define, Design, Implementation, and Evaluation) form an integrated process to ensure the training runs relevantly, applicably, and sustainably. The Define stage successfully identified the real needs of teachers, namely limited conceptual understanding regarding deep learning and the need for operational guidance for its application in the classroom.

Based on these findings, the Design stage produced a training curriculum emphasizing active learning experiences, digital integration, and collaborative reflection among teachers. In the Implementation stage, teachers were actively involved in concept reinforcement activities, collaborative workshops, and learning simulations (microteaching). Quantitative and qualitative data show an increase in teachers' conceptual understanding from 61% to 86%, and the ability to design contextual learning with digital tool integration reached 87%.

The Evaluation stage further confirmed this success, with increased post-test scores and teachers' ability to produce RPP in line with Deep Learning principles and the six main competencies (6C). More than just improving individual abilities, this training also encouraged the growth of a reflective teacher community that serves as a forum for sharing best practices and continuous learning innovation. This shows that the combination of Deep

Learning principles, the utilization of digital technology, and peer collaboration can be an effective strategy to transform learning practices into more meaningful, reflective, and student-centered.

Thus, this training provides empirical evidence that teacher professional development based on digital innovation and reflective collaboration can be a sustainable model supporting the implementation of the Merdeka Belajar policy. In the future, similar activities need to expand the scope of mentoring and networking between schools so that deep learning practices can be applied more broadly and consistently in the primary education environment.

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Empowering Teachers to Create Character-Based Children's Songs: A Workshop for Elementary and Kindergarten Educators in Yogyakarta

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Abstract. Early childhood education lays the foundation for the development of future generations. Children's songs are effective and engaging media for integrating positive values in young learners. However, many kindergarten and elementary school teachers have limited skills in selecting or creating songs that reflect character education values. Therefore, a workshop was organized as a community service program to facilitate 61 kindergarten and elementary school teachers in learning how to compose and teach songs that integrate character education into music instruction. The workshop took place in Sleman, Special Region of Yogyakarta, on July 8-9, 2025. These activities were as follows: (1) introduction to children's songs with character values, (2) musical foundations, (3) principles of composition, and (4) implementation and mentoring. The results show that participants successfully composed eight original children's songs and effectively implemented the new materials in their classrooms, with students showing great enthusiasm. The program also produced an e-book compilation of 11 children's songs (including the eight originals) as a sustainable learning resource. These results show that teachers can successfully include character education into music instruction and creation.

INTRODUCTION

Character education is essential for shaping a moral, ethical, and responsible future generation from an early age (Hasbi & Ine Indiyani, 2025). Childhood, often called the golden age, is a crucial period when children easily absorb moral and social values through enjoyable learning experiences. One of the most effective and engaging media for integrating character values is children's songs (Destiana, 2024).

Theoretically, children's songs play an essential role in early childhood learning. They are musical compositions that are intended to convey educational lessons and are based on the traits, actions, and experiences of children (Kusumawati, 2013). Songs for children that are effective usually have catchy, simple lyrics, upbeat tempos, and moral lessons applicable to daily life (Afiffah et al., 2022; Guatama, 2020). These songs can foster positive character qualities, social development, creativity, and language abilities when they are age-appropriate (Wicaksono et al., 2023).

Despite their pedagogical value, the availability of new children's songs relevant to the current era is severely limited. Teachers of kindergarten and elementary school frequently use traditional works by authors like A.T. Mahmud and Ibu Sud. Even though these songs have plenty of instructional value, kids nowadays are exposed to more and more popular songs that are affected by social media and may not necessarily represent moral principles. This situation emphasizes how urgently children's songs that are more contextual, relevant, and overtly full of virtues like cooperation, honesty, discipline, responsibility, and tolerance need to be developed.

Kindergarten teachers of Aisyiyah Seyegan Foundation and elementary school teachers of Muhammadiyah Seyegan Foundation in Sleman also face similar problems. The teachers are highly enthusiastic about educating children, but face limitations in developing song-based learning media. They still find it difficult to find references for new children's songs that can be used to integrate character values into teaching and learning activities. In addition, the teachers' skills in teaching children's songs are still limited to traditional methods focusing on introducing lyrics and melodies without integrating collaborative activities that encourage children's creative expression, self-confidence, and togetherness.

The kindergarten teachers of Aisyiyah Seyegan Foundation and the elementary school teachers of Muhammadiyah Seyegan Foundation in Sleman face similar difficulties. They are highly enthusiastic about

educating children, but encounter a limitation: difficulty finding **references for new children's songs** that can be used to integrate contemporary character values into their teaching.

Based on these issues and theoretical studies, concrete efforts are needed to empower teachers in creating and teaching character-based children's songs. Thus, a community service (Pengabdian kepada Masyarakat/PkM) workshop on children's song creation was deemed necessary to improve teachers' competence in integrating character education through music. This activity aims to:

1. Introduce new children's songs that contain character values to teachers.
2. Develop teachers' skills in singing, creating, and teaching character-based children's songs.
3. Produce a sustainable e-book collection of children's songs written by the participating teachers as an inspiring learning resource for partner schools.

METHODS

This community service activity was a workshop designed to improve the competence of kindergarten and elementary school teachers in creating and teaching character-based children's songs. The workshop was held in Sleman Regency, Special Region of Yogyakarta, from July 8 to 9, 2025.

Participants and Setting

Sixty-one teachers participated in this activity, including teachers from the Kindergartens of Aisyiyah Seyegan Foundation and the Elementary Schools of Muhammadiyah Seyegan Foundation. The training was conducted at the Genduk Wulan Meeting Hall in Sleman.

Workshop Stages

The workshop was structured into several consecutive stages to ensure a comprehensive learning experience:

1. Introduction and Conceptualization: The participants were given materials on the essence of children's songs, their special nature, their learning purposes, and the direct connection between musical material and character values.
2. Musical Foundation: This stage provided an introduction to simple musical notation (solfège/numbers) that teachers could readily use as a practical guide for song composition and instruction.
3. Composition Principles: The participants were presented with the fundamentals of developing children's songs, such as organizing simple melodies, making the lyrics fit their students' ages, and incorporating moral messages that apply to their everyday lives.
4. Implementation and Mentoring: Following the intensive training, teachers were assigned a project to independently create a children's song and implement the three newly learned songs in their classrooms. Follow-up mentoring was conducted to monitor the application of the new songs and evaluate the program's success.

Training Methods

The following methods were implemented in the workshop.

1. Lectures and Demonstrations: These are applied to introduce fundamental ideas of children's songs, character values, and musical notation using such media as presentation slides and keyboard instruments. The facilitator demonstrated proper singing techniques, intonation, expression, and song introduction methods.
2. Drills: Applied through repetition of singing and teaching practices to improve participants' skills and confidence in musical performance.
3. Project Method: Teachers applied their new skills by creating an original song and implementing it at school. This approach aimed at ensuring the sustainability of the training results within the participants' work environment.

Outcomes

The primary outcomes of this activity were: (1) an improvement in the teachers' skills in creating and teaching character-based children's songs, and (2) the publication of an e-book collection of children's songs created by participants, providing a sustainable learning resource for partner schools.

RESULTS AND DISCUSSION

Results

The workshop, titled 'Workshop on the Implementation of Character-Based Children's Songs for Kindergarten Teachers in Yogyakarta', was successfully conducted on July 8–9, 2025, at the Genduk Wulan Meeting Hall in Sleman. Sixty-one teachers from Aisyiyah kindergartens and Muhammadiyah elementary schools in Kapanewon Seyegan attended.

The first day was Tuesday, 8 July 2025. The schedule for the first day included (1) materials on children's songs and musical notation, (2) introductory material on composing children's songs, and (3) practice in composing children's songs. At the end, the teachers were assigned a project to create children's songs with good characters to conclude the activity.

For the first materials, facilitators presented materials on the characteristics of children's songs and simple musical notation. After understanding these basic concepts, participants practiced creating simple children's songs under the guidance of the facilitator team.

FIGURE 1. Materials presentation on children's songs and musical notation

FIGURE 2. Materials and practice on composing children's songs

The workshop's second day was Wednesday, 9 July 2025. During this workshop, the teachers learned proper singing techniques, conducted songs, and sang three new children's songs. The new songs are *Ke Sekolah* (To School), composed by Heni Kusumawati; *Bunga di Taman* (Flowers in the Garden), composed by Agustianto; and A*nak Indonesia* (Indonesian Children), composed by Heni Kusumawati. The entire team guided this practice. The following is the documentation for the second day of the workshop.

FIGURE 3. Second day of workshop

Teachers' Skill Development and Song Creation

After the conceptual and practical training, the participants finished the final composition project. The participating teachers created eight original songs for children, and each of the songs had explicit themes of character education, as is the case in their students' daily lives.

These eight original songs were compiled alongside three new songs introduced by the facilitators (*Anak Indonesia*, *Ke Sekolah*, and *Bunga di Taman*), resulting in a comprehensive e-book collection of 11 character-based children's songs. This e-book, which features lyrics, musical notation, and guiding audio, was published as a sustainable learning resource accessible via the link: https://bit.ly/Kumpulan_Lagu_Anak.

FIGURE 5. Children's Song Compilation Book

The original compositions selected for the compilation demonstrated a wide range of character themes. For example, songs addressed gratitude and spirituality (*Ciptaan Allah*), positive self-concept (*Aku Anak Bahagia*), hygiene and responsibility (*Jagalah Kebersihan*), and daily positive routines (*Sebelum Sekolah*, *Sekolah*). The specific details of these eight original teacher-composed songs are provided in the table below.

TABLE 1. Songs composed by teachers

Title	Composer (Teacher)	Theme
Aku Anak Bahagia	Wagiyem	Positive self-concept
Ciptaan Allah	Arini Hidayati	Gratitude, spirituality
Hari Bahagia	Supraptinah	Daily positive routines
Jagalah Kebersihan	Sutari	Hygiene, responsibility
Ngitung Basa Jawa	Dewi Ayu Winursita	Local language (Javanese)
Sebelum Sekolah	Sri Dwi Haryati	Pre-school routines
Sekolah	Anik Indriayani	School enthusiasm
Sepeda Baru	Ismi Chanifah	Simple joy, responsibility

Implementation and Student Response

The final project required teachers to implement the three facilitator-composed songs in their respective classrooms. All participating teachers successfully demonstrated their ability to teach the new children's songs using correct singing and conducting techniques. Video documentation submitted by the teachers confirmed that the children showed great enthusiasm and active participation in learning the new songs, validating the students' successful engagement with the character-based musical material.

FIGURE 4. Implementation of the new songs

Discussion

The findings confirm the workshop's overall success in addressing the two primary challenges faced by kindergarten and elementary school teachers in Sleman: the lack of relevant new music and limitations in creative instruction.

To begin with, the composing of eight original and character-based children's songs is a direct address to the issue of limited resources for new children's songs. These new songs, which the teachers themselves have constructed, are contextual and relevant to the daily life and the local culture of the students, which is critically important in the moral transmission (Kusumawati, 2013)This finding shows that giving local educators the power to create learning media rather than merely consume it is an effective intervention strategy.

Second, the effectiveness of the training methods is justified by the fact that the implementation of the training methods in the classroom led to the success of the work and the enthusiasm of the students. This shift in the approach, by shifting towards non-traditional teaching and integrating collaborative practice and project-based learning, not only gave the teachers greater confidence and skills in applying music as an interactive pedagogical method. By implementing the project approach, the training became sustainable because the teachers incorporated the training skills in real-life work experience.

Overall, this program was able to fill the gap between the necessity of character education and access to the appropriate musical media by building up local expertise and indicating that training in creative arts was a feasible system to develop character education in early childhood environments.

CONCLUSION

Based on the workshop program, it can be concluded that the participating kindergarten and elementary school teachers enhanced their competence significantly. They were able to sing, educate, and present a new character-based children's song through proper techniques. More importantly, they were empowered to compose new, original songs relevant to their students' needs and local values, which were compiled into a sustainable e-book resource. Overall, this workshop model successfully improved teacher competence and provided a lasting, contextual tool for character education through music creation and instruction.

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Assistance and Readiness for Scientific Writing Competitions on Emerging Technologies (IoT/AI) for Junior High School Students and Teachers

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Abstract. The rapid development of emerging technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI) requires students and teachers to possess adequate technological literacy and scientific writing skills. This community service program aimed to enhance the readiness of junior high school students and teachers at SMP Negeri 12 Yogyakarta to participate in scientific writing competitions focused on IoT and AI. The program employed a training-and-mentoring approach consisting of needs analysis, project-based IoT/AI literacy training, intensive scientific writing mentoring, and competition simulation. A pretest–posttest design was used to evaluate learning outcomes. The results showed a statistically significant improvement in participants' understanding of IoT and AI concepts, with the mean score increasing from 7.25 to 8.75 and a medium normalized gain (g = 0.50). These findings indicate that the program effectively improved participants' technological understanding and academic readiness.

INTRODUCTION

The rapid advancement of emerging technologies, particularly the Internet of Things (IoT) and Artificial Intelligence (AI), has significantly transformed various sectors, including education 1,2. These technologies are no longer limited to higher education or industry contexts but have increasingly become relevant at the secondary school level 1. Students and teachers are expected not only to understand basic technological concepts but also to develop higher-order skills such as critical thinking, problem-solving, and ability to communicate ideas through scientific writing. 3

Scientific writing competitions play an important role in fostering a research-oriented culture among students 4. Through such competitions, students are encouraged to explore real-world problems, apply scientific methods, and present their findings in a structured and academically acceptable manner. Previous studies have shown that early exposure to scientific writing activities can enhance students' academic confidence, analytical skills, and motivation to pursue science and technology-related fields. However, participation in these competitions requires adequate technological literacy and familiarity with academic writing conventions, which are often challenging for junior high school students and their teachers.

In the context of emerging technologies, IoT and AI offer rich and relevant themes for student research5. IoT enables learners to understand the interaction between hardware, software, and data through connected devices, while AI introduces concepts such as data processing, pattern recognition, and intelligent decision-making2. When integrated into educational activities, these technologies can make abstract concepts more concrete and meaningful.6 Nevertheless, the effective use of IoT and AI as research topics requires guidance, particularly in translating technological ideas into systematic scientific papers.

SMP Negeri 12 Yogyakarta is a junior high school with strong academic potential and active participation in various academic activities. Despite this potential, preliminary observations and discussions with school stakeholders revealed several challenges. First, students and teachers had limited exposure to structured IoT and AI learning experiences. Second, experience in writing scientific papers according to academic standards was still minimal. Third, systematic mentoring for scientific writing competitions was not yet optimally implemented due to limited time, resources, and access to expertise. 7

In response to these challenges, a community service program (Pengabdian kepada Masyarakat/PkM) was designed to provide structured assistance and mentoring for students and teachers. The program emphasized project-based IoT and AI literacy combined with intensive scientific writing mentoring and competition simulation. This approach was expected to not only improve participants' conceptual understanding of emerging technologies but also strengthen their readiness to participate in scientific writing competitions.

Furthermore, this program aligns with the Merdeka Belajar Kampus Merdeka (MBKM) policy, which encourages universities to engage in off-campus learning activities and contribute directly to community development. By involving lecturers and students in mentoring activities at the school level, the program also supports institutional Key Performance Indicators (IKU), particularly in strengthening collaboration between higher education institutions and secondary schools. Therefore, this study aims to describe the implementation of the program and evaluate its effectiveness in improving participants' understanding of IoT and AI as well as their readiness for scientific writing competitions.

METHOD

This study employed a training-and-mentoring model within a community service framework to improve students' and teachers' readiness for scientific writing competitions focusing on emerging technologies. The program was conducted at SMP Negeri 12 Yogyakarta and involved junior high school students with an interest in science and technology, accompanied by subject teachers.

Program Design

The program was designed as a structured intervention consisting of four sequential stages: (1) needs analysis and planning, (2) IoT and AI literacy training, (3) scientific writing mentoring and competition simulation, and (4) evaluation. This design was intended to ensure that participants not only gained conceptual understanding of emerging technologies but also developed the ability to translate technological ideas into scientifically structured written works.

Participants

A total of 24 students participated in the complete program and were included in the pretest–posttest analysis. The participants were selected in coordination with school teachers based on their interest and potential in science and technology-related activities. All participants completed both the pretest and posttest and actively engaged in the training and mentoring sessions.

IoT and AI Literacy Training

The literacy training focused on introducing fundamental concepts of IoT and AI through project-based learning activities. Participants were exposed to basic IoT system components, including sensors, microcontrollers, data transmission, and simple data interpretation. AI-related topics were introduced at a conceptual level, emphasizing practical understanding rather than mathematical complexity. Learning activities included demonstrations, guided discussions, and simple project examples relevant to everyday contexts.

Scientific Writing Mentoring and Competition Simulation

Following the technology literacy sessions, participants received intensive mentoring in scientific writing. The mentoring covered topic selection, formulation of research problems, literature exploration, research methodology, data presentation, and academic writing conventions. Participants were guided step-by-step in drafting scientific papers suitable for student-level competitions. In addition, competition simulation activities were conducted to familiarize participants with presentation formats, time management, and question-and-answer sessions commonly used in scientific competitions.

Instruments and Data Collection

To evaluate the effectiveness of the program, a pretest–posttest design was employed. The instrument consisted of a structured test measuring participants' understanding of basic IoT and AI concepts, with a maximum possible score of 10. The pretest was administered prior to the implementation of the training program, while the posttest was conducted after the completion of all training and mentoring activities. The test items were developed by the program team and reviewed by subject experts to ensure content validity.

Data Analysis

The collected data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to calculate the mean, standard deviation, minimum, and maximum scores for both pretest and posttest results. Learning improvement was examined using gain score analysis and normalized gain (g). Furthermore, a paired-sample t-test was applied to determine whether the difference between pretest and posttest scores was statistically significant. All statistical analyses were conducted at a significance level of 0.05.

RESULTS AND DISCUSSION

The effectiveness of the community service program was evaluated using a pretest–posttest design involving 24 junior high school students. Descriptive statistical analysis showed that the mean pretest score was 7.25 (SD = 1.45) out of a maximum score of 10. This result indicates that participants possessed a moderate level of prior understanding of basic IoT and AI concepts before the intervention. The pretest scores ranged from 2 to 9, reflecting a relatively wide variation in initial knowledge levels among participants.

TABLE 1. Descriptive Statistics of Students' Pretest and Posttest Scores on IoT and AI Concepts.

Statistic	Pretest	Posttest
N	24	24
Mean	7.25	8.75
Standard Deviation	1.45	1.19
Minimum	2	6
Maximum	9	10

Following the implementation of the IoT and AI literacy training and scientific writing mentoring, the mean posttest score increased to 8.75 (SD = 1.19). The posttest scores ranged from 6 to 10, indicating not only an overall improvement in performance but also a reduction in score dispersion. This suggests that the program helped participants with lower initial understanding to improve while maintaining high achievement among higher-performing students.

The gain score analysis revealed a mean gain of 1.50 points, while the normalized gain (g) was 0.50, which falls into the medium improvement category. This level of gain indicates a meaningful learning improvement, particularly considering the relatively high initial pretest scores. To further examine the significance of this improvement, a paired-sample t-test was conducted. The results showed a statistically significant difference between pretest and posttest scores ($t(23) = 5.31$, $p < 0.001$), confirming that the observed improvement was not due to chance.

Discussion

The statistically significant increase in posttest scores demonstrates that the training-and-mentoring program had a positive effect on participants' understanding of IoT and AI concepts. The medium normalized gain suggests that the intervention was effective in deepening conceptual understanding rather than merely producing superficial score improvements. This outcome is particularly important given that the participants already demonstrated a moderate level of prior knowledge, which often limits the magnitude of measurable learning gains.

FIGURE 11 Documentation of Material Delivery Session to Students at SMP Negeri 12 Yogyakarta

The reduction in score variability observed in the posttest results indicates that the program contributed to a more equitable learning outcome among participants. Students who initially had lower levels of understanding benefited from structured guidance, hands-on activities, and peer-supported learning environments, while higher-

performing students were able to refine and consolidate their existing knowledge. This finding aligns with the principles of project-based and mentoring-based learning, which emphasize active engagement and individualized support.

FIGURE 12 IoT Material Delivery Session During the Training Program

Beyond cognitive learning outcomes, the program also addressed participants' readiness for scientific writing competitions. Through intensive mentoring sessions, participants learned how to formulate research problems, organize ideas systematically, and communicate technological concepts in written form. Although these skills were not directly measured through the pretest–posttest instrument, observations during mentoring and competition simulations indicated increased confidence and competence in scientific communication. The improvement in conceptual understanding, as reflected in the posttest scores, provided a strong foundation for participants to engage in higher-order tasks such as scientific writing and presentation.

From an educational perspective, the integration of IoT and AI topics into community-based training programs offers significant pedagogical value 8. These technologies provide authentic and relevant contexts for learning, enabling students to connect theoretical concepts with real-world applications. When combined with structured scientific writing mentoring, such programs can effectively foster a research-oriented mindset and early exposure to academic practices at the secondary education level.

FIGURE 13 Distribution of IoT Training Kit to Support Hands-On Learning Activities

Furthermore, the results support the alignment of the program with the Merdeka Belajar Kampus Merdeka (MBKM) framework and institutional Key Performance Indicators (IKU). The involvement of university lecturers

and students in mentoring activities strengthened the collaboration between higher education and secondary schools while providing meaningful learning experiences for all stakeholders. Therefore, the findings of this study suggest that similar training-and-mentoring models can be replicated or scaled up to other schools to promote technological literacy and scientific writing readiness in the digital era.

CONCLUSION

This community service program demonstrated that a structured training-and-mentoring approach focusing on emerging technologies can effectively enhance junior high school students' academic readiness for scientific writing competitions. The pretest–posttest analysis revealed a statistically significant improvement in participants' understanding of IoT and AI concepts, with a medium normalized gain ($g = 0.50$). These results indicate that the program successfully strengthened participants' conceptual foundations, even among learners who already possessed moderate prior knowledge.

Beyond measurable cognitive gains, the program contributed to the development of essential academic competencies, particularly in scientific writing and communication. Through intensive mentoring and competition simulation, participants were able to translate technological ideas into structured scientific papers and gain confidence in presenting their work. This finding highlights the importance of combining technology literacy training with guided academic writing support, especially at the secondary education level where such skills are still emerging.

The results also underscore the pedagogical value of integrating IoT and AI topics into project-based and mentoring-oriented learning activities. These technologies provide authentic and meaningful contexts that encourage student engagement, reduce learning gaps, and promote higher-order thinking skills. Moreover, the reduction in score variability after the intervention suggests that the program supported more equitable learning outcomes among participants with diverse initial abilities.

From an institutional and policy perspective, this program aligns well with the Merdeka Belajar Kampus Merdeka (MBKM) framework and contributes to institutional Key Performance Indicators (IKU) by fostering sustainable collaboration between higher education institutions and secondary schools. The involvement of university lecturers and students in community-based mentoring not only benefits school participants but also enriches the professional development of higher education stakeholders.

In conclusion, the findings of this study suggest that similar community service programs integrating emerging technology literacy with scientific writing mentoring can be effectively implemented in other secondary schools. Future initiatives are recommended to incorporate longitudinal assessments and more comprehensive evaluation instruments to capture higher-order outcomes related to research design, scientific reasoning, and communication skills. Such efforts are essential to strengthening research culture and technological literacy in the digital era.

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THE USE OF DRONES IN INDUSTRIAL ELECTRONICS LEARNING

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Abstract. This study aims to examine the effectiveness of using drones on students' cognitive learning outcomes, psychomotor skills, and learning motivation in the Industrial Electronics course. The research was motivated by the needs of the Industry 4.0 era, which demands mastery of automation systems, control, and the Internet of Things (IoT), where drones serve as innovative learning media integrating concepts of sensors, control, and communication in a contextual manner. This study employed a pre-experimental method using a One-Group Pretest–Posttest Design. The participants were students of the Electronics Education Study Program who took part in practice-based learning using drones. Data were collected through cognitive tests, psychomotor skill observation sheets, and learning motivation questionnaires. The instruments were proven valid and reliable (Cronbach's Alpha = 0.949). Data were analyzed using the Paired Sample t-test and Cohen's d Effect Size to determine learning effectiveness.The findings show a significant improvement in all three measured aspects. The average cognitive score increased by 5.05%, with a Cohen's d value of 0.50, indicating a moderate effect, meaning that the use of drones produced a practically meaningful improvement in learning outcomes. A total of 83.05% of participants showed score improvement, while 16.95% exhibited fluctuations due to motivational and technical factors. The learning motivation scores were high, particularly in interest, attention, and confidence indicators, while psychomotor observations revealed notable progress in operational skills, safety awareness, and control system application using drones. These results confirm that the use of drones is effective in enhancing students' cognitive learning outcomes, psychomotor performance, and learning motivation. Drones serve not only as practice tools but also as innovative and contextual learning media aligned with industrial applications. Therefore, drone-based learning can be further integrated into Industrial Electronics and Technical Education curricula to support competency development in the digital era and the Fourth Industrial Revolution.

Keywords: Drone, Learning Media, Industrial Electronics, Pre-Experimental Design, Paired t-test, Effect Size..

INTRODUCTION

The rapid advancement of Industry 4.0 has significantly transformed the competencies required in industrial electronics education. Automation, robotics, embedded systems, and Internet of Things (IoT) technologies demand not only theoretical understanding but also strong practical and integrative skills. Higher education institutions, particularly those offering vocational and technical education, are therefore challenged to redesign learning approaches that bridge the gap between abstract concepts and real-world industrial applications.

One emerging technology with strong pedagogical potential is the unmanned aerial vehicle (UAV), commonly known as a drone. In industrial contexts, drones are widely used for inspection, monitoring, data acquisition, and system integration. These functions inherently involve industrial electronics components such as sensors, microcontrollers, control algorithms, wireless communication, and embedded programming. However, despite their relevance, the integration of drones into industrial electronics learning remains limited and underexplored, especially as a structured instructional medium rather than a demonstration tool.

Traditional learning in industrial electronics often relies on lectures and isolated laboratory exercises, which may not sufficiently support students in understanding complex system interactions. As a result, students frequently struggle to connect theoretical knowledge of control systems, sensors, and communication protocols with practical industrial applications. Drone-based learning offers a contextual, hands-on platform where students can directly apply theoretical concepts to a functioning system, thereby promoting deeper conceptual understanding and skill acquisition.

This study addresses this gap by examining the effectiveness of drone-based learning in an Industrial Electronics course. The research focuses on three learning dimensions: cognitive learning outcomes, psychomotor skills, and learning motivation. By employing a pre-experimental design, this study aims to provide empirical evidence on whether integrating drones into industrial electronics learning can meaningfully enhance students' learning experiences and outcomes in the context of Industry 4.0-oriented education.:

LITERATURE REVIEW

Drone Technology in Education

Recent studies indicate that drones have strong potential as educational tools in engineering and technical education. Drones provide a tangible representation of abstract concepts, enabling learners to visualize and interact with dynamic systems. Research in higher education contexts shows that drone-based instruction can increase student engagement, motivation, and technical competence, particularly in electronics, control engineering, and robotics-related courses.

Lobo et al. demonstrated that drone-centered active learning significantly improved students' readiness for drone-related careers by integrating real-world problem-solving tasks into instruction [1]. Similarly, Mostafa et al. found that the use of drones in engineering education enhanced students' conceptual understanding and practical skills compared to conventional instructional methods [2]. These findings suggest that drones can serve as effective learning media when integrated into structured instructional designs rather than used solely for demonstration purposes.

Industrial Electronics Learning and Industry 4.0

Industrial electronics education encompasses system control, sensor integration, actuators, embedded systems, and communication technologies. The Industry 4.0 paradigm requires graduates to master not only individual components but also system-level integration and real-time data processing. Chen et al. emphasized that modern industrial automation increasingly relies on intelligent, interconnected systems that demand multidisciplinary competence [3].

Drone-based learning aligns well with these requirements, as drones operate as integrated systems combining electronics, control algorithms, sensors, and wireless communication. Kumar et al. highlighted that UAVs are increasingly adopted in industrial monitoring and maintenance due to their flexibility and real-time data acquisition capabilities [4]. Integrating such technologies into education can therefore enhance the relevance and authenticity of learning experiences.

Learning Theories Supporting Drone-Based Instruction

The effectiveness of drone-based learning can be explained through several learning theories. Constructivist learning theory posits that knowledge is actively constructed through experience and interaction with the environment. Drone-based activities allow students to engage in hands-on experimentation, encouraging active knowledge construction.

Additionally, the Technology Acceptance Model (TAM) suggests that perceived usefulness and ease of use influence learners' acceptance of new technologies. When drones are perceived as relevant to industrial practice, students are more likely to accept and engage with them as learning tools. Furthermore, Mayer's Multimedia Learning Theory argues that learning is enhanced when learners process information through multiple channels. Drones provide dynamic visual and physical representations of electronic systems, supporting deeper cognitive processing.

Empirical studies support these theoretical perspectives. Ghazi and Voyer reported that using drones as instructional platforms in control engineering improved students' conceptual understanding and engagement, even among learners without prior aeronautical backgrounds [5]. These findings collectively indicate that drone-based learning has a strong theoretical and empirical foundation for enhancing industrial electronics education..

RESEARCH METHOD

This study employed a pre-experimental research method using a One-Group Pretest–Posttest Design. The participants were undergraduate students enrolled in the Industrial Electronics course in the Electronics Education Study Program at Universitas Negeri Yogyakarta. The sample was selected purposively, consisting of students who had prior knowledge of basic electronics and microcontroller programming.

The learning intervention involved integrating drones into practical learning activities. Students engaged in tasks related to sensor integration, embedded control, wireless communication, and operational safety using drones as learning platforms. Data collection instruments included cognitive tests (pretest and posttest), psychomotor skill observation sheets, and learning motivation questionnaires.

Instrument validity and reliability were established prior to data analysis. The motivation questionnaire demonstrated high internal consistency, with a Cronbach's Alpha coefficient of 0.949, indicating excellent reliability. Data analysis involved descriptive statistics, paired sample t-tests to examine learning gains, and Cohen's d effect size to assess practical significance.

RESULTS AND DISCUSSION

Learning Effectiveness Based on Cognitive Outcomes

The effectiveness of drone-based learning was first examined through students' cognitive learning outcomes using a pretest–posttest comparison. The results indicate a positive learning gain, with an average increase of 5.05% from pretest to posttest scores. The calculated Cohen's d value of 0.50 indicates a moderate effect size, suggesting that the observed improvement is not only statistically meaningful but also practically significant. More than 83% of students demonstrated score improvement, while the remaining participants showed minor fluctuations that may be attributed to individual motivational or technical factors. These findings confirm that the integration of drones as instructional media effectively enhances students' understanding of industrial electronics concepts, particularly those related to sensors, control systems, and embedded programming.

FIGURE 1. Students were presenting the results of their project assignment to make a fixed wing drone training aircraft.

Students' Attitudes Toward Drone-Based Learning

In addition to cognitive outcomes, students' attitudes toward drone-based learning were analyzed using a 20-item Likert-scale attitude questionnaire completed by 79 students. Overall, the findings reveal a very positive attitude toward the use of drones in industrial electronics learning, with an overall mean score of 4.37, which falls into the Very Positive category. This result indicates strong acceptance and appreciation of drones as learning media.

From an affective dimension, students demonstrated high levels of interest and enthusiasm. Items related to attention, enjoyment, and perceived attractiveness of drone-based learning consistently obtained high mean scores. This suggests that drone-based instruction successfully enhanced emotional engagement and made learning activities more interesting and motivating compared to conventional instructional approaches.

In terms of the cognitive attitude dimension, students strongly agreed that drone-based learning helped them understand and contextualize theoretical concepts in industrial electronics. The high mean scores in this dimension indicate that students were able to meaningfully connect hands-on drone activities with abstract concepts such as sensor integration, system control, and electronic communication. This supports constructivist learning theory, which emphasizes knowledge construction through direct experience.

Regarding the conative dimension, which reflects students' willingness to participate and take action, the results show a positive tendency. Students expressed readiness to engage in drone-related assignments and practical activities. Although items related to actively asking questions obtained slightly lower mean values than other dimensions, they remained within the Positive category, indicating that drone-based learning encourages participation while leaving room for further improvement in interactive classroom practices.

FIGURE 2. Drone-based learning activities in the classroom

Furthermore, students demonstrated very positive responses in the dimension of professional values and responsibility. High scores on items related to discipline, teamwork, responsibility, and safety awareness indicate that drone-based learning contributes not only to technical competence but also to the development of professional attitudes essential in vocational and industrial education contexts. These findings highlight that drones are perceived not merely as technical tools, but also as media for fostering professional character and ethical awareness.

Overall, the attitude scale results complement the cognitive findings by demonstrating that drone-based learning positively influences affective, cognitive, and behavioral aspects of student learning. The relatively low standard deviations across dimensions indicate consistent responses among students, suggesting broad acceptance of drone integration in the learning process.

Summary of Students' Attitude Scale Results

TABLE 1. Summary of Students' Attitude Scale Results

Dimension	Mean	SD	Category
Affective (Interest & Enthusiasm)	4.38	0.60	Very Positive
Cognitive (Perception & Understanding)	4.39	0.62	Very Positive
Conative (Participation & Willingness)	4.12	0.71	Positive
Professional Values & Responsibility	4.42	0.58	Very Positive
Overall Attitude	4.37	0.64	Very Positive

These results strengthen the conclusion that drone-based learning is not only effective in improving learning outcomes but also well received by students, supporting its implementation as an innovative and contextually relevant instructional approach in industrial electronics education.

CONCLUSION

This study demonstrates that the integration of drones into industrial electronics learning is effective in improving students' cognitive learning outcomes, psychomotor skills, and learning motivation. The moderate

effect size (Cohen's d = 0.50) indicates that drone-based learning provides meaningful educational benefits in practical instructional contexts.

Drones offer a contextual and industry-relevant learning platform that supports the development of competencies aligned with Industry 4.0. Therefore, drone-based learning can be considered a viable and innovative instructional approach for industrial electronics and technical education curricula. Future research should explore experimental designs with control groups and investigate long-term learning impacts across diverse educational settings.

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	Digitization of Archives Scanning of priority documents and

Aspect	Reform Strategy	Implementation
	community service information systems, as well as digital archiving input in the correspondence system.	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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Self- Potential Interest and Aptitude Test for Senior High School Students

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Abstract. This community service activity aims to introduce self-potential to high school and vocational school students in order to face the challenges of education and the job market in the era of globalisation. Many students still lack understanding of career paths or study programmes that match their interests and abilities. Interest and aptitude testing is considered a strategic approach to help them identify academic and career tendencies, while raising awareness of the importance of future planning based on self-potential. The focus of this activity is the dissemination of interest and aptitude tests and reflection on the results related to the choice of study programmes in higher education, especially at Yogyakarta State University (UNY). Implementation methods include direct approaches in schools and to students visiting the Indonesian Education Museum (MPI) at UNY, through interactive materials, digital-based test simulations, group discussions, and individual guidance. School counsellors and parents were involved as supporting partners. Observations and questionnaires were used to evaluate students' understanding. Results showed an increase in students' understanding of their potential and career direction, accompanied by high enthusiasm during the activities. Teachers and parents rated the programme as relevant and worth implementing as a routine guidance activity, as a foundation for strengthening career guidance services in schools.

Keyword: Career Guidance, Self Potential, High School Students, Educational Psychology.

INTRODUCTION

In this competitive era of globalisation, understanding one's interests, talents and potentials is very important, especially for SMA/SMK students. Realising this, many parties, including schools, government, and various educational institutions, are trying to provide maximum support in helping students find and develop their interests and talents. One of the most effective ways to find out students' potential is through interest and talent tests. This test serves to explore and identify students' interest and talent tendencies, as well as provide guidance for planning the right steps in their educational and career journey (Suherman & Ratnasari, 2021) .

The importance of interest and aptitude tests for high school students cannot be underestimated. Most students at this level are often faced with a confusing array of choices regarding the major they will take in college or the world of work after graduation. Uncertainty about the right career choice is often a burden for many students, which in turn can interfere with their learning focus and motivation (Yusuf, 2009) . Therefore, interest and aptitude tests provide a solution to guide them to understand more about themselves, as well as to make wiser and more informed decisions regarding future choices (Wanga et al., 2014) .

Interest and aptitude tests are measurement tools designed to help individuals recognise their interests and talents more clearly. This test usually takes the form of a series of questions that lead to an understanding of things that are liked, natural abilities, and potential that can be developed (Santrock, 2011) . For SMA/SMK students, this test is very useful to help them understand college majors that match their interests and talents, and help them recognise their potential that can be used as a basis for choosing a career path in the future (Candra et al., 2024) . However, despite its importance, the socialisation of interest and aptitude tests is still uneven. Many students are unaware of these tests or even feel that they are irrelevant to their lives. This is certainly a challenge in itself, as limited understanding can hinder students in optimising their potential. This ineffective socialisation of the importance of interest and aptitude tests needs to be improved immediately so that students can get the maximum benefit from the test results (Setiawan, 2020) .

The socialisation of interest and aptitude tests to SMA/SMK students must be done in a way that is interesting, easy to understand, and relevant to their lives. The approach used must also involve various parties, such as teachers, parents, and school counsellors, so that the results can be maximised (Hurlock, 2002) . In the socialisation, students need to be given a clear understanding of the purpose and benefits of this test. They must know that this test is not just a measuring tool, but also a means to help them recognise their potential, so that they can determine the right steps in facing the world of education and career (Putri & Mufidah, 2025) .

In addition, socialisation should also include an explanation of how these tests are conducted and what types of tests are available. Various interest and aptitude tests, such as personality tests, intelligence tests, skills tests, and academic potential tests, need to be introduced to students so that they understand the various options they can take to explore their potential more deeply (Suherman & Ratnasari, 2021) . It is also important that students do not feel intimidated or confused when taking interest and aptitude tests. Besides the socialisation aspect, it is also important to provide concrete examples or relevant case studies. For example, showing the success story of someone who found a career that suits their interests and talents after taking an interest and aptitude test. Thus, students can see firsthand the benefits of taking this test, which will motivate them to be more open and active in the process of recognising their potential (Setiawan, 2020).

Through good socialisation, students are expected to understand that interest and aptitude tests are part of their efforts to recognise their potential and plan for a brighter future. By knowing their interests, talents and potential, students will be more confident in making education and career choices that suit their abilities and desires (Yusuf, 2009) . In addition, this test can also help reduce the confusion or uncertainty often experienced by many students in choosing a college major or future job (Kholida & Puspasari, 2025). .The socialisation of interest and aptitude tests also has a positive impact in preparing young people who are better prepared to face the challenges of the world of work. By knowing their potential, students will not only be more productive, but also more motivated to develop themselves according to their field of interest. This will create more qualified, innovative, and globally competitive human resources (Santrock, 2011) . In the long run, this positive impact will be felt by the community and the nation, as they will have a more intelligent, creative, and competent generation in various fields.

Overall, the socialisation of interest and aptitude tests for SMA/SMK students is very important to help them find the right education and career path. This socialisation not only benefits individual students, but also society as a whole. Therefore, all parties involved in education, be it schools, government, or society, must work together to ensure that every student has an equal opportunity to recognise and develop their potential (Hmad & Dukhan, 2021) .

COMMUNITY SERVICE METHOD

The method of implementing the socialisation of interest and aptitude tests for SMA/SMK students must be designed in a structured and effective manner to ensure that the objectives of the socialisation are achieved, namely increasing students' understanding of the importance of these tests and facilitating them in recognising their potential (Einali et al., 2021) . The method to be used involves several stages from planning, implementation, to evaluation. The following is the suggested implementation method:

1. **Planning**

Planning is a crucial first step in the implementation of socialisation. This stage includes target identification, selection of test types, and determination of the time and place of implementation.

a. **Target Identification:** The target audience for this socialisation is high school/vocational school students who are in the final stages of their education and are preparing to choose an education or career path. In this case, the socialisation can be conducted for grades 11 and 12 who need to prepare for decisions regarding further education or the world of work.

b. **Selection of Interest and Aptitude Test Types:** Schools should liaise with institutions or consultants that have experience in providing credible interest and aptitude tests. The types of tests used may vary, ranging from paper-based tests to digital-based tests. Some of the test options that can be chosen are interest tests based on Holland's theory (RIASEC), aptitude tests, or personality tests that can give an idea of students' academic and career tendencies.

c. **Scheduling and Location:** Determine an appropriate time for students to participate in socialisation without disrupting their academic activities. Ideal times are after exams or during extracurricular activities that can accommodate all students involved. The socialisation can be conducted in a classroom or school hall that can accommodate a good number of students.

2. **Implementation of socialisation**

The implementation of socialisation consists of several main activities, namely the provision of information materials, test simulations, discussion sessions, and mentoring.

a. **Provision of Materials and Information:**

Introduction to Interest and Aptitude Tests: At this stage, material will be presented on what interest and aptitude tests are, the purpose and benefits of tests, and the various types of tests that exist. This can be done through presentations using visual media such as slides or attractive videos. Resource persons who can be invited to provide explanations are career experts, educational counsellors, or alumni who have successfully found careers that match their interests.
Parent Involvement: Schools can also invite parents to a separate information session to help them understand the benefits of interest and aptitude testing for their child and support their child's career decision process. This meeting also provides an opportunity for parents to ask questions directly to the experts regarding the testing process.

b. **Test Simulation:** Before students take the actual test, they will be given the opportunity to take a simple interest and aptitude test simulation. This simulation aims to give students an idea of the kind of test they will be taking and make them feel more comfortable. The simulation can be a multiple-choice test related to interests or personality tests that can be taken online or in paper form. *Online Platform*: If possible, using an online platform for the simulated test will make it easier for students to access the test. This platform can provide immediate feedback on test results and explanations regarding their interests or aptitudes. *Discussion of Test Results*: After the simulation, students can be given feedback on their test results. This is important so that they can understand how to read and interpret the test results better.

c. **Discussion and Q&A Session:** After the simulation, there will be an open discussion session where students can ask the resource person directly about their experience taking the interest and aptitude test. In addition, students can also discuss career choices or majors that are in accordance with their test results. This session aims to give students the opportunity to get clarification on things that still confuse them.

d. **Individual** Assistance **and Counselling**: Students who need further assistance in interpreting the test results or who feel confused in choosing an educational or career path can be provided with individual counselling sessions with the school counsellor. This could be in the form of a career guidance session that provides recommendations based on the test results that the student has taken (Smyth et al., 2015) .

3. Evaluation and Follow-up

After the socialisation is complete, evaluation is an important step to find out how effective this activity is in increasing students' understanding of interest and aptitude tests.

a. Evaluation Questionnaire: Each student who participates in the socialisation will be asked to complete an evaluation questionnaire that aims to measure the extent to which they understand the benefits of interest and aptitude tests. This questionnaire can also be used to find out if students feel more prepared in making decisions regarding their education or career path after attending the socialisation.

b. **Feedback from Parents and Teachers:** Collecting feedback from parents and teachers on the implementation of socialisation can provide an additional perspective on the impact of socialisation on students. It can also give an idea of how parental involvement can influence the decisions that students make.

c. **Follow-up for Students**: Based on the evaluation results, students who need further assistance in choosing a career or education can be directed to take more in-depth tests or get more intensive assistance from school counsellors. In addition, information about education and career pathways that are suitable for the test results can be conveyed through brochures or other materials.

d. Dissemination of Results and Experiences

After the socialisation activities are completed, it is important to share the experience and results with the entire school community, be it through publication on the school's social media, producing a report on the results of the activities, or organising experience sharing activities for students who have not participated. This can raise awareness and motivate more students to take the interest and aptitude test in the future.

The method of implementing the socialisation of interest and aptitude tests integrates several important components, including information provision, test simulations, discussions, individual assistance, and evaluation. With a structured approach and involving various parties, it is hoped that the socialisation of interest and aptitude tests can be carried out effectively, so that SMA / SMK students can better understand their potential and make the right decisions related to their future education and career (González-Zamar et al., 2021) .

2. Result

Preparation for The Socialisation of Self Potential Interest and Talent Tests for SMA / SMK Students has been carried out in several partner schools as well as in a series of educational tour visits to Yogyakarta State University (UNY). This activity is designed to provide insight to students about the importance of recognising their potential early on as a provision in determining educational or career choices. The implementation process is carried out in

stages, starting from planning, providing material, test simulations, to discussion sessions and individual assistance, involving teachers, counsellors, and active student participation. The following are the stages:

1. Planning Stage

The planning stage is a very important initial phase in determining the success of the potential interest and talent test socialisation activities. This process is conducted systematically and collaboratively, involving mapping of student needs, strategic scheduling, and preparation of appropriate media and resources.

a. Target Identification

The target of this activity is addressed to:

a) Students in grades XI and XII at the high school and vocational school levels, especially those who are in the preparation stage of determining the direction of further education or entering the world of work.
b) Students who visited UNY in the Educational Tourism programme, as well as students from several partner schools who invited this activity directly to their school environment.

Identification was done through communication with counselling teachers or school leaders to ensure students' needs related to the introduction and understanding of their potential, as well as their readiness to participate in the activities. In addition, the target selection also considered variations in educational backgrounds, both from academic (SMA) and vocational (SMK) schools, to enrich the dynamics of the discussion and the relevance of the material.

b. Scheduling and Location of Implementation

The implementation of the activities was carried out in two main scenarios that were adjusted to the conditions of the students and the school schedule:

1. Scenario One: During UNY Educational Tour
    a. The first activity was carried out in conjunction with student visits to UNY in the Educational Tourism programme, with the location of the activity at the UNY National Education Museum.
    b. The choice of this location aims to provide an educational atmosphere that supports the spirit of learning and exploration of students.
    c. The activity is packaged as part of a series of visits, so that students feel enthusiastic and more open to receiving material.
2. Second Scenario: Post Mid Semester Examination (UTS)
    a. Follow-up activities are carried out in their respective school environments, especially after students have completed the UTS or on days with a light academic load.
    b. Classrooms are used as the implementation location, adjusting the capacity of participants and the availability of supporting facilities such as LCDs, whiteboards, or internet connections for test simulations.

c. Duration and Flow of Activity Sessions

Each socialisation session is held for 1.5 hours (90 minutes) which consists of several structured stages:

1) 10 minutes - Opening and introduction to the activity by the facilitator or accompanying teacher.
2) 25 minutes - Delivery of material on the concept of interest, talent, and the importance of recognising self-potential.
3) 30 minutes - Interest and Talent Test simulation using digital or paper platform.
4) 15 minutes - Discussion and Q&A on the simulation results and students' reflections on their interest tendencies.
5) 10 minutes - Reflection and closure, including completion of a short evaluation sheet.

This flow is designed to maintain student focus, encourage interaction, and allow room for personal understanding of the material presented.

2. Socialisation Implementation Stage

The implementation stage is the core of this service activity, where all the plans that have been prepared are implemented directly to the students. This activity is designed so that students not only receive information passively, but are also actively involved in the process of self-understanding through various forms of interaction, simulation, and reflection. Socialisation is carried out gradually and systematically through four main components, namely material delivery, test simulation, discussion, and individual assistance (Karkoub et al., 2020) .

a. Provision of Materials and Information

The activity began with the delivery of material related to the introduction of interests and talents. The material was delivered in an interesting way through **PowerPoint presentations, short video screenings, and distribution of informative leaflets**. Students were invited to understand the basic understanding of interests and talents, the difference between the two, and why self-recognition of potential is important in the decision-making process of taking a higher education degree.

To contextualise understanding, resource persons also shared **examples of test results and how to read them**, including simple interpretations of the results. In some partner schools, parents are also involved through online

sessions or special meetings. This aims to build **family support** for their children's decisions, as well as open communication between students, parents and schools regarding realistic future plans that match the students' potential.

b. Interest and Talent Test Simulation

After the presentation of the material, the activity continued with a simulation of interest and talent tests. The test was conducted using a digital platform based on Google Form, which has been adapted to the needs of high school students. The test includes questions about preferred activities, learning tendencies, and responses to certain situations. This simulation aims to give students an initial experience of the form and content of the interest test and how to fill it in honestly and reflectively (Abhayawansa et al., 2012) .

The simulation results were compiled and analysed in general, then discussed collectively in the forum. The enthusiasm of the students was high, as some of them were taking the test for the first time. Many were surprised and intrigued to find out that the interim results showed trends in interests that they had not realised before, such as interests in social work, engineering, art, or entrepreneurship (Villalobos et al., 2024) .

c. Discussion and Q&A Session

After the simulation results were shared and explained, the activity continued with an open discussion and question and answer session. In this session, students were given space to ask questions, both about test results, choice of college majors, and the world of work. The discussion was guided by resource persons and counselling teachers, who shared their experiences and provided tips in responding to test results objectively (Haseeb et al., 2019) .

The session also served as a medium for mutual reflection, where students shared their views on their interests and aspirations. Some students expressed their confusion in choosing a major or the mismatch between personal desires and parents' expectations. This forum became a safe and open space to talk about the future, thus strengthening students' awareness of the importance of making the right decisions based on their potential.

d. Individual Mentoring and Counselling

As a follow-up to the general discussion, students who felt uncertain or wanted to explore the test results more deeply were facilitated to attend individual counselling sessions. Counselling is conducted by BK teachers or resource persons who are experienced in career guidance. In this session, students are guided to interpret the test results in a more personalised way, consider external factors (such as family conditions and access to education), and make short and long term plans related to education and employment.

Some students who showed strong interest but still lacked a clear direction were directed to take formal follow-up tests, such as professional psychological tests at career counselling institutions. Students are also given access to self-learning resources, such as career websites, major e-books and higher education brochures, so that they can continue to explore their interests independently.

3. Evaluation and Follow-up

The evaluation and follow-up stage is an important part of the whole series of socialisation activities. Evaluation is carried out to determine the level of understanding, the effectiveness of material delivery, and the impact of activities on students' readiness to make decisions related to education or career. Meanwhile, follow-up is designed to ensure that this activity does not stop at just one meeting, but is sustainable in assisting students to find and develop their potential (Henderson et al., 2024) .

a. Evaluation Questionnaire

After the socialisation activity was completed, each student was asked to fill out **a short evaluation questionnaire** covering aspects of understanding the material, experience taking the test simulation, as well as an assessment of the discussion and mentoring sessions. The evaluation results showed that the **majority of students felt helped and better prepared** in understanding the importance of recognising their potential. They claimed to have gained new information about interests and talents as well as how to interpret the test results independently. In addition, most of the participants stated that they felt more confident in considering college majors or jobs in the future, thanks to the results of the simulations and discussions they participated in (Agung Prakoso et al., 2020) .

b. Feedback from Parents and Teachers

Apart from students, feedback was also collected from **counselling teachers and some parents of students** who attended or followed the online information session. The teachers said that this activity **is very relevant to the needs of students today,** especially in the midst of the challenges of the times that demand accuracy in making educational choices. They also noted that this activity provides a new perspective for students who have been confused or tend to follow the crowd in choosing a major.

Some parents also expressed their appreciation for this activity because it opens up space for discussion between children and parents regarding long-term education plans. They feel more confident in assisting their children to make important decisions because they have received information that supports them from a psychological and educational perspective.

c. Follow-up for Students

As part of the sustainability of the programme, students who demonstrated further needs were provided with **additional mentoring routes.** They were directed to:

1) **Take a more in-depth interest and aptitude test** through a professional institution or school psychology service centre, in order to gain a more comprehensive picture.
2) **Access regular school counselling services**, especially career guidance, to have regular discussions about interest development and further education information seeking.
3) **Explore sources of information about majors and professions**, including attending education fairs, study abroad programmes or professional introduction webinars.

In some partner schools, this activity was even responded proactively by arranging follow-up programs in the form of **"Career Talks",** counselling rooms and others. This follow-up proves that the socialisation activity is not just an informative activity, but also a trigger for real change in the strategy of assisting students towards a more purposeful future.

3. Discussion

The socialisation of interest and aptitude tests carried out shows high urgency and relevance in the context of assisting high school / vocational school students before the transition to higher education or the world of work. Based on the results of the implementation in several schools and in the UNY educational tourism programme (Yogyakarta, 2023) , it appears that most students do not have a complete understanding of their interests and talents, and how they play a role in future decision-making. This indicates a gap in information and guidance that needs to be filled through similar activities (Nugroho & Wahyuni, 2022) . Providing material on the concepts of interest, aptitude, and available forms of tests provides new insights for students. Digital-based test simulation is an effective method in introducing potential assessment forms in a practical and interesting way (Rondon Pereira et al., 2025) . With an interactive and contextualised approach, students are able to more easily relate the test results to their experiences, interests and tendencies in their daily activities. This is in line with the differentiated and individualised education approach that is increasingly relevant in today's education (Tomlinson, 2014) .

Open discussions and question and answer sessions allow students to express their confusion, concerns, and discrepancies between their desires and the expectations of their surroundings. This space for reflection is important because it brings students closer to conscious and responsible decisions (Wang & Zhu, 2019) . In addition, individual mentoring and counselling showed that some students did need further guidance that could not be resolved in a single socialisation session. Therefore, follow-up in the form of regular counselling and strengthening career guidance programs are highly recommended (Kependidikan, 2021; Sutrisno, 2020) .

In terms of involving parents and teachers, this activity also builds collective awareness that educational decisions are not only the responsibility of students, but are the result of dialogue between students, parents and educators. This involvement is important so that decisions are not only academically logical, but also socially and emotionally realistic (Nugroho & Wahyuni, 2022) . Overall, this activity is a strategic step in supporting the implementation of potential and character-based education. With consistent implementation and expansion of target coverage, this kind of activity has the potential to become an integral part of a sustainable student self-development programme in schools (Kependidikan, 2021) .

CONCLUSION

The interest and aptitude test socialisation activities carried out for SMA / SMK students have a positive and significant impact in helping them recognise their potential and plan their future education and career more purposefully. Through the stages of careful planning, interactive implementation, and structured evaluation and follow-up, students gain meaningful learning experiences in understanding the importance of recognising interests and talents early on.

The delivery of material in an interesting and relevant manner, accompanied by test simulations, open discussions, and individual counselling services, has provided a strong space for personal reflection for students. Positive responses from participants, teachers, and parents indicate that this activity not only adds insight, but also encourages changes in perspective in making educational decisions based on self-potential.

More than just socialisation, this activity opens up opportunities for the establishment of a sustainable career mentoring system in schools, as well as strengthening collaboration between schools, families and higher education institutions. Thus, this activity deserves to be continued and developed more widely so that more students are helped in finding the direction of education and career that suits their best potential.

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Training on Archival Digitization and Virtual Reality Development at the Museum Monumen Kesatuan Pergerakan Wanita Indonesia

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Abstract. This community engagement program aims to provide systematic training for the staff of the Museum Monumen Kesatuan Pergerakan Wanita Indonesia, enhancing their conceptual understanding, technical skills, and practical competencies in archival digitization and virtual reality (VR) development. The training is designed to achieve three main objectives: (1) to strengthen participants' motivation and commitment to engaging in archival digitization and the development of digital technology-based archival media; (2) to improve participants' theoretical understanding of virtual reality as an innovative medium for archival digitization and VR media production. Archival digitization enables museum collections that were previously accessible only in physical form to be transformed into digital formats that are more widely accessible to the public. This process involves converting documents, photographs, and historical artifacts into digital files that can be disseminated through online platforms. Consequently, archival materials that were once limited in accessibility can become open sources of knowledge for broader audiences. Moreover, when archival digitization in integrated with virtual reality technology, the educational potential of museums is significantly expanded. VR offers immersive learning experiences that allow visitors to experience historical narratives more engagingly and experientially, fostering deeper historical understanding. The methods employed in this community engagement activity include lectures, interactive discussions, case-based learning, and simulation exercises. The evaluation of the training implementation is conducted through structured questionnaires. Indicators of program success are measured using two approaches: (1) formative evaluation conducted throughout the training process, and (2) summative evaluation conducted after the completion of the training. The target participants of this program consist of 3 staff members of the museum monument kesatuan pergerakan Wanita Indonesia. This activity is designed to contribute to the achievement of Key Performance Indicators (IKU), particularly IKU 6 related to institutional partnerships and IKU 8 concerning lecturers' engagement in off-campus activities.

Keywords: archival digitization, virtual reality, museum studies, women's movement.

INTRODUCTION

Archives serve as a bridge connecting the past and the present. Historian Pierre Nora, in Les Lieux de Mémoire (1989), argues that archives and historical sites function as "sites of memory" that safeguard the collective identity of a nation. In the Indonesian context, archives documenting women's struggles play a crucial role in preserving the memory of women's significant contributions to national history. The Museum Monumen Kesatuan Pergerakan Wanita Indonesia serves as an important institution in safeguarding this heritage. However, in the digital era, physical archives face various threats, including deterioration and loss. At the same time, younger generations demonstrate a declining interest in historical narratives. For these reasons, training in archival digitization and the development of Virtual Reality (VR) technology has become a vital strategy for preserving and disseminating the history of Indonesian women's movements in more contemporary and engaging ways.

Located in Yogyakarta, the Museum Monumen Kesatuan Pergerakan Wanita Indonesia houses numerous important documents related to the history of women's activism, including archives of the First Indonesian Women's Congress in 1928. Susan Blackburn, in Women and the State in Modern Indonesia (2004), identifies the First Women's Congress as a pivotal moment in the development of the Indonesian women's movement. The congress addressed critical issues such as women's education, maternal and child health, and equality within marriage, laying the foundation for organized women's advocacy in Indonesia.

Integrating archival digitization with VR technology represents an effective strategy for revitalizing public interest in history. Jeffrey et al. (2012), within the framework of Digital Heritage, emphasize that digital technologies can function as bridges connecting younger generations to cultural heritage. In the era of globalization and digital transformation, access to information has become increasingly widespread; paradoxically, however, many individuals are becoming disconnected from historical consciousness and cultural roots. Consequently, the adoption of digital technologies in museums should not be understood merely as a response to technological trends, but rather as a strategic necessity for sustaining collective memory.

Archival digitization enables museum collections that were previously accessible only in physical locations to be transformed into digital formats that are more easily accessed by the public. This process involves converting documents, photographs, and historical artifacts into digital files that can be disseminated through online platforms. As a result, archival materials that were once hidden or rarely encountered by visitors can become publicly available sources of knowledge. Conway (2010) emphasizes that archival digitization is not solely concerned with preservation, but also with the democratization of access to historical information, allowing individuals from diverse backgrounds to engage with their national past.

When archival digitization is combined with Virtual Reality technology, the educational potential of museums expands significantly. VR offers immersive learning experiences in which visitors can feel as though they are transported into the past and are witnessing historical events as they occurred. Riva et al. (2016) demonstrate that immersive experiences facilitated by VR can enhance users' memory retention and comprehension, as information is processed through direct interaction rather than through static texts or images.

Within the context of the Museum of the Indonesian Women's Movement, the integration of digitization and VR can create unique experiences that transport visitors to the First Indonesian Women's Congress of 1928. By using VR devices, visitors can "attend" the congress, listen to inspirational speeches delivered by women leaders of the period, and observe interactions among participants as they debated key issues such as education, health, and gender equality. As Blackburn (2004) underscores, the First Women's Congress of 1928 represents a critical moment in the history of the Indonesian women's movement, and VR technology offers an effective medium for introducing this historical event to younger generations in an engaging and accessible manner.

Furthermore, the availability of digital archives and VR-based exhibitions allows museums to extend their educational reach globally. Audiences are no longer required to visit the museum physically to learn about the history of Indonesian women; instead, they can access digital content anytime and anywhere. Virtual exhibitions, accessible through websites or dedicated applications, can provide interactive tours, archival documentation, and interviews with historians or relevant stakeholders. Such technology-based educational experiences are particularly effective in engaging younger audiences, often referred to as digital natives, who tend to respond more positively to interactive media than to conventional learning methods. Accordingly, the development of VR applications and the digitization of archival collections constitute strategic steps toward maintaining the relevance of museums in the digital era while strengthening historical literacy among younger generations.

Although promising, the integration of archival digitization and virtual reality (VR) technology entails notable challenges. A key constraint is the limited availability of personnel with expertise in information technology and archival management. Consequently, targeted training in digitization tools and VR content development is essential. Furthermore, sustained collaboration with academic institutions and technology-focused communities is critical to ensuring the long-term viability of these initiatives.

The integration of archival digitization and virtual reality (VR) at the Museum Monumen Kesatuan Pergerakan Wanita Indonesia represents a strategic approach to historical preservation and public education in the digital era. These technologies not only safeguard cultural heritage but also create immersive experiences that foster deeper engagement with the history of women's contributions to the nation. This study emphasizes the critical role of capacity-building through training in digitization and VR development to enhance the museum's ability to preserve and disseminate historical narratives. By adopting innovative and interactive methods, the initiative seeks to strengthen historical literacy and sustain collective memory amid globalization and rapid technological change.

METHOD

The partner institution, the Museum Monumen Kesatuan Pergerakan Wanita Indonesia, has not yet implemented visual archival digitization through Virtual Reality (VR) technology. Virtual Reality is a technology that generates three-dimensional (3D) simulated environments consisting of virtual objects, visual information,

and additional data presented through graphics and sound. VR creates an artificial or virtual environment that allows users to experience and interact with simulated spaces through sensory stimuli—primarily visual and auditory—while enabling user interaction to influence events within the virtual environment.

One of the main challenges faced by the partner institution is the limited awareness of the urgency of visual archiving. VR-based visual archives have rarely been implemented due to the advanced technical competencies required. A major constraint is the lack of human resources with sufficient expertise in information technology and archival management. Therefore, training museum staff in the use of digitization software and VR content development has become a critical priority. In addition, collaboration with higher education institutions and technology-oriented communities is necessary to ensure the sustainability of the digitization program. An assessment of the partner's existing human resources indicates strong potential, which can be optimized through structured training.

The proposed solution is a training program focused on the development of visual archives. The training is conducted through two main objectives:

1. Enhancing museum managers' understanding of the urgency and significance of visual archival digitization.
2. Improving museum managers' technical skills in producing visual archives using Virtual Reality technology.

To address the identified problems, the program is implemented through several structured stages. The first step involves recruiting participants for the visual archiving training. The training is conducted over two days. On the first day, participants receive theoretical instruction on the urgency of archival digitization in the context of visual archives, followed by an introduction to Virtual Reality as a medium for visual archiving. The VR materials cover key stages, including needs analysis, VR design, VR development, VR implementation, and evaluation of VR products. On the second day, participants engage in hands-on field practice focused on capturing visual archives using 360-degree panoramic imaging.

Based on the identified problems and proposed solutions, the framework of the program is summarized as follows.

No.	Problem	Solution	Indicator of Achievement
1	How to improve understanding of the urgency of archival digitization through Virtual Reality at the *Museum Monumen Kesatuan Pergerakan Wanita Indonesia?*	Training through lectures, discussions, and demonstrations addressing the urgency of VR-based archival digitization	Participants demonstrate an understanding of the importance of VR-based archival digitization.
2	How to enhance technical skills in producing VR-based digital archives?	Training through lectures, discussions, and demonstrations on the technical steps involved in VR-based archival digitization	Participants can produce VR-based visual archives.

THEORETICAL FRAMEWORK

Archival digitization refers to the process of converting physical documents into digital formats to improve security, preservation, and accessibility. Conway, in Preservation in the Age of Google: Digitization, Digital Preservation, and Dilemmas (2010), argues that digitization not only protects archives from physical deterioration but also expands public access to historical information. In Indonesia, archival digitization efforts continue to face challenges, particularly due to limited professional expertise and insufficient awareness of archival importance. Through digitization training, the Museum of the Indonesian Women's Movement can strengthen staff capacity in managing historical collections while expanding institutional collaboration and educational outreach.

Riva et al. (2016), in Transforming Experience: The Potential of Augmented Reality and Virtual Reality for Enhancing Personal and Clinical Change published in Frontiers in Psychiatry, emphasize that Virtual Reality is not merely an entertainment tool, but an effective medium for reshaping perception, emotion, and behavior. VR enables immersive experiences that foster deep emotional and cognitive engagement, making it particularly valuable for education and cultural heritage preservation. In museum contexts, VR allows visitors to experience historical events directly, thereby enhancing historical understanding.

Furthermore, VR has the potential to strengthen episodic memory—memory associated with personal experience—through direct interaction with simulated environments. This principle is highly relevant to museum-

based historical education, where immersive experiences can deepen visitors' understanding of women's struggles in Indonesian history. Riva et al. (2016) also highlight the importance of psychologically informed VR design, emphasizing authentic narratives that stimulate curiosity and empathy. Accordingly, VR content developed for the Museum of the Indonesian Women's Movement must be designed with strong and authentic narratives to convey the historical atmosphere of women's resistance during the colonial and revolutionary periods.

In practical application, VR technology at the museum can be used to virtually reconstruct historical events such as the First Indonesian Women's Congress of 1928 or communal kitchens during the revolutionary era. Through VR, visitors may interact with representations of women activists and gain insight into the social and cultural challenges they faced in their struggles for women's rights.

TRAINING IMPLEMENTATION STAGES

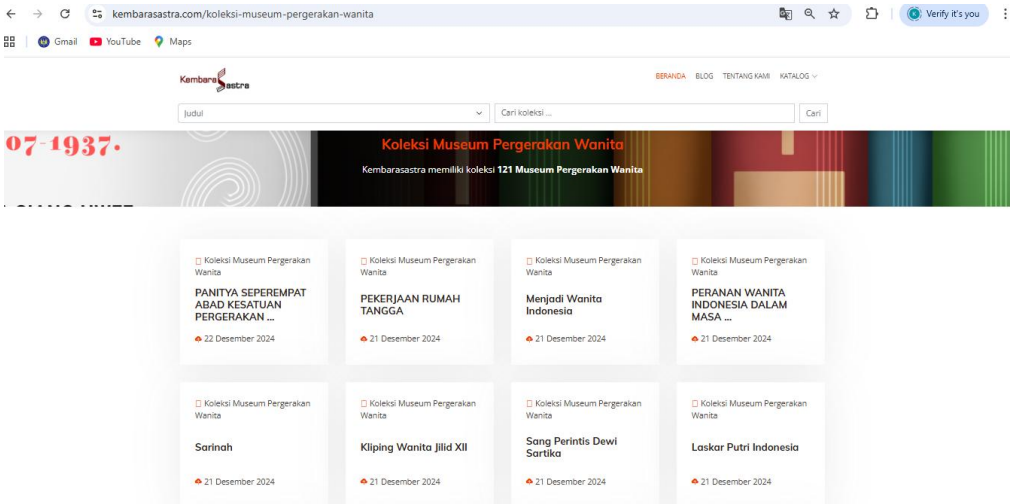
The training program is implemented through the following stages:

1. **Training Needs Analysis**
   Identifying participants' initial competencies to determine appropriate training levels (basic, intermediate, or advanced).
2. **Training Preparation**
   Preparing technical and non-technical aspects, including facilities, equipment, and training materials tailored to participants' needs.
3. **Training Implementation**
   Conducted over two days, consisting of theoretical presentations and simulations on the first day, followed by direct field practice on the second day. Instructional methods include interactive lectures, group discussions, and guided simulations facilitated by subject-matter experts.
4. **Training Evaluation**
   Evaluation is conducted through observation, interviews, and questionnaires to assess whether training objectives and indicators of achievement have been met.

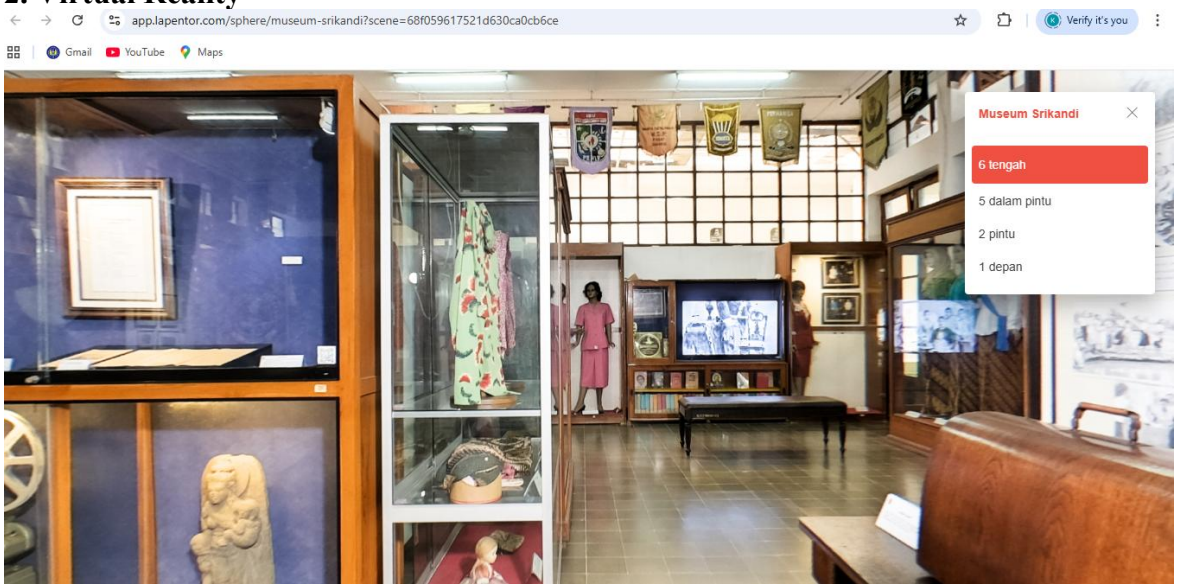
This community engagement initiative, implemented under the PKM DLK (Pengabdian kepada Masyarakat–Dosen Luar Kampus) scheme, involved multiple stakeholders, including lecturers, museum staff, and students. Museum staff served as training participants, while lecturers acted as instructors and program facilitators. Students contributed as assistants in archival digitization and Virtual Reality (VR) content development, gaining practical experience in applied digital heritage practices. Partner institutions provided technical expertise, particularly in immersive video production and digitization workflows, ensuring the quality and sustainability of program outcomes. Furthermore, student participation in this PKM DLK program was formally recognized through academic credit for the Laboratory Development course (ISJ6332), supporting the achievement of Key Performance Indicator (IKU) 2, which emphasizes experiential learning and student engagement in off-campus academic and community-based activities.

IMPLEMENTATION OF THE COMMUNITY SERVICE (PKM) ACTIVITIES

1. Digitization



2. Virtual Reality



CONCLUSION

The community engagement program conducted at the Museum Monumen Kesatuan Pergerakan Wanita Indonesia effectively addressed key challenges in archival digitization and Virtual Reality (VR) development. The initiative produced two principal outcomes: (1) digitization of archival materials, particularly collection books, and (2) the creation of a VR-based museum experience. These outputs enhanced digital archival management, strengthened museum promotion, and improved information systems through collaborative efforts among museum staff, lecturers, and students, supported by adequate infrastructure. Despite these achievements, persistent challenges include limited technical expertise, the need for specialized equipment, and long-term operational sustainability.

RECOMMENDATIONS

1. Advanced Training

   It is recommended that continuous and intensive training be provided to museum staff to further enhance their proficiency in managing digital archives and independently producing VR-based video content.
2. Sustained Technical Mentorship
   Establishing long-term collaborations with relevant institutions is essential to provide ongoing technical support, particularly in the management and maintenance of the technologies employed.
3. Financial Planning
   The museum should develop comprehensive budget planning that includes operational and maintenance costs for digital equipment to ensure the long-term sustainability of the project.
4. Optimization of Technological Infrastructure
   Regular updates to equipment and technological upgrades are necessary to support more efficient digitization activities and future VR-based promotional initiatives.
5. Collaboration and Development of Follow-up Projects
   Continued collaboration with other museums is encouraged to expand museum modernization programs, maximize the utilization of digitized collections, and develop additional VR features.

These measures are expected to enable the Museum Monumen Kesatuan Pergerakan Wanita Indonesia to sustain the program's achievements and effectively mitigate future challenges in managing technological infrastructure and information systems

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Neuroscience education : A Hybrid Systematic Literature Review And Bibliometric Analysis

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Abstract. Objectives – Various studies have examined neuroscience education in recent decades. However, comprehensive research on the variables and practices of neuroscience education is still relatively limited. Therefore, this study aims to conduct a systematic literature review and bibliometric analysis related to neuroscience education based on existing empirical research. Design/methodology/approach – The methodology used in this study is the Systematic Literature Review, using the term "neuroscience education" in the "Article Titles, Abstracts, and Keywords" of the Scopus database, resulting in a number of publications from the 1999s to 2025. The evaluation will be carried out on October 1, 2025. The collected data was then bibliometrically analyzed using VOSviewer to map the distribution, trends, and influence of publications in the field of neuroscience education. Findings – Research on neuroscience education is still limited, especially in developing countries and primary education contexts. Most previous studies have focused on higher education in developed countries. In the future, research needs to be directed to areas with limited access to neuroscience education. The main variables influencing this field include teacher knowledge and training, interdisciplinary integration, methodological challenges, digital technology advancements, and cultural and social factors. In addition, the conceptual framework of neuroscience education to strengthen evidence-based teaching practices was also discussed. Research limitations/implications – This study used the Scopus database for articles related to neuroscience education. Further research can improve the generalization of findings by integrating additional databases, such as the Web of Science or ERIC, so that the scope of the study becomes more extensive. Practical implications – The findings of this study have implications for the development of teaching practices and curriculum design based on neuroscience, so that it can optimally increase the effectiveness of learning and the development of student competencies. Social implications – This research provides insight for educators, policymakers, and the wider community regarding the application of neuroscience education principles in the context of adaptive, inclusive, and evidence-based learning. Originality/value – Research on neuroscience education continues to evolve globally. However, a comprehensive study of variables, practices, and their application in various educational contexts is still relatively limited.

Keywords- neuroscience education, literature review, Vosviewer, Bibliometrik, Paper type-Literature review

INTRODUCTION

Conducting a Systematic Literature Review (SLR) on the current neuroscience education variables is very important to advance the field of neuroeducation because it can synthesize, expand, and consolidate existing knowledge systematically. Neuroscience, as an interdisciplinary domain that integrates education, psychology, and neurophysiology, provides important insights for optimizing learning processes and pedagogical practices [1]. By systematically examining neuroscience and psychology findings, SLR bridges the gap between neuroscience research and educational practice, and ensures teaching methods are based on the latest empirical findings [2]. In addition, SLRs use rigorous and transparent methodologies, including standardized search, selection, and critical assessment of studies, often guided by frameworks such as PRISMA, which improve the reliability and credibility of reviews [3]–[5]

By synthesizing findings from various studies, SLR can identify research gaps, emerging trends, and provide a roadmap for future research, while supporting evidence-based decision-making and the development of adaptive and student-centered educational interventions[6]–[10]. In addition to its benefits, SLR also highlights the practical and ethical challenges of integrating neuroscience into education, so researchers and practitioners are encouraged to follow best practices and avoid potential pitfalls [11]. Overall, conducting SLR in neuroscience education is a crucial step to consolidate interdisciplinary knowledge, improve research rigor, identify gaps, guide further studies, and support evidence-based and ethical educational practices.

This research focuses on exploring the current landscape of research on neuroscience education and evaluates the relevance of this topic as a focus of future research. This study also reviews the evolution of academic discourse on neuroscience education and aims to identify how this study can contribute to the theory of neuroscience education. The research questions asked were: RQ1: Is the study of Neuroscience Education still a significant topic for future scientific research? RQ2: How is research distributed related to Neuroscience Education today? RQ3: What are the theoretical and practical implications from a future research perspective?

Bibliometrics to answer three research questions. The systematic literature review method is suitable for synthesizing existing research and helping to identify gaps, trends, and future research directions, while providing evidence-based insights that can influence further policy, practice, and research. This approach ensures that conclusions are drawn from a broad and representative sample of studies and highlights areas that need further research [12]–[14] Bibliometric analysis will complement this review by quantifying the distribution and impact of publications related to Islamic Leadership. Using VOSviewer and the Scopus database, this study will analyze publications related to neuroscience education from various journals, focusing on articles published until October 1, 2025. This methodology allows for a comprehensive mapping of the development of this field and provides a deeper understanding of its growth as well as future research directions.

LITERATURE REVIEW

Neuroscience education

Neuroscience education is defined as a scientific approach that studies how the brain and nervous system work in understanding, remembering, and processing information to improve learning effectiveness [15]–[17]. This approach emphasizes the integration of findings from neuroscience, cognitive psychology, behavioral, and pedagogy to create teaching practices that are aligned with the brain's natural mechanisms [18], [19]. Neuroscience is also a key pillar in the field of Mind, Brain, and Education (MBE) which combines the science of the brain with psychology and education to support the optimal learning process of students [20]. Furthermore, this approach highlights the importance of understanding brain plasticity, cognitive development, and the role of emotions in learning to create an effective and meaningful learning environment at various levels of education [21]–[23].

In addition, neuroscience education encourages the application of multisensory learning strategies that utilize various sensory channels to strengthen information processing and long-term memory [24]–[26]. This approach also emphasizes the importance of active student engagement through contextual and project-based learning experiences, which are in line with the principles of brain-based learning [27], [28]. Thus, the integration of neuroscience in education not only provides insight into how students learn, but also provides a scientific basis for teachers to design pedagogical interventions capable of improving students' motivation, creativity, and critical thinking skills [29]–[31]. The application of these neuroscience findings has become particularly relevant in the era of 21st-century education, where the demands of cognitive, social, and emotional competencies demand adaptive, personalized, and innovative learning models.

Table 1.defining elements of neuroscience education

No	Defining neuroscience education	reference
1.	Neuroscience education is defined as the exploration of emotions and feelings in the context of the learning and teaching process related to neuroscience, especially at various stages of career.	[21]
2.	The neuroscience approach in education emphasizes understanding how the brain works in learning and its application to improve teaching methods through adaptation to the brain's natural mechanisms.	[32]
3.	The neuroscience approach in education emphasizes the integration of insights from neuroscience to improve teaching practice and learning outcomes. This approach includes an understanding of brain development, plasticity, and learning mechanisms that can help educators create optimal conditions as well as understand the influence of external factors on information processing.	[22]
4.	The neuroscience approach in education integrates brain knowledge to enhance learning, emphasizing neural plasticity and cognitive processes to optimize students' teaching and learning experiences.	[23]
5.	Neuroscience is the science that explains how the brain learns, remembers, and processes information, so it can be the basis for more effective teaching practices.	[16], [17]
6.	Neuroscience is one of the main pillars in the field of Mind, Brain, and Education (MBE), which is a science that integrates neuroscience findings with psychology and pedagogy to understand how to best support the learning process of students.	[20]

7.	The neuroscience approach in education refers to the application of knowledge from the science of the brain into teaching practice. This approach integrates findings from behavioral science, cognitive psychology, neuroscience, and pedagogy to improve educational practices.	[18]
8.	Neuroscience can be defined as a scientific approach that studies how the brain and nervous system work in influencing human thinking, learning, and behavioral processes.	[15]

RESEARCH METHOD

A systematic literature review with a bibliometric approach is used to quantitatively assess the literature in order to identify trends, patterns, and key research entities within a discipline. Using the PRISMA framework, this approach ensures a comprehensive and replicable literature review process, resulting in a clear and transparent picture of the topics being studied [33]–[35] Research inclusion criteria include articles published by 1 October 2025, English-language publications, and focusing on the topic of the neuroscience approach. Bibliometric analysis was carried out using VOSViewer to visualize bibliographic data to analyze citation networks, collaboration between authors, and the emergence of concurrent keywords, thereby revealing the intellectual structure and dynamics of the research field. This combination of bibliometric analysis and systematic review assists researchers in synthesizing empirical findings as well as mapping the research landscape, including identifying key contributors and emerging trends [36]. In addition, this approach also provides an understanding of the development, historical trajectory, and future direction of a field of research, making it particularly useful in interdisciplinary studies to gain more in-depth insights [37], [38]. Bibliometric analysis is also used for strategic purposes in scientific publications, which was first introduced by Bertrand et al. (1970) to evaluate scientific journals based on their economic weight.

The initial stage in this scientific study involves keyword selection, which can be done through a macro (top-down) methodology, starting from a broad search path to more specific studies and topics. Therefore, after evaluating the limitations inherent in previous research and the lack of studies that discuss Islamic Leadership, this study integrates the keyword "neuroscience education" as the main focus in the article title, abstract, and keyword sections. In addition, the Scopus database is used by researchers for a variety of investigative purposes, including conducting a literature review, identifying experts in a specific field, as well as monitoring research trends.

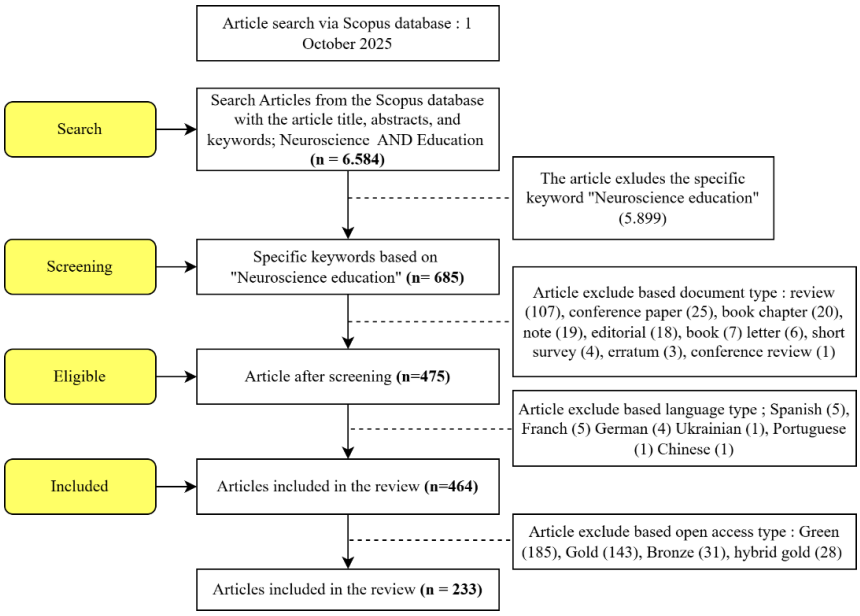


Figure 1. Systematic Literature Review information flow using PRISMA

Based on search results obtained on October 1, 2025 from the Scopus database using article titles, abstracts, and keywords "neuroscience AND education" in various academic disciplines, ranging from the earliest publication in 1986 to the most recent in 2025, the total number of articles on Neuroscience Education is 685 documents (see Figure 1). Based on these findings, a process of screening documents was carried out according to their classification. Articles eliminated based on document type include: review (107), conference paper (25), book chapter (20), note (19), editorial (18), non-English (17), and Excluded articles based on open access type

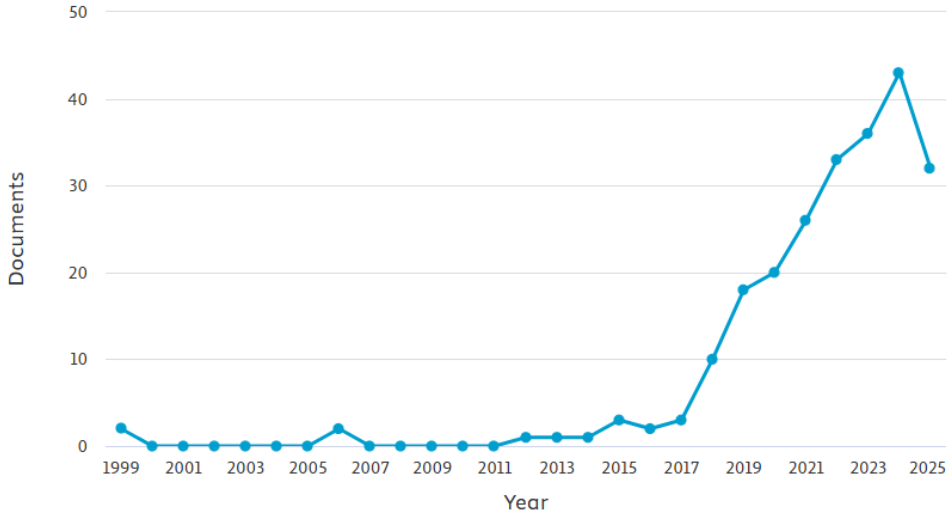
Green (185), Gold (143), Bronze (31), hybrid gold (28) so that a total of 233 documents remain. The results of the screening by document type resulted in 233 articles. The documents were then further analyzed in this study to answer the following research questions (RQ): RQ1: Is the study of Neuroscience Education still a significant topic for future scientific research? RQ2: How is research distributed related to Neuroscience Education today? RQ3: What are the theoretical and practical implications from a future research perspective?

RESULT AND DISCUSSION

The results of this study focus on the findings of 233 articles in the Scopus database that discuss Neuroscience Education. The data was obtained from the identification of the number of articles published, the distribution of publications by year, and the source of the journal where the article was published. The study also highlights the most influential elements of the study of Neuroscience Education, including the authors, institutional affiliations, and countries involved in the study.

RQ1: **Is the study of Neuroscience Education still a significant topic for future scientific research?**

Based on data obtained from the Scopus database, it is known that for more than four decades, scientific papers discussing Neuroscience Education amounted to 233 articles; This shows that research related to neuroscience education is still relatively limited, as shown in Figure 1. Studies on Neuroscience Education have begun to experience significant development in the last decade, especially since 2024. The first research was conducted by Purdy et al., (1999) under the title "Using Problem-Based Learning in Neurosciences Education for Medical Students", which marked the emergence of the term now known as brain-based learning. Currently, the development of research on Neuroscience Education has begun to attract the attention of many academics, with a focus on improving the learning process based on how the brain works, developing critical and creative thinking skills, increasing learning motivation, and optimizing learning strategies that are in accordance with the cognitive and emotional functions of students [40]–[43]. In addition, Neuroscience Education also contributes significantly to the improvement of brain-based learning [44].



Source : Scopus database

Figure 1. Number of neuroscience education publications

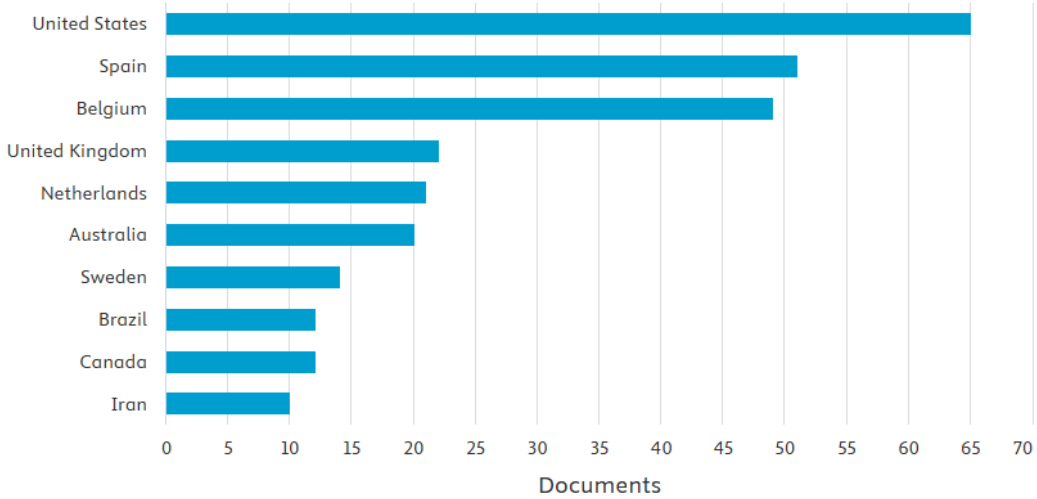
Since 1999, the literature on neuroscience education has been limited due to the lack of research published in reputable journals, creating opportunities for future researchers to fill these gaps. This research has important significance in expanding the horizon of neuroscience education, which has a good effect on improving learning outcomes as well as learning that is fun and liked by students. This is expected to facilitate a deeper understanding of the practical and sustainable application of neuroscience education in various fields.

RQ2: How is research distributed related to Neuroscience Education today?

The analysis of the distribution of research on Neuroscience Education in 233 articles was carried out by categorizing the articles based on classifications such as country, region, affiliation, source, and author, with the limitation of displaying only the top 10 articles in each classification. This understanding of the distribution of knowledge relevant to Neuroscience Education will be useful for academics and practitioners in formulating the next research agenda, especially in the sustainable development of Neuroscience Education.

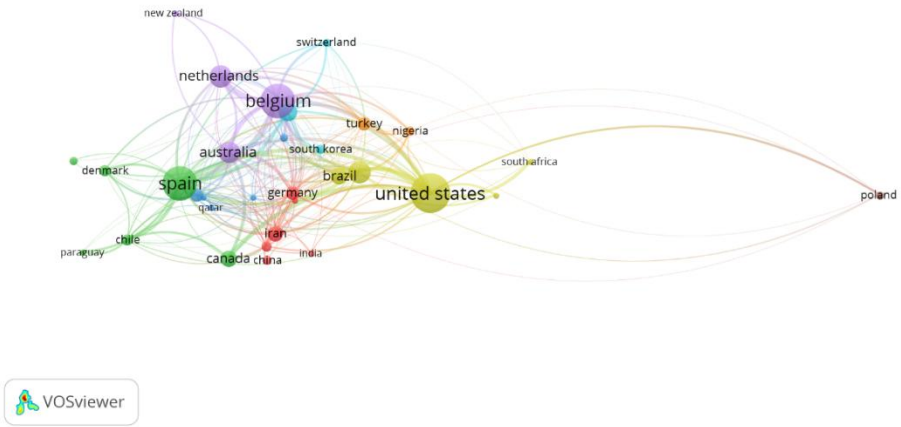
First, the distribution of scientific research related to Neuroscience Education by country or geographic region is dominated by the United States with 65 articles, followed by Spain with 51 articles, Belgium with 49 articles,

the United Kingdom with 22 articles, the Netherlands with 21 articles, Australia with 20 articles, Sweden with 14 articles, Brazil with 12 articles, Canada with 12 articles and Iran with 10 articles (see Figure 2).



Source : Scopus database

Figure 2. Number of articles by country or territory (top 10 country)

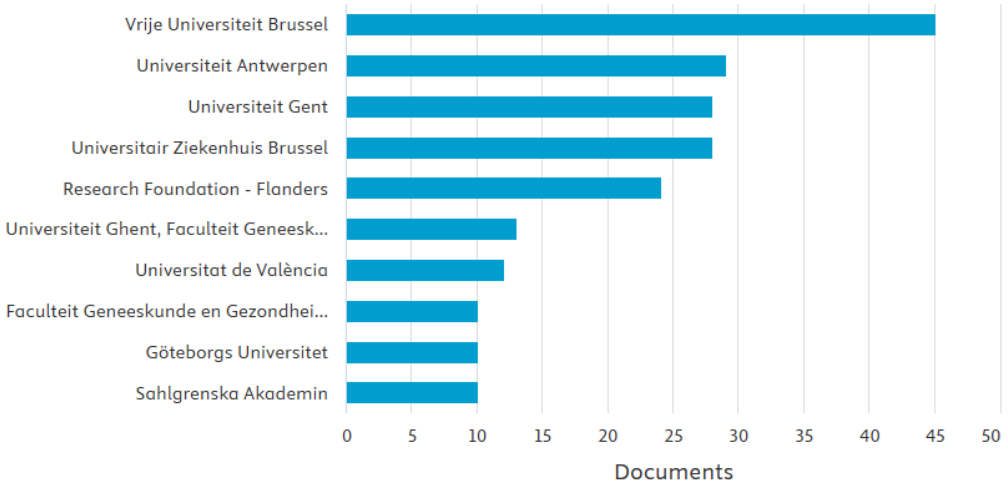


Source : Output VOSviewer software

Figure 3. Network country visualization

From the map, it can be seen that the United States is the main center of the network with the largest node size and extensive connectivity, indicating its dominant role in international research and cooperation in the field of Neuroscience Education. Other countries that also have high levels of contribution and collaboration are Spain, Belgium, the Netherlands, Australia, and Germany, which are members of several large clusters in the European and Oceania regions. In addition, cross-continental collaboration also appears to involve countries such as South Korea, Brazil, Turkey, and Iran, which strengthens ties between the Asian region and Europe. Meanwhile, countries like Poland appear to be located somewhat separate from the main network, suggesting limited involvement in global collaboration. Some countries in South America, such as Paraguay and Chile, are on the edge of the network with relatively few connections, signaling that research contributions still need to be improved. Overall, the results of this analysis show that research on Neuroscience Education is still dominated by developed countries with strong research networks. However, the involvement of developing countries indicates the opening of wider global collaboration opportunities in the development of educational neuroscience in the future.

Second, the distribution of scientific publications related to Neuroscience Education by institutional affiliation is dominated by the Belgian state by the Vrije Universiteit Brussel with 45 articles, the Universiteit Antwerpen with 29 articles, the Universiteit Gent with 28 articles, the Ziekenhuis University of Brussels with 28 articles, the Research Foundation-Flanders with 24 articles, the Universiteit Ghent, the Faculteit Geneeskunde en Gezondheidswetenschappen with 13 articles, Universitat de València (Spain) with 12 articles, Universiteit Ghent Faculteit Geneeskunde en Gezondheidswetenschappen (Belgium) with 10 articles, Göteborgs Universitet (Sweden) with 10 articles, and Sahlgrenska Academy, University of Gothenburg (Sweden) with 10 articles.

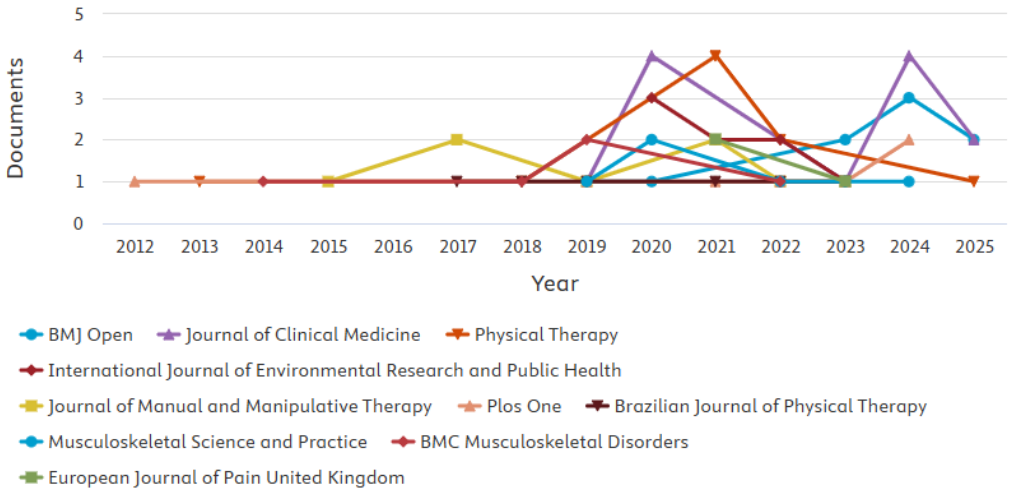


Source : Scopus database

Figure 4. Network country visualization

Based on the distribution of institutions, the results of the analysis show that the Vrije Universiteit Brussel occupies the position as the most productive institution with a total of 45 documents, which indicates its role as a leader in the development of research in this field. Furthermore, the Universiteit Antwerpen, Universiteit Gent, and Universitair Ziekenhuis Brussel each contributed about 25–30 publications, demonstrating the strong Belgian academic presence in the field of research. The Research Foundation – Flanders also made a significant contribution with some 25 papers, confirming the existence of active research collaboration among academic networks in Belgium.In addition, institutions such as Universiteit Ghent, Faculteit Geneeskunde, Universitat de València (Spain), Faculteit Geneeskunde en Gezondheid, Göteborgs Universitet, and Sahlgrenska Akademin (Sweden) each contributed between 10–15 publications. These findings suggest that institutions in Europe, particularly those based in Belgium, dominate the research landscape, reflecting strong institutional support, good funding mechanisms, and interdisciplinary collaborations that drive sustainable academic productivity in this field.

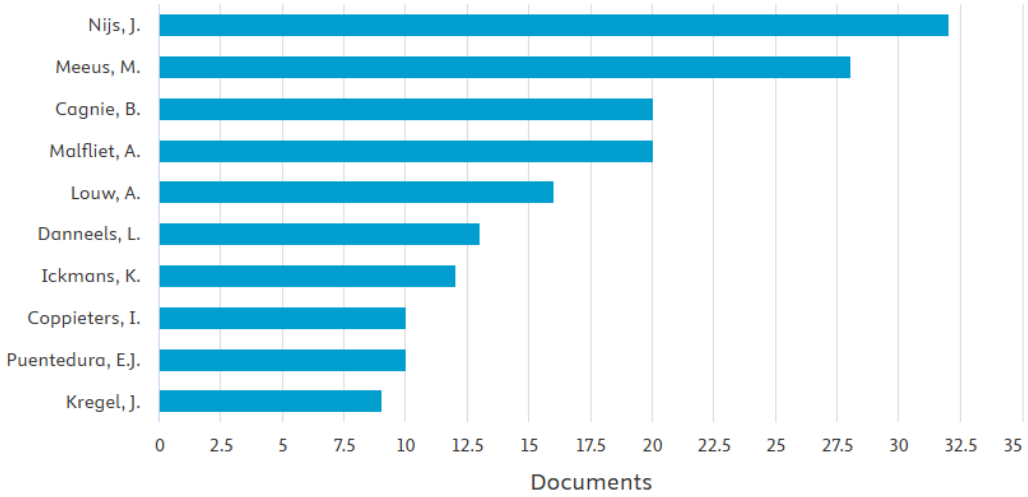
Third, the distribution of Research on Neuroscience Education based on publication sources is dominated by the Journal of Clinical Medicine with 12 articles, BMJ Open with 9 articles, Physical Therapy with 9 articles, Journal of Manual and Manipulative Therapy with 8 articles, Plos One with 7 articles, Brazilian Journal of Physical Therapy with 6 articles, Musculoskeletal Science and Practice with 6 articles, BMC Musculoskeletal Disorders with 5 articles, and European Journal of Pain United Kingdom with 3 articles.



Source : Scopus database

Figure 5. Number of articles by Sources (top 10 sources)

Fourth, the distribution of researchers related to neuroscience education which occupies 10 outstanding authors in the study of neuroscience education, including Nijs, J. Meeus, M. Cagnie, B. Malfliet, A. Louw, A. Danneels, L. Ickmans, K. Coppieters, I. Puentedura, E.J. Kregel, J.



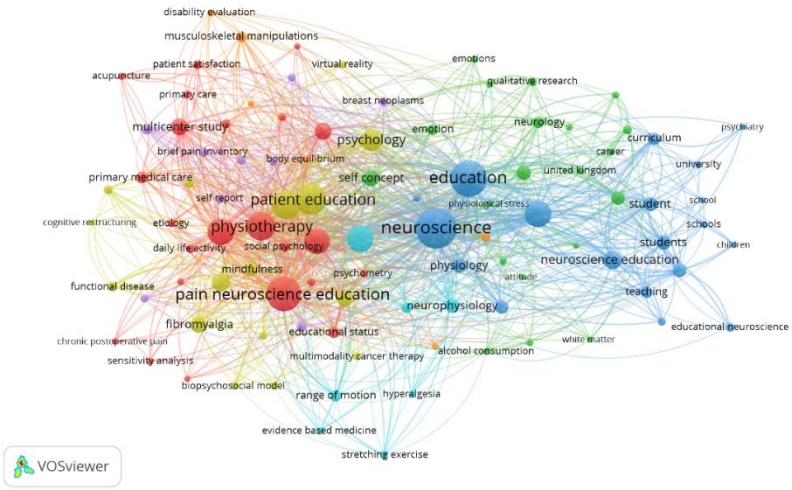
Source : Scopus database

Figure 5.count of publication by author (top 10 authors)

An analysis of the distribution of authors shows a relatively balanced contribution among the top ten authors without significant dominance. Nijs, J. became the most prolific author with about 33 publications, followed by Meeus, M. with 28, as well as several other authors such as Cagnie, B. and Malfliet, A. with 15–25 publications. This pattern reflects the existence of strong and equitable scientific collaboration in the development of the field of neuroscience education.

RQ3: What are the theoretical and practical implications from a future research perspective?

An examination was carried out on 233 manuscripts collected from the Scopus repository. VOSviewer is used to illustrate that the results of this study may have theoretical and pragmatic implications for future research on neuroscience education. The results of metadata analysis using VOSviewer will help researchers and practitioners better understand assumptions and findings related to neuroscience education. The results of bibliometric analysis using VOSviewer can show which variables have been extensively researched by previous researchers and which variables have not been explored extensively, so that they can be the basis for future research. From the perspective of practitioners, the results of the literature analysis using VOSviewer will help practitioners in implementing neuroscience education in a sustainable manner in the future and promote learning with neuroscience education for teachers around the world. From figure 7, the occurrence of neuroscience (111), education (90), pain neuroscience education (81), patient education (66), procedures (54), analgesia (48), physiotherapy (54), psychology (34), cognitive behavioral therapy (21), neuroscience education (23), physiotherapist (20), multicenter study (19), fibromyalgia (19), pain assessment (17),cognition (16), Fear (16), Catastrophization (16) musculoskeletal pain (16) surveys and questionnaires (16), sensitization (15) rehabilitation (15), avoidance behavior (15) Neurophysiology (14), young adult (14), pain severity (14), Student (14), spinal pain (14), Students (14), physiology (14), human experiment (14), knee osteoarthritis (14), mindfulness (14).



Source : Output VOSviewer software

Figure 6. Co- occurrence framework and representation of key terms

Table 2. keyword by authors

Rank	keyword	Total link strength
1	neuroscience	111
2	education	90
3	pain neuroscience education	81
4	patient education	54
5	procedures	48
6	physiotherapy	54
7	psychology	34
8	cognitive behavioral therapy	21
9	neuroscience education	23
10	physiotherapist	20

Source : Output VOSviewer software

Based on the results of mapping and analysis of previous studies, it was found that there were shortcomings in previous studies, where most studies on Neuroscience Education were conducted in countries or regions with established neuroscience research advances (see Figure 2 and Figure 4). Therefore, future research needs to be conducted in developing countries or regions with limited applications of neuroscience approaches in education. This kind of research can fill in gaps from previous studies and provide more comprehensive information about the application of Neuroscience Education in improving the quality of learning and academic performance of students, which can be explored in a universal context and its implications for educational innovation. Variables that influence neuroscience education can be categorized into several main areas, namely teacher knowledge and training, interdisciplinary integration, methodological challenges, digital and technological advancements, and cultural and social influences. In terms of teacher knowledge and training, studies show that teachers with formal training in neuroscience education have higher knowledge scores than those who rely on ongoing professional development or informal sources, demonstrating the importance of structured training programs to improve the understanding and application of neuroscience in education [20], [45] Interdisciplinary integration, which combines education, psychology, and neuroscience, is key to the effectiveness and development of this field, with collaborations between researchers, educators, and policymakers facilitating the translation of research findings into practical educational strategies [21], [46], [47].

Methodological challenges include translating neuroscience research into classroom practice, overcoming neuromyths, and developing reliable and valid assessment tools, such as the Educational Neuroscience Knowledge Test (ENKT), to measure teachers' understanding [45], [48], [49]. Digital and technological advances have also had a significant impact, where digital neuropsychology education presents both opportunities and challenges related to access, equity, and validity of assessments, while online training programs, such as those implemented during the COVID-19 pandemic, have proven effective in delivering material without compromising the quality of learning [2], [10]. In addition, cultural and social factors, including social and emotional influences on learning, as well as variations in neuroscience education conditions globally especially in regions such as sub-Saharan Africa that require resources and training are more important considerations in designing educational strategies that support students' cognitive and emotional development [22], [23].

CONCLUSIONS

The study examined 233 academic publications from the Scopus repository and outlined five key conclusions. First, research related to neuroscience education has been relatively rare over the past four decades since its emergence in the early 1999s. Second, studies on neuroscience education are spread across various countries, but the distribution is not even and is still concentrated in certain regions. Third, research on neuroscience education is not only conducted in developed countries with strong research infrastructure (such as the United States, Belgium, and Spain), but also begins to develop in developing countries, including Singapore and several other Asian countries. Fourth, the main characteristics in neuroscience education emphasize cross-disciplinary integration, especially between the fields of education, psychology, and neuroscience, which results in five main focuses: understanding the basic concepts of the brain, applying research results to the classroom, teacher development, multidisciplinary collaboration, and the use of digital technology in learning. Fifth, this study also develops a conceptual model of neuroscience education that explains its impact on the learning process, including learning motivation, student well-being, academic performance, classroom climate, learning engagement, and creativity.

Finally, the researchers also acknowledged that the study had some limitations. First, the study only used publications taken from the Scopus database, which could limit the generalization of the findings. Further research is recommended to combine data from Scopus and the Web of Science to make the results more comprehensive. Follow-up studies can also deepen the exploration of specific issues in neuroscience education, such as the effectiveness of neuroscience-based teacher training or the application of multisensory learning in elementary schools. Finally, although the researchers have used rigorous methodologies to minimize interpretation bias, future research is expected to apply mixed methodological approaches or new analytical techniques to complement the results of this study.

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SPORTS PSYCHOLOGY TRAINING FOR TENNIS ATHLETES AND COACHES IN SLEMAN REGENCY

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Abstract. This community service activity was motivated by the lack of attention to the psychological aspects of coaching tennis athletes in Sleman Regency. Both coaches and athletes were found to have insufficient psychological knowledge and skills to cope with competitive pressure. This training program aimed to enhance athletes' understanding and mental skills while broadening coaches' insights into psychological strategies for sports coaching. The activity was conducted on August 9–10, 2025, at the UNY Tennis Court in collaboration with the Sleman Regency branch of Pelti, involving a total of 20 participants. The methods included a pre-test, interactive lectures, mental skills training (visualization, relaxation, and self-talk), match simulations, short mentoring sessions, and a post-test. The results indicated a significant improvement in participants' understanding of sports psychology concepts, increased athletes' mental readiness, and enhanced coaches' competence in developing athletes' mental performance. The program received positive feedback and is recommended to be implemented continuously to support athlete preparation for the PORDA DIY 2025

Keywords: sports psychology, tennis athletes, coaches, Sleman

INTRODUCTION

Sleman Regency, a region in the Special Region of Yogyakarta, is experiencing rapid sports development, including tennis. This is evident in the increasing number of clubs and communities, as well as the annual tennis championships. Support from the community and local government is also a driving factor in the development of tennis in the region. However, this increase in sporting activity has not been fully accompanied by comprehensive development, particularly in strengthening the psychological aspects of athletes. In the context of modern sports, athlete development focuses not only on physical and technical abilities but also on mental readiness, which plays a significant role in determining athlete performance on the field.

Psychological aspects are a crucial component of competitive sports, as athletes often face competitive pressure, performance demands, and expectations from coaches and their environment. In individual sports like tennis, these pressures tend to be even greater because athletes must rely solely on their own abilities during matches. In Sleman Regency, many young athletes, including students and teenagers, demonstrate great potential but face various mental challenges such as pre-match anxiety, fear of making mistakes, lack of focus, and difficulty controlling emotions. These conditions significantly impact the quality of their play, often leading to decreased performance at crucial moments.

Furthermore, coaches, who play a crucial role in developing athletes, have not received adequate training in sports psychology. Most coaches emphasize technical, physical, and strategic aspects of the game, while mental development is not yet part of a systematic training program. This leaves coaches unable to help athletes manage competitive pressure, build internal motivation, or provide psychological support tailored to their needs. Consequently, the coaching process is suboptimal because it does not encompass the mental aspects that are fundamental to stable and consistent performance.

Recognizing this need, sports psychology training is a strategic step needed to support the development of tennis in Sleman Regency. This training aims to provide athletes and coaches with a basic understanding of the importance of mental aspects in sports, as well as equip them with practical psychological skills that can be applied in training and competitions. Techniques such as relaxation, visualization, emotional management, and positive self-talk are fundamental skills proven effective in helping athletes improve focus and self-confidence.

Through this Community Service activity, it is hoped that athletes will be able to develop better mental abilities so they can perform optimally during matches. Meanwhile, for coaches, this training is expected to provide them with the necessary tools to improve the quality of their coaching through a more structured mental approach. Ultimately, strengthening this psychological aspect will not only impact competitive performance but also

improve the overall psychological well-being of athletes, enabling more comprehensive and sustainable sports coaching in Sleman.

The partner in this activity is Pelti Sleman Regency, an organization that plays a key role in the development of tennis in the region. Although the performance and number of tennis participants in Sleman Regency continues to increase, several issues remain obstacles to comprehensive athlete development. One major issue is the coaches' lack of understanding of sports psychology. Coaches have traditionally emphasized technical and physical aspects of training, while mental development has not been an integral part of the routine training program. As a result, the support provided to athletes in dealing with the pressures of competition remains suboptimal, resulting in suboptimal performance, especially during important matches.

Furthermore, many athletes, particularly those in the school and adolescent age groups, often experience anxiety, fear of failure, and a lack of confidence when facing competition. This anxiety is not only mental but also affects physical aspects, such as muscle tension, poor coordination, and decreased focus. This condition results in their performance on the court not matching their true abilities. The inability of athletes to manage this mental stress highlights the need for a coaching strategy that emphasizes not only technical and physical abilities but also strengthens psychological readiness.

Another problem is the lack of a systematic mental development program within the Sleman tennis community. Most clubs and communities lack modules or guidelines related to sports psychology training, resulting in sporadic and immeasurable mental approaches provided to athletes. This lack of programs leaves athletes' mental skills needs, such as relaxation techniques, visualization, emotional management, and positive self-talk, unmet. This leaves athletes' mental development unstructured and not a primary focus in developing athletic performance.

From the coaches' perspective, limited knowledge of sports psychology also impacts the coaching methods used. Coaches are often unable to recognize signs of mental stress in athletes or provide appropriate psychological support during training and matches. This situation highlights the gap between athletes' need for mental support and their ability to facilitate this aspect. Therefore, a structured, practical, and applicable sports psychology training program is essential, not only to improve athletes' mental preparedness but also to equip coaches to develop athletes holistically.

The issues identified above indicate that the success of tennis athlete development in Sleman Regency is determined not only by technical and physical abilities, but also by strengthening psychological aspects. Therefore, intervention through community service activities in the form of sports psychology training is a strategic solution that can bridge the gap between athlete needs and coach capabilities, and help create more comprehensive, sustainable, and effective coaching.

IMPLEMENTATION METHOD

The training was conducted using a practice-based training approach that actively involved athletes and coaches. The training took place on August 9–10, 2025, at the UNY Tennis Court, and was attended by 20 participants, consisting of student athletes and tennis club coaches in Sleman Regency. The first step in the training was a pre-test to assess participants' initial knowledge of sports psychology. The material was then delivered through interactive methods such as lectures, discussions, Q&A sessions, and match simulations.

Following this, participants had the opportunity to practice the psychological skills taught, such as breathing relaxation techniques to reduce tension, visualization to increase focus and competition readiness, and positive self-talk to build confidence. During the field practice sessions, athletes applied these mental techniques in exercises supervised by coaches and the PkM team. Short mentoring sessions were then provided to ensure participants were able to practice the techniques independently. At the end of the training, participants took a post-test to measure improvements in knowledge and mental skills. Additional evaluations were conducted through observation, attendance, and participant responses.

RESULTS AND DISCUSSION

The two-day sports psychology training, held on August 9–10, 2025, was attended by 20 participants, consisting of 15 young athletes and 5 tennis coaches from various clubs in Sleman Regency. This activity aimed to improve the psychological understanding and skills of both athletes and coaches. Based on pre- and post-test results, the average knowledge score of participants before the training was 55.3/100, indicating a low basic understanding of sports psychology concepts. After the training, the average post-test score increased to 82.5/100, representing an average increase of 27.2 points. This indicates that participants successfully absorbed the training material.

In addition to increased theoretical knowledge, changes in athlete behavior were also observed during field practice. Of the 15 athletes, 12 (80%) were able to apply breathing and relaxation techniques to reduce tension before a simulated match, while 10 athletes (66.7%) successfully used visualization techniques to improve focus.

Positive self-talk was practiced by 11 athletes (73.3%), and most reported feeling more confident and better prepared for competition. Observations from the implementing team indicated that athletes who implemented this technique performed more consistently compared to previous training sessions, for example, with fewer service errors and more precise ball placement.

Coaches who participated in the training also gained new insights into mental support for athletes. Of the five coaches, all (100%) stated they understood how to provide positive instruction, recognize signs of anxiety in athletes, and provide mental support during training and matches. Short interviews indicated that coaches felt more confident in guiding athletes holistically, combining physical, technical, and psychological aspects. Coaches also reported that visualization and self-talk techniques were easier to implement and had a rapid impact on athletes' mental well-being.

A further impact of this activity was the opening of opportunities for further collaboration between the PkM team and the Sleman Regency Pelti (Indonesian Sports Committee). All participants expressed interest in participating in follow-up coaching sessions ahead of the 2025 Yogyakarta PORDA. Based on the attendance list, all participants (100%) attended the entire training series, indicating high enthusiasm and engagement. Observation data showed that the active participation rate in discussions and practice sessions reached 85%, indicating high participant engagement.

Overall, this training demonstrated the effectiveness of a sports psychology approach in improving athletes' mental preparedness. The integration of relaxation techniques, visualization, and self-talk was shown to significantly impact athletes' confidence and focus during training and match simulations. Improved post-test scores, the percentage of athletes able to apply psychological techniques, and positive responses from coaches and athletes demonstrate that this program is relevant, applicable, and has the potential for sustainable implementation in the development of tennis athletes in Sleman Regency.

CONCLUSION

The Community Service Program (PKM) program, a sports psychology training program for tennis athletes and coaches in Sleman Regency, was successfully implemented and achieved its stated objectives. Participants demonstrated increased knowledge and skills in applying psychological techniques to enhance performance. Coaches gained new insights into mental development strategies, and athletes felt more psychologically prepared for training and competition. This training was deemed highly relevant and beneficial, warranting continued implementation. Going forward, it is hoped that this program will become an important part of tennis athlete development in Sleman, particularly in supporting preparations for championships such as the 2025 Yogyakarta Regional Sports Week (PORDA DIY).

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HOTS-ORIENTED TEST INSTRUMENT ABOUT ENVIRONMENTAL CHANGE IN ELEMENTARY GRADE 5

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Abstract. Higher-order thinking skills can be improved through assessments that require analytical, evaluative, and creative skills. This study is part of research and development (R&D) using the Borg and Gall development model, which has been modified into six stages: (1) preliminary study, (2) planning and and develop, (3) preliminary filed testing, (4) main product revision, (5) main field testing, and (6) operational product revision. The research involved 68 fifth-grade elementary school students. The results showed that the developed multiple-choice HOTS social studies item instrument met the validity criteria, with 23 of the 25 items declared valid and reliable, with a coefficient value of 0.711. The test items had an average difficulty level of 0.58 (moderate) and an average discrimination power of 0.43 (excellent).

Keywords: elementary school, HOTS, multiple choice question, social studies

INTRODUCTION

Higher-order thinking skills are essential skills in the 21st century. Higher-order thinking skills refer to the ability to understand information, draw conclusions, connect it with other concepts or information, categorize, manipulate, and shape it into ideas to solve problems (Thomas & Thorne, 2009). Brookhart, (2010) states that higher-order thinking skills can be interpreted as three forms of thinking: transfer, critical thinking, and problem-solving. To help teachers understand higher-order thinking skills, experts have developed aspects of thinking skills, including Bloom's taxonomy (1956), SOLO (1982), Bloom's revised taxonomy (2001), Webb's levels of thinking (2002), and Marzano's taxonomy (2007). Each taxonomy was developed to make it easier for educators to measure and assess students' thinking skills (Anderson et al., 2001).

Various factors influence thinking skills. Mahapoonyanont, (2012) found that thinking skills are influenced by three factors, namely personal factors, educational factors, and student factors. Meanwhile, based on a systematic analysis (Smare & Elfatihi, 2024), it was concluded that the factors that influence thinking skills can be categorized into individual factors, family factors, educational factors, and socio-cultural factors. (Budsankom et al., 2015) found that classroom conditions have twice the influence of other factors because learning management can control and encourage the intellectual characteristics of learners during the learning process. One of these is the implementation of learning assessment, which plays an important role in the development of learners' thinking (Brookhart & Nitko, 2011).

Based on a needs analysis conducted among elementary school teachers, it was found that there is still a need for HOTS assessment instruments in IPAS subjects, especially in social studies for fifth-grade elementary school students. The objective of social studies education is civic education, which encompasses the mastery of knowledge, values, character, and skills (Chapin, 2013; Jarolimek, 1986). Zarrillo, (2012)adds that social studies education also encourages students to master the learning process. Social studies content helps examine everyday social phenomena; therefore, a contextual and in-depth learning approach is needed in the learning process. In Indonesia, social studies learning in elementary schools is integrated with science content, known as IPAS, to provide students with a comprehensive understanding. The topics studied in social studies and science are sourced from phenomena and the students' surroundings, making them interrelated.

Understanding the environment is very important for students to learn from an early age. Awareness of environmental protection is an important skill for every member of society. The habit of protecting the environment by disposing of waste properly is an implementation of science and social studies learning in everyday life. One of the topics studied in fifth-grade elementary school social studies is "Bumiku Sayang,

Bumiku Malang" which covers the concepts of global change, its causes, its impact on society, and efforts to mitigate it. To achieve in-depth social studies learning objectives, students need to engage in higher-level thinking, including analyzing social phenomena, evaluating actions within the social environment, and generating ideas or solutions to address social problems.

Assessment has two primary purposes: to measure the achievement of learning objectives and to evaluate learning (Nirmala, 2020). The measurement of learning achievement is based on the learning outcomes of students. Assessment instruments that measure thinking skills in line with higher-order thinking aspects are essential because they determine the credibility of the results presented. Therefore, assessment is not only a report of learning outcomes for parents and teachers (Dwivedi, 2019), but also a strategy to encourage the development of students' potential (Mustika et al., 2025). Assessment results show progress and areas that need improvement (Büyükkarci, 2014).

Farris, (2024) states that higher-order thinking skills in elementary and secondary social studies education encompass the ability to acquire knowledge, engage in problem-solving, communicate effectively, conduct inquiry, and reflect critically. Teachers can choose one or all of these aspects to measure students' thinking levels. Principles that can be applied in assessing HOTS include presenting context-dependent item sets, using contexts that have never been presented to students, and setting different levels of thinking and difficulty for each question (Brookhart, 2010). The revised Bloom's Taxonomy is one of the most widely used thinking level hierarchies by teachers as a basis for assessing students' thinking skills (Kania & Kusumah, 2025). The revised Bloom's Taxonomy is an improvement on the original version, Bloom's Taxonomy (1956), by Krathwohl et al (2001). Slightly different from the original version, the revised version consists of remembering, understanding, applying, analyzing, evaluating, and creating. There are differing opinions regarding higher-order thinking skills, with some arguing that they begin at the applying stage (C3) and others stating that the higher-order thinking process begins at the analyzing stage (C4).

Assessment instruments in elementary school social studies learning are still not oriented towards higher-order thinking skills. Due to teachers' lack of understanding of the aspects of higher-order thinking skills, which affects their confidence and encourages a return to traditional assessment (Epinasti et al., 2021; Schulz & FitzPatrick, 2016), and difficulties in implementation to ensure consistency with learning outcome indicators and evaluation (Afflerbach et al., 2015; Wald & Harland, 2021).

The development of instruments for assessing higher-order thinking skills in this study drew on aspects of thinking in Bloom's revised taxonomy, including analysis (C4), evaluation (C5), and creation (C6), as referenced in the findings (Kania & Kusumah, 2025). Analytical skills include the ability to differentiate and attribute (Anderson et al., 2001). In line with Brookhart (2010), analytical skills are measured by assessing students' focus on the main ideas presented, analyzing arguments, and comparing and contrasting them. Evaluation skills consist of checking and critiquing (Anderson et al., 2001). Brookhart (2010) states that to assess students' evaluation skills, students are asked to explain or summarize a material or information and critique it. In this process, the extent of their understanding of the material and their ability to critique it is obtained. Good criticism is accompanied by evidence or supporting arguments. Meanwhile, the ability to create, previously referred to as synthesis (Kania & Kusumah, 2025), encompasses the skills to generate, plan, and produce (Anderson et al., 2001). Brookhart (2010) states that the ability to create can be assessed through formative, summative, or self-assessment.

Practical instruments for measuring social studies skills that are oriented toward higher-order thinking skills are still limited. Multiple-choice questions are one type of cognitive ability assessment instrument that is widely used due to their practicality and ease of administration. The advantages of multiple-choice questions include versatility in question design, efficiency and practicality, enhanced learning and engagement, and applicability to assess various cognitive levels (Finley, 2019; Glass & Sinha, 2013; Hegde et al., 2014). However, pitfalls must also be avoided, including ambiguous words, irrelevant distractors, and questions that do not align with learning objectives (Finley, 2019; Gottlieb et al., 2023; Mitra, 2022). To avoid poor multiple-choice question design, the following strategies can be used: determine the purpose and scope of the question; a competent team consisting of subject matter and assessment experts; concise questions that require mastery of knowledge and broad understanding; clarity of the concepts tested in each item, plausible distractors, avoidance of grouped answers; provision of explanations rather than answer keys; provision of validity and evaluation tests for the instrument (Gottlieb et al., 2023).

Research on measuring higher-order thinking skills has been conducted, including a meta-analysis by Kania and Kusumah (2025) on the assessment of higher-order thinking skills in mathematics. Handayani et al., (2024) researched the development of instruments for assessing higher-order thinking skills in social studies for junior high school students. They found that the multiple-choice instruments developed were theoretically and empirically proven to be capable of measuring students' HOTS. This study focused on testing the validity and reliability of HOTS assessment instruments in elementary school social studies on the topic of environmental change.

METHOD

Research Design

This research is a development study aimed at creating a HOTS-oriented assessment instrument on the theme of "My Earth, My Poor Earth" for fifth-grade elementary school students. This theme explores the concept of environmental change resulting from natural factors and human activities, as well as its impact on the social life of the community. The development model refers to Borg and Gall (1983), which has been simplified to include the following stages: (1) preliminary study, (2) planning and initial product development, (3) limited testing, (4) refinement of the initial product, (5) expanded testing, and (6) final refinement (Zainuddin et al., 2020), adjusted to the needs and limitations of the research.

The preliminary study stage involved reviewing literature related to HOTS-based assessment in elementary school social studies and conducting focus group discussions (FGDs) with seven elementary school teachers, resulting in data on the need for HOTS-based assessment instruments for fifth-grade elementary school students studying the theme "My Beloved Earth, My Poor Earth." The planning stage involved analyzing the curriculum, including learning outcomes and indicators in the independent learning curriculum, mapping the targeted cognitive domains (C4, C5, and C6), developing initial products, and determining the required validation instruments. The products were then validated by experts, who provided feedback on the developed products. The products were improved based on the feedback provided by the experts. A limited trial was conducted after the products were declared feasible by the experts. The trial involved 14 fifth-grade students at SD N Kalongan. The initial product improvement stage was carried out based on feedback provided by classroom teachers. Next, an expanded trial was conducted involving 54 fifth-grade students at SD N Depok 1. The data obtained from the students was then used to test the validity and reliability. Finally, final improvements were made to the product. Data collection was carried out from January to August 2025, involving three elementary schools in the Sleman district. The schools were selected at random.

Participants in this study consisted of fifth-grade elementary school students, elementary school teachers, and experts. A total of 68 fifth-grade elementary school students were involved in the field trial, and two learning experts were involved to provide input and validate the content of the developed product.

Data collection instruments included FGD guidelines focusing on teacher data, social studies learning models or strategies, social studies assessment methods, and obstacles to social studies learning in elementary schools. These instruments were used to collect initial data for needs analysis. Questionnaires were used to test the validity of the developed test instruments.

The data obtained was then analyzed using Aiken V to determine the content validity of the items. Subsequently, empirical testing was conducted to determine the validity, reliability, discrimination, and difficulty level of the developed items. The data was analyzed using SPSS and Microsoft Excel.

RESULT

Preliminary Study Results

Based on the results of the FGD conducted with seven elementary school teachers in the Province of Yogyakarta, data were obtained on the profiles of the teachers, the approaches and strategies used in teaching social studies, and their relationship to the higher-order thinking skills of fifth-grade students. It is well understood that teachers recognize higher-order thinking skills as a primary objective in social studies education in elementary schools. However, they still find it difficult to improve these skills in learning due to limited knowledge about aspects of higher-order thinking, the development of learning strategies oriented towards higher-order thinking in classes where students have varying abilities, and difficulties in developing appropriate and practical assessment instruments. These findings have been presented (Epinasti et al., 2021; Schulz & FitzPatrick, 2016) that teachers' lack of confidence in their competence causes the assessment of students' thinking skills to revert to traditional methods.

The preliminary study results were also confirmed by document analysis in the form of the 2024 Regional Education Standardization Assessment (ASPD) results for fifth-grade students in Sleman Regency, which showed that students obtained an average score of 185.01-190.00 out of a total score of 300, indicating that there is still room for improvement. The Sleman Regency ASPD is an evaluation designed to map the quality of education and measure the competency achievements of fifth-grade students. Although the ASPD results do not specifically test competencies in social studies, social studies competencies can be covered in questions on reading literacy, numeracy, or science.

Previous studies have also found that the measurement of thinking skills in social studies still needs to be developed to be appropriate to the learning objectives and characteristics in the field. These findings reinforce the

need for alternatives related to HOTS-oriented social studies learning, one of which is the development of test instruments.

Planning and Develop

The initial product planning and development stage was conducted based on the results of a preliminary study that identified the need for a test instrument focused on Higher Order Thinking Skills (HOTS). At this stage, the researchers compiled a preliminary product design in the form of a test grid and questions developed in accordance with the basic competencies and competency achievement indicators applicable in the curriculum. The test blueprint was developed to ensure the integration of learning objectives, teaching materials, and indicators of higher-order thinking skills to be measured.

The developed test items were oriented towards the revised Bloom's taxonomy (Krathwohl & Anderson, 2010), covering the cognitive domains of analysis (C4), evaluation (C5), and creation (C6). Each item is developed with consideration of the characteristics of HOTS questions, namely the presence of contextual stimuli, inter-conceptual connections, and logical reasoning that requires students to think critically and reflectively. The test format developed is multiple choice with four answer options, consisting of one correct answer and three logical distractors.

Additionally, at this stage, researchers designed an assessment format and instructions to enable the practical use of the instruments in the field. The initial draft of the questions, which had been reviewed, was then given to expert validators to assess the suitability of the content, construction, and language. The result of this initial product planning and development stage is a draft of the HOTS IPS I test, a set of HOTS test instruments ready for validation by experts.

Preliminary Filed Testing

A preliminary field test was conducted to obtain preliminary information about the practicality and readability of the questions developed in the draft HOTS IPS I test. This trial involved homeroom teachers and 14 fifth-grade students at Kalongan Public Elementary School as research subjects. The subjects were selected purposively, considering the suitability of the participants' characteristics in relation to the target users of the instrument, namely, elementary school students at the same grade level as the test design. The trial was conducted under controlled conditions in the classroom, lasting one hour.

The results of the trial showed that the draft HOTS IPS test was practical to use, with an average score of 0.91 (very practical) by teachers and 21.85 (very practical) by students. Students were able to understand the content and context of the questions effectively. However, some students still experienced confusion regarding the use of specific terms in the question stimuli and the length of the discourse in several items. Based on these findings, the researcher revised the wording of the sentences, simplified the stimuli, and adjusted the layout of the answer options. These revisions were made to improve the clarity, readability, and practicality of the instrument before proceeding to the extended trial phase.

Main Field Testing

This stage is carried out after the instrument has undergone revisions based on the results of limited trials. The purpose of this stage is to obtain stronger empirical data regarding the validity, reliability, difficulty level, and discriminating power of the refined items.

The test results data were analyzed using statistical techniques appropriate for multiple-choice items. The empirical validity of each item was calculated using point biserial correlation, test reliability was analyzed using Cronbach's alpha, while the difficulty level (p) and discrimination power (D) were calculated to assess the quality of each item. The results showed that out of 25 questions, two questions were declared invalid, namely numbers 2 and 5. The results of the validity, reliability, difficulty level, and discrimination power analysis are presented in Table 1 below.

TABLE 1. The Validity, Reliability, Difficulty Level, and Discrimination Power

No item	Decision	Discrimination Index	Difficulty Index
1	Valid	Sufficient	Difficult
2	Invalid	Poor	Difficult
3	Valid	Excellent	Moderate
4	Valid	Excellent	Moderate
5	Invalid	Good	Moderate
6	Valid	Excellent	Moderate
7	Valid	Good	Difficult
8	Valid	Excellent	Easy
9	Valid	Excellent	Moderate
10	Valid	Excellent	Easy
11	Valid	Excellent	mudah
12	Valid	Excellent	Moderate

13	Valid	Excellent	Moderate
14	Valid	Excellent	Easy
15	Valid	Good	Easy
16	Valid	Good	Easy
17	Valid	Excellent	Moderate
18	Valid	Good	Easy
19	Valid	Excellent	Moderate
20	Valid	Good	Moderate
21	Valid	Excellent	Moderate
22	Valid	Good	Easy
23	Valid	Excellent	Moderate
24	Valid	Excellent	Easy
25	Valid	Excellent	Moderate

The difficulty level ranged from 0.2 to 0.8. The average difficulty level of the items was 5.82, indicating that most questions were of moderate difficulty. The reliability, as measured by Cronbach's Alpha, yielded a coefficient value of 0.711. Overall, it was found that out of 25 items, two items were declared invalid, with an average difficulty level of moderate. Based on these analysis results, in the final revision stage, the two invalid questions were removed, leaving 23 questions.

CONCLUSION

Based on the analysis of the Higher-Order Thinking Skills (HOTS) test instrument, it was found that most items met the criteria for suitability as a measurement tool. Empirical validity testing revealed a correlation value above 0.05, indicating that the items were deemed valid. The reliability test results produced a coefficient of 0.711, indicating that the instrument has a high level of internal consistency. The difficulty level analysis revealed that the majority of items fell into the moderate category, with a proportional distribution between easy and difficult items, ensuring the test measured students' abilities in a balanced manner. Meanwhile, the discrimination test results show that most items have a D value ≥ 0.30, indicating that the items can effectively distinguish between high- and low-ability students. Thus, the developed HOTS test instrument is deemed valid, reliable, and suitable for measuring the higher-order thinking skills of elementary school students.

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BASIC LITERACY COMPETENCE OF ELEMENTARY SCHOOL TEACHERS: A CASE STUDY IN KEPANEWONAN GODEAN, SLEMAN

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Abstract. Basic literacy competence is a fundamental prerequisite for elementary school teachers in supporting 21st-century learning and responding to rapid developments in information and communication technology. However, empirical evidence indicates that teachers' literacy competence has not yet been optimally developed, particularly in peri-urban contexts experiencing socio-technological transformation. This study aims to explore the profile of basic literacy competence of elementary school teachers in Kepanewonan Godean, Sleman Regency. Employing a qualitative single-case study design, data were collected from 29 elementary school teachers through open-ended questionnaires, Focus Group Discussions, in-depth interviews, and document analysis. Data were analyzed using an interactive qualitative analysis model encompassing data reduction, data display, and conclusion drawing. The findings reveal that teachers' basic literacy competence can be categorized into three interrelated domains: professional knowledge, professional instructional practice, and teachers' personal literacy development. Overall, teachers demonstrated a moderate level of literacy competence, with professional knowledge more strongly developed than instructional practice and professional self-development. While many teachers were able to analyze students' reading and writing profiles, only a small proportion demonstrated reflective and problem-solving-oriented literacy pedagogy. Literacy assessment practices remained largely summative, literacy-rich learning environments were predominantly classroom-centered, and teachers' engagement in professional literacy activities such as reading, writing, and knowledge sharing was limited. These findings indicate a persistent gap between conceptual literacy understanding and pedagogical implementation, influenced by structural constraints, digital pedagogical readiness, and institutional support. The study highlights the need for a systemic approach to strengthening teachers' basic literacy competence through practice-based professional development, supportive school ecosystems, meaningful technology integration, and the cultivation of a sustainable professional literacy culture.

Keywords: Basic literacy competence; elementary school teachers; literacy pedagogy; professional development; qualitative case study

INTRODUCTION

In the context of the twenty-first century, literacy has become a fundamental competence that underpins educational quality, human resource development, and social participation. Contemporary education no longer positions teachers merely as transmitters of subject matter, but rather as facilitators who guide learners in accessing, interpreting, and using information critically across diverse contexts. Consequently, teachers are required to possess literacy competencies that exceed those of their students in order to design meaningful, relevant, and future-oriented learning experiences. However, empirical evidence suggests that not all teachers have attained adequate levels of basic literacy competence to meet these demands.

Improving the basic literacy skills of elementary school teachers, including reading and writing, numeracy, science, digital, financial, cultural, and civic literacy, is a strategic necessity to support 21st-century learning and respond to developments in information and communication technology (ICT). This urgency has been emphasized through various national policies, including the Minister of Education and Culture Regulation No. 23 of 2015 concerning Character Building and related regulations that emphasize the integration of literacy, numeracy, competence, and character in learning, which was then reinforced through the implementation of the National Literacy Movement (GLN) and the School Literacy Movement (GLS) as systematic efforts to build a culture of literacy in schools, families, and communities (Dayantri & Nasution, 2024; Hidayat & Kosasih, 2019; Ibda, 2018; Rakhmawati & Mustadi, 2022).

However, various studies show that the implementation of these policies still faces challenges in the field, such as uneven teacher literacy and numeracy skills, limitations in the development of literacy-based learning and

assessment, and low digital literacy due to a lack of training and supporting infrastructure, which has an impact on student literacy achievement as reflected in national and international assessment results (Dasan, 2025; Purwasih & Wahananto, 2022; Riyani & Purnamasari, 2024; Solih & Julianto, 2025). Therefore, the literature recommends various strategies to strengthen teacher competencies, including through continuous training in literacy, numeracy, and digital skills, the integration of technology and interactive learning media, cross-subject and professional community collaboration, and the development of Higher Order Thinking Skills (HOTS) and 21st-century skills (4C) based learning, which have been proven to contribute to improving the quality of learning and building a stronger school literacy ecosystem (Ibda, 2018; Mayudana & Sukendra, 2020).

Despite the implementation of various literacy policies and programs, literacy culture and reading engagement in Indonesia remain low, as reflected in UNESCO reports and international assessment results such as PISA, which consistently place Indonesia at the bottom in reading literacy skills (Ibda, 2018; Lewier & Da Costa, 2021; Ridlwan et al., 2022). UNESCO's reading interest index, which only reached 0.001, and the 2015 and 2018 PISA results show that the literacy skills of Indonesian students are generally still at a basic level, limited to simple information detection (Cahyani & Rasydah, 2020; Liestari, 2020). This condition has a systemic impact on the quality of learning and the development of 21st-century skills, placing elementary school teachers as key actors in strengthening literacy from an early age, even though they still face challenges in the form of limited training, less innovative learning methods, and gaps in infrastructure and digital literacy (Alamsyah et al., 2025; Asrul et al., 2023; Rusman et al., 2023).

From a pedagogical perspective, teachers' basic literacy competence is not limited to individual reading and writing skills. Rather, it represents a multidimensional construct that integrates professional knowledge, instructional practice, and ongoing professional development. Drawing on the framework of teacher competence, basic literacy competence can be categorized into three interrelated domains: (1) professional knowledge, which includes understanding and applying literacy strategies; (2) professional instructional practice, encompassing literacy-oriented teaching, assessment, mapping students' diverse reading and writing abilities, and managing literacy-rich learning environments; and (3) professional development, which involves teachers' continuous efforts to enhance their own literacy capacities. When these domains are adequately developed, teachers are better positioned to design adaptive learning pathways, conduct meaningful assessments, and foster students' literacy growth across contexts.

Previous empirical studies have indicated that many elementary school teachers still demonstrate limited literacy competence. Research on teachers' literacy awareness and literacy-based instruction has shown that only a small proportion of teachers achieve high literacy scores, while the majority remain at moderate or low levels. Other studies have emphasized the crucial role of teachers in school literacy movements, highlighting their functions as role models, motivators, facilitators, and creators of literacy-rich environments. Collectively, these findings suggest that teachers' literacy competence significantly influences students' literacy development, yet systematic evidence on the actual profile of teachers' basic literacy competence remains limited.

The issue of teachers' literacy competence becomes increasingly critical in peri-urban and buffer regions that experience rapid socio-economic and technological transformation. Kepanewonan Godean, Sleman, is one such area. Located adjacent to the city of Yogyakarta, Godean has undergone significant development driven by ICT advancement and increased access to higher education institutions. While this proximity offers strategic advantages, it also presents challenges related to information overload, digital exposure, and disparities in educational infrastructure. Elementary school teachers in this context are required to navigate complex literacy demands, including digital information management, communication skills, and the cultivation of lifelong learning dispositions among students. However, variations in teachers' backgrounds, access to resources, and professional support may result in uneven literacy competence across schools and communities.

In response to these conditions, there is a need for in-depth empirical inquiry that captures the actual profile of elementary school teachers' basic literacy competence and identifies factors that shape it. Most existing studies focus on literacy outcomes or intervention programs, while fewer investigations provide a contextualized portrait of teachers' literacy competence as a foundation for evidence-based policy and professional development planning. Addressing this gap is essential to ensure that subsequent training programs, community service initiatives, and educational interventions are aligned with real needs and contextual challenges.

Accordingly, this study aims to explore the basic literacy competence of elementary school teachers through a qualitative case study conducted in Kepanewonan Godean, Sleman. By examining teachers' professional knowledge, instructional practices, and professional development related to literacy, this research seeks to provide a comprehensive portrait of teachers' literacy competence in a strategically significant region. The findings are expected to contribute to the broader discourse on teacher literacy in basic education and to inform the design of more targeted and sustainable professional development initiatives in the era of digital transformation.

Throughout this introduction, arguments are grounded in prior empirical and theoretical studies on teacher literacy and digital competence. Research has highlighted persistent terminological and conceptual gaps between literacy, digital literacy, and information literacy (Manabat, 2021), as well as the urgent need to strengthen teachers' digital and information literacy in basic education (Fernández-Otoya et al., 2024; Jung et al., 2024).

Studies have further emphasized that rapid technological change requires teachers to continuously adapt their pedagogical and literacy competencies in order to support students' learning and well-being in digital environments (Díaz-Burgos et al., 2023; Weber et al., 2025). In addition, international evidence underscores the importance of developing teachers' literacy and digital competence as part of broader professional development strategies in both basic and higher education contexts (Wang & Zhang, 2025a). These studies collectively provide a conceptual foundation for examining basic literacy competence among elementary school teachers within specific local contexts, such as Kepanewonan Godean, Sleman.

Thus, strengthening the basic literacy skills of elementary school teachers is a strategic necessity for improving the quality of education and preparing students to face global challenges. Consistent policy support, ongoing training based on the real needs of teachers, and the integration of technology in learning are key to the successful implementation of literacy in elementary schools.

METHOD

This study employed a qualitative approach using a single-case study design to obtain an in-depth understanding of elementary school teachers' basic literacy competence within a specific real-life context, namely Kepanewonan Godean, Sleman Regency. The case study approach was selected because it enables a holistic exploration of the phenomenon by considering social conditions, educational policies, and instructional practices as they naturally occur in the field (Yin, 2018). This design is particularly appropriate for examining teachers' literacy competence as a complex phenomenon that is inseparable from the institutional and cultural contexts in which teachers perform their professional roles.

The study was conducted in several elementary schools located in Kepanewonan Godean, with elementary school teachers actively engaged in teaching serving as the primary participants. Participants were selected through purposive sampling, taking into account their involvement in instructional practices and school literacy activities. The timing of data collection was adjusted to the teachers' availability to ensure that data gathering occurred naturally without disrupting their professional responsibilities.

Research data were collected using a combination of Focus Group Discussions (FGDs), in-depth interviews, and document analysis. FGDs were employed to capture teachers' collective perspectives on their understanding, experiences, and challenges in developing and implementing basic literacy competence in classroom practice. In-depth interviews were conducted individually to obtain more reflective data regarding teachers' literacy competence, instructional strategies, and literacy assessment practices. In addition, documentation in the form of assessment records, activity reports, and relevant policy documents issued by the Sleman Regency Office of Education and Youth was used as supporting data to strengthen field findings. In this qualitative study, the researcher served as the primary research instrument, being directly involved in data collection, analysis, and interpretation, consistent with the characteristics of qualitative inquiry (Creswell & Poth, 2018).

Data analysis was conducted simultaneously and continuously using the interactive analysis model developed by Miles and Huberman (2009), which consists of data collection, data reduction, data display, and conclusion drawing and verification. Data reduction involved selecting relevant information, coding the data, and identifying patterns and themes representing teachers' basic literacy competence. The reduced data were then presented in narrative form and thematic matrices to facilitate interpretation and meaning-making. Conclusions were drawn gradually while maintaining a reflective and open stance toward the emergence of new insights throughout the analysis process.

Data trustworthiness was ensured through the application of source triangulation and method triangulation by comparing findings from FGDs, interviews, and documentation. In addition, an audit trail was maintained through discussions and reflective processes among the research team to ensure methodological consistency and rigor. To support transferability, the research context was described in sufficient detail to allow readers to assess the applicability of the findings to other elementary education contexts with similar characteristics (Guba & Lincoln, 1981).

RESULTS AND DISCUSSION

Results

This study involved 29 elementary school teachers from Kepanewonan Godean, Sleman Regency, comprising 23 female teachers and 7 male teachers, with teaching experience ranging from 2 to 20 years. All participants served as homeroom teachers from Grades 1 to 6 and were selected through purposive sampling to ensure representation of diverse grade levels and teaching experiences. Data collection was conducted in several stages, beginning with an open-ended questionnaire to capture teachers' initial perceptions and self-reported practices related to basic literacy competence. These preliminary data were subsequently elaborated and validated through a series of Focus Group Discussions (FGDs) and in-depth interviews, all of which were conducted at Madrasah

Ibtidaiyah Candran, Godean, providing a shared and familiar setting that facilitated open professional dialogue among participants.

The findings reveal that teachers' basic literacy competence can be systematically classified into three interrelated domains, namely professional knowledge, professional instructional practice, and the development of teachers' personal literacy skills, with varying levels of achievement observed across these domains. Overall, the distribution of competence indicates a stronger orientation toward conceptual understanding than toward reflective practice and sustained professional literacy development.

In the domain of professional knowledge related to literacy strategies, the majority of teachers demonstrated competence at the level of analysis and interpretation of students' reading and writing profiles. Specifically, 48% of teachers were able to analyze and interpret students' reading abilities across key components, including letter knowledge, phonemic awareness, reading fluency, vocabulary, and reading comprehension. In addition, these teachers demonstrated the ability to examine students' writing skills in terms of idea development, organization, mechanics, language use, and point of view, and to articulate the role of literacy-rich environments in supporting students' motivation to read and write. This group represents the largest proportion of participants and reflects a shift beyond basic descriptive understanding toward more analytical literacy awareness. However, only 14% of teachers reached the highest level of professional knowledge, characterized by the ability to evaluate literacy problems, formulate instructional solutions, and engage in systematic reflection on students' reading and writing difficulties. This disparity suggests that while conceptual literacy knowledge is relatively well established among many teachers, advanced reflective and problem-solving capacities remain limited to a small subset of practitioners.

With respect to professional instructional practice, particularly literacy-oriented teaching and assessment, notable variation was also observed. Approximately 38% of teachers reported developing instructional designs that considered students' learning characteristics and needs and applying both formative and summative literacy assessments on a regular basis. These teachers also demonstrated the use of multimodal learning media, adjusting instructional resources to align with students' reading levels and learning profiles. Nevertheless, a substantial proportion of teachers (31%) continued to rely on simplified instructional designs dominated by summative assessment, with limited differentiation or integration of literacy strategies. In addition, 14% of teachers reported using a single type of learning medium for all students regardless of individual differences. Only 14% of teachers explicitly integrated reading and writing strategies into instructional activities in a systematic and intentional manner, indicating that pedagogical integration of literacy has not yet become a dominant or widespread instructional practice.

Regarding the mapping of students' diverse reading and writing abilities, the findings indicate gradual progress toward more systematic assessment practices. The largest group of teachers (38%) conducted reading and writing profiling at multiple points during the academic year and implemented targeted follow-up interventions to support students' literacy development. Furthermore, 17% of teachers reported conducting regular, ongoing assessments and providing instructional adjustments based on students' individual literacy profiles. However, despite these positive practices, FGDs revealed that time constraints and dense instructional schedules were the primary barriers to conducting continuous and comprehensive literacy mapping. Teachers frequently cited competing curricular demands and administrative responsibilities as factors limiting sustained assessment efforts.

In terms of the management of literacy-rich learning environments, the findings show that 38% of teachers had adjusted classroom layouts and provided literacy-supporting facilities, such as reading corners and supplementary books. However, literacy activities—particularly reading—were often implemented on an incidental rather than systematic basis. Only 10% of teachers reported achieving an optimal level of literacy environment management, characterized by scheduled reading activities, deliberate selection of enrichment texts, and active involvement of students, parents, and the broader school community. These results indicate that literacy environment management remains largely classroom-centered and has not yet evolved into a collaborative, school-wide literacy ecosystem.

Finally, in the domain of teachers' personal literacy skill development, the findings reveal relatively limited engagement beyond formal participation. While 38% of teachers reported membership and participation in professional forums or teacher associations, such participation was primarily confined to attending seminars, workshops, and training programs as participants. Teachers who demonstrated active engagement in reading professional literature, writing reflective or scholarly texts, and disseminating best instructional practices or research findings accounted for only 3% of participants. This finding suggests that professional literacy culture among teachers remains underdeveloped and continues to rely heavily on institutional or structural initiatives, rather than emerging as an internally sustained professional practice.

Discussion

The findings of this study indicate that elementary school teachers' basic literacy competence in Kepanewonan Godean is situated at a moderate level, with a stronger emphasis on professional knowledge than on instructional practice and professional self-development. This imbalance reflects a persistent gap between conceptual

understanding and pedagogical enactment of literacy, a phenomenon that has been widely reported in studies of teacher literacy within elementary education contexts. While teachers generally demonstrate awareness of literacy concepts and frameworks, the translation of such knowledge into sustained instructional practices and reflective professional behavior remains limited. This finding reinforces earlier research suggesting that literacy competence is not solely a matter of knowledge acquisition, but also of pedagogical habit formation and institutional support structures.

The predominance of teachers operating at the level of analysis and interpretation of students' literacy profiles (48%) suggests that many teachers have moved beyond purely traditional, transmission-oriented instruction. Teachers in this category demonstrate the capacity to recognize variations in students' reading and writing abilities and to articulate literacy-related challenges with a degree of analytical sophistication. However, the relatively small proportion of teachers capable of critical reflection and solution formulation (14%) indicates that higher-order pedagogical literacy has not yet been internalized as a dominant professional competence. This gap highlights the need for literacy pedagogy that explicitly foregrounds reflective practice and instructional decision-making, rather than focusing primarily on diagnostic skills. In digitally mediated learning environments, such pedagogical competence becomes increasingly important, as teachers are expected to design adaptive instructional strategies, including multimodal learning and flipped classroom approaches, that promote students' autonomy, engagement, and self-regulated learning (Wang & Zhang, 2025).

In relation to literacy assessment, the continued reliance on summative assessment practices among the majority of teachers reflects limited integration of literacy within digitally enriched instructional contexts. This finding aligns with previous studies showing that assessment practices often lag behind curricular and pedagogical reforms. In contrast, formative and multimodal literacy assessment has been identified as a critical mechanism for fostering sustained reading and writing development, particularly when aligned with digital tools that support feedback, monitoring, and differentiation. International assessment frameworks such as PISA emphasize literacy as a multidimensional construct encompassing access to information, effective use of texts, and ICT competence across reading, science, and mathematics domains (Çelik et al., 2024). Consequently, strengthening teachers' digital pedagogical competence is not merely a technical requirement, but a strategic necessity for transforming assessment practices from evaluative routines into instruments of learning enhancement (Bentri & Hidayati, 2023).

The positive trend observed in teachers' ability to map the diversity of students' reading and writing abilities, particularly through systematic reading and writing profiling, indicates growing awareness of differentiated instruction. However, the persistence of time constraints and administrative workload as major barriers underscores structural challenges that cannot be addressed solely through individual teacher capacity building. This finding suggests the need for curricular and organizational reform, particularly within pre-service teacher education programs, to integrate literacy assessment and digital competence as core professional skills rather than supplementary components. As emphasized by Dolezal et al. (2025), teacher education curricula must adopt a more holistic approach that aligns literacy pedagogy, assessment literacy, and digital competence to prepare future teachers for complex classroom realities.

With regard to the management of literacy-rich learning environments, the findings reveal that literacy remains predominantly conceptualized as a physical and classroom-centered practice, with limited extension into broader school or community contexts. The minimal involvement of parents and community stakeholders indicates that literacy has not yet been positioned as a sustainable social ecosystem. Previous studies emphasize that both physical and digital literacy environments are shaped by institutional structures, leadership practices, and policy alignment, all of which require systematic direction and long-term commitment (Jung et al., 2024; Weber et al., 2025). Without such systemic support, classroom-level literacy initiatives risk remaining fragmented and episodic.

The very low proportion of teachers actively engaged in reading, writing, and sharing professional knowledge (3%) further illustrates that professional literacy has not yet evolved into a cultural norm within the teaching profession. This condition reflects the interplay of economic constraints, employment status, motivational factors, and organizational culture, which collectively influence teachers' capacity and willingness to invest in sustained professional development. In the digital era, however, teachers' participation in online learning communities, knowledge production, and reflective professional discourse is increasingly recognized as a prerequisite for sustainable professional growth and instructional innovation (Rahma et al., 2024). The absence of such engagement risks perpetuating a cycle in which professional learning remains externally driven rather than internally sustained.

From a broader perspective, the findings of this study emphasize that strengthening teachers' basic literacy competence requires a systemic and multi-level approach. Such an approach should integrate practice-based professional development, supportive school ecosystems, strategic technology integration, and the cultivation of a sustainable professional literacy culture among teachers. At the policy level, these findings suggest the importance of aligning literacy initiatives with workload management, incentive systems, and school leadership practices. At the institutional level, schools should foster collaborative literacy practices that extend beyond classrooms and engage families and communities. At the individual level, teachers should be supported in

developing reflective and generative literacy practices that position them not only as literacy instructors, but also as lifelong learners and knowledge producers.

Finally, this study opens several avenues for future research. Subsequent studies could employ longitudinal designs to examine the development of teachers' literacy competence over time and to assess the long-term impact of targeted professional development interventions. Comparative studies across regions or school types would also provide deeper insights into contextual factors shaping literacy competence. In addition, future research may integrate quantitative or mixed-method approaches to examine relationships between teachers' literacy competence, instructional quality, and student learning outcomes. Such investigations would further strengthen the empirical foundation for evidence-based literacy policy and practice in elementary education.

CONCLUSION

This study concludes that elementary school teachers' basic literacy competence in Kepanewonan Godean is generally at a moderate level, with professional knowledge more strongly developed than instructional practice and professional literacy self-development. While many teachers demonstrate adequate capacity to analyze students' reading and writing profiles, the translation of this knowledge into reflective, problem-solving-oriented literacy instruction and formative assessment remains limited. These findings indicate a persistent gap between conceptual literacy understanding and pedagogical implementation, influenced by structural constraints, digital pedagogical readiness, and limited professional literacy culture. Overall, the study emphasizes that strengthening teachers' basic literacy competence requires a systemic approach that integrates practice-based professional development, supportive school ecosystems, meaningful technology integration, and the cultivation of sustainable professional literacy practices to enhance the quality of elementary education.

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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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DEVELOPMENT OF SOCIO-EMOTIONAL MODULE BASED ON LOCAL WISDOM OF MAJA LABO DAHU WITH AUGMENTED REALITY (AR) TECHNOLOGY APPROACH

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Abstract. Social-emotional learning (SEL) plays a crucial role in shaping students' character; however, SEL models adopted from global frameworks are often less contextualized to local cultural values. This study aimed to develop a Social-Emotional Learning (SEL) teaching module based on the local wisdom of Maja Labo Dahu, integrated with Augmented Reality (AR) technology, to support more contextual and meaningful learning in elementary schools. The study employed a Research and Development (R&D) approach using the ADDIE model, covering the analysis, design, development, implementation, and evaluation stages. Needs analysis conducted in two elementary schools in Bima City indicated high teacher and student interest in AR-based learning (mean = 3.95) and a strong need for SEL-specific modules (mean = 3.90), while emotional regulation emerged as the main challenge (mean = 3.15). The developed module was validated by material experts, media experts, and educational practitioners, yielding very high feasibility scores: 96% for material validity, 81.9% for media validity, and 90% for practitioner validation, indicating that the module was highly feasible for use after minor revisions. Practicality testing through small-group and field trials showed very high practicality, with mean scores of 4.17 and 4.43, respectively. Effectiveness testing using a pretest–posttest design revealed significant improvement in students' social-emotional competencies, with N-Gain scores of 0.62 (effective) in the initial trial and 0.74 (highly effective) in the extended field trial. Overall, the findings demonstrate that the SEL-MLD-AR module is feasible, practical, and effective in enhancing elementary students' social-emotional skills through the integration of local cultural values and interactive AR technology.

Keywords: Learning Module; Social-Emotional Learning; Local Wisdom; Maja Labo Dahu; Augmented Reality.

INTRODUCTION

Social-emotional learning (SEL) is one of the pillars of student character building in the 21st century education era (Brush et al., 2022; Richard, 2022). SEL education helps students manage emotions, improve social skills, and build positive relationships with peers and the community (Millán Franco et al., 2021; Molyneux et al., 2023). However, in Indonesia, the implementation of SEL still faces various challenges, especially in integrating local cultural contexts that are rich and relevant to student character. The results of a survey conducted by Badan Penelitian dan Pengembangan Kementerian Pendidikan dan Kebudayaan (2022), showed that as many as 33% of students in several Indonesian provinces had report card scores below 6.0 and experienced emotional and behavioral disorders. A similar study by the National Adolescent Mental Health Survey (I-NAMHS, 2022) found that one in three Indonesian adolescents aged 10-17 years experienced mental health problems. This indicates the importance of strengthening character education and social-emotional competence among students to overcome these problems.

SEL programs adopted in Indonesia mostly refer to Western approaches, which are not yet fully compatible with Indonesia's cultural context and local values. Therefore, there is an urgent need to develop more contextualized SEL learning, which not only teaches social- emotional skills but also integrates local cultural values relevant to students' lives (Fadhil et al., 2023; Andriani et al., 2024). Research on SEL in Indonesia is still largely limited to the application of global frameworks that focus more on cognitive and emotional aspects, such as those developed by CASEL (Collaborative for Academic, Social, and Emotional Learning) (CASEL, 2003). Although these SEL programs have proven to be effective in improving students' social and emotional competencies, much of the literature suggests that the implementation of SEL in Indonesia is still hampered by the mismatch between global approaches and local cultural values (Sandilos et al., 2023; Gidalevich & Mirkin, 2024).

Indonesia has a wealth of local wisdom that can be used as a basis for character education (Sartono et al., 2021; Sartono et al., 2024). One of them is the Maja Labo Dahu philosophy from the Bima community, which teaches about the shame of doing wrong and the importance of following social norms as moral principles (Mustamin, 2018; Sina et al., 2023). Despite having great potential to enrich character education, this value has

not been integrated in the formal learning system, especially at the basic education level. In addition, technology has brought great changes in the world of education, with various innovative approaches that utilize interactive technology, one of which is Augmented Reality (AR). AR technology has been proven effective in increasing learning motivation and student engagement, especially in subjects that require visualization of abstract concepts, such as science. However, the utilization of AR in character education and local cultural values in Indonesia is still very limited (Lampropoulos et al., 2022; Roopa et al., 2021). Some studies show that AR can be used to explore social-emotional values, but there are no studies that combine AR with local cultural values in character learning (Hidayat et al., 2021; Sudrajat et al., 2024).

Although AR has been used in learning in various fields, its application in character education and integration of local cultural values is still very limited. So far, most existing research only examines the use of AR for more technical or scientific materials, such as geometry or anatomy (Ariani et al., 2022; Sudrajat et al., 2024). There is no research that combines AR with the concept of character education based on Indonesian local wisdom, especially in the context of SEL. Therefore, this research focuses on the existing gap, by developing an SEL teaching module based on the local wisdom of Maja Labo Dahu that uses AR interactive technology to improve students' understanding of social-emotional values and their application in daily life.

This research has novelty in three aspects that have never been combined in one educational platform before, namely from conceptual, contextual and technological aspects. The first conceptual aspect integrates the local wisdom value of Maja Labo Dahu with social- emotional learning, something that has not been done much in character education in Indonesia. This module will adopt the moral and ethical principles of Maja Labo Dahu as the basis for strengthening students' social-emotional character, which is based on the values of honesty, courage, and sense of responsibility. Second, from the contextual aspect, it provides a more contextualized and down-to-earth educational approach by integrating local values in social- emotional learning. With this, students not only learn about universal social-emotional competencies, but also how the local cultural values around them can shape their character and social interactions. Technological: Using Augmented Reality (AR) technology in character learning, which has not been widely used to teach cultural values and social-emotional competencies. AR will be used as a tool that allows students to interact with simulations depicting social dilemmas, conflicts, and solutions based on local cultural values, providing an immersive and reflective experience.

This research aims to develop an SEL teaching module based on the local wisdom of Maja Labo Dahu with an Augmented Reality (AR) interactive technology approach. This module will be designed to help students manage emotions, improve social relationships, and understand and apply local cultural values in their daily lives. By utilizing AR technology, this module is expected to increase students' engagement in social-emotional learning that is more contextual and meaningful. This research is expected to make a major contribution in the development of character learning that is more relevant to the Indonesian cultural context. By integrating AR technology and local cultural values, this research can be an innovative model for character education at the primary level. In addition, this research also has the potential to enrich the literature of character education and educational technology in Indonesia, as well as having a positive impact on social-emotional education in elementary schools.

METHOD

This study employed a Research and Development (R&D) approach using the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. In contrast to the initial design that focused only on the early stages, this research was conducted through all ADDIE stages, culminating in practicality and effectiveness testing to ensure that the developed module was not only valid in theory but also usable and effective in real classroom contexts.

1. Analysis

The analysis stage aimed to identify the needs and challenges related to social- emotional learning in elementary schools. Data were collected through interviews and needs- analysis questionnaires administered to teachers and students in two elementary schools in Bima City. The findings revealed a strong need for SEL-specific teaching modules that integrate local cultural values and interactive technology. Teachers and students expressed high interest in Augmented Reality (AR)-based learning, while emotional regulation was identified as a major challenge in current SEL practices.

2. Design

At the design stage, the structure and components of the SEL-MLD-AR teaching module were developed. The module design included the Pancasila learner profile, learning outcomes, social-emotional learning materials, learning activities, student worksheets, assessment components, and the integration of Augmented Reality (AR) media. The design was adapted to the characteristics of fifth-grade elementary school students (Phase C) and emphasized the integration of local wisdom values of Maja Labo Dahu. The module was organized in A4 format with an attractive layout, clear typography, and visual elements to enhance student motivation and engagement.

3. Development

The development stage involved producing the initial version of the SEL-MLD-AR teaching module, followed by expert validation and revision. The module was validated by two expert validators (material and media experts) and one educational practitioner to assess content feasibility, media quality, clarity of instructions, and usability in elementary school learning contexts. Feedback from the validators was used to revise and refine the module prior to classroom implementation.

4. Implementation

The implementation stage consisted of try-outs of the revised module in elementary school classrooms. The module was implemented through a small-group trial followed by a wider field trial, involving teachers and fifth-grade students. This stage aimed to examine the practicality of the module, focusing on ease of use, clarity of learning procedures, student engagement, and the feasibility of integrating AR into classroom activities. Data were collected through observation, teacher and student questionnaires, and field notes.

5. Evaluation

The evaluation stage aimed to assess the effectiveness of the SEL-MLD-AR module in improving students' social-emotional competencies. A pretest–posttest design was employed to measure changes in students' social-emotional skills before and after the implementation of the module. Learning gains were analyzed using the Normalized Gain (N-Gain) score to determine the level of effectiveness. In addition, formative evaluation was conducted throughout the implementation process to identify areas for improvement and to ensure the module functioned effectively in real learning environments.

Instruments and Data Analysis

Techniques The assessment was carried out using a Likert scale-based validation sheet with five assessment categories. The validation result score was calculated using the formula:

$$\text{Percentage Kevalidan} = \frac{Total, Score, which, Obtained}{Number, Score, Highest} \text{ x } 100\ \%$$

Table 1. Criteria for the Kevalidan Module

Criteria	Percentage Range
Not Valid	0% – 20%
Kurang Valid	21% – 40%
Sufficiently Valid	41% – 60%
Valid	61% – 80%
Very Valid	81% – 100%

The SEL-MLD-AR teaching module was declared theoretically feasible if it obtained a validity score above 61%. The validation data was analysed descriptively quantitatively to determine the feasibility level of the module, while the qualitative input from the validators was used as the basis for revising the product before the implementation test was carried out in the next research stage.

This research was conducted in several primary schools in Bima City in the odd semester of the 2024/2025 academic year, with the data collection process carried out in May- Desember 2025.

RESULTS AND DISCUSSION
RESULT

1. Analysis Stage

The initial stage of this research began with a needs analysis conducted in two primary schools in Bima City. Data collection was conducted through interviews with teachers as well as distributing questionnaires to teachers and students to identify problems faced in the implementation of social-emotional learning in schools. The results of interviews with teachers show that social-emotional learning based on the CASEL Five-Dimensional framework has not been fully understood and applied operationally by students in the classroom. Teachers revealed that despite efforts to teach social-emotional values, many students have difficulties in understanding

and applying these concepts in real situations. This indicates the need for more contextualised learning, which integrates local wisdom values that are closer to students' daily lives and experiences.

Based on the results of the descriptive analysis of the teacher questionnaire, the overall average score of the indicators was 3.54. The indicator with the highest score was "teachers' willingness to use AR-based modules" with an average of 3.95, indicating strong support for the development of technology-based SEL modules. In contrast, the indicator with the lowest score is "students have difficulty controlling their emotions" with an average of 3.15, indicating that the aspect of emotional control still requires further strengthening and development in the learning module design. The data from this questionnaire is presented in the following table to provide a comprehensive picture of teachers' needs and readiness for the implementation of social-emotional teaching modules.

Table 1. Results of Teacher Needs Analysis of SEL-MLD-AR Module Development

Indicator	Average	Standar Deviasi
Students find it difficult to control their emotions	3.15	1.14
Students often have conflicts with peers	3.5	1.05
Learning still lacks SEL development	3.45	1.15
Need a specialised SEL module	3.9	1.17
Local cultural values are important to integrate	3.7	1.03
There is no Maja Labo Dahu teaching material yet	3.5	1.24
Ever used digital media/AR	3.4	0.94
Digital media aids SEL comprehension	3.55	1.1
Willing to use AR modules	3.95	1.19
Will input SEL module	3.25	1.12

Source: Researcher Processed Data 2025

Overall, the results showed that teachers have positive perceptions and a high level of readiness in implementing the Social-Emotional Learning (SEL) learning module that integrates local cultural values of Maja Labo Dahu with the support of Augmented Reality

(AR) based interactive technology.

In addition, the results of interviews with students also reflected that although they understand the basic concepts in social-emotional learning, they more easily remember and respond to learning that is linked to local cultural values that they are familiar with. Students also expressed interest in the use of digital media, especially media that can enable interaction and visualisation through Augmented Reality (AR). The results of these interviews reinforce the importance of developing teaching modules that integrate digital technology and local cultural values, as a way to improve students' understanding and engagement in social- emotional learning.

Similar findings were also obtained from questionnaires completed by 30 students from three primary schools in Bima City, which provided an overview of the students' socio- emotional condition, understanding of the local cultural value of Maja Labo Dahu, and their interest in interactive technology-based learning. Based on the descriptive analysis, it is known that most of the indicators obtained an average score above 3, which is categorised as high. This indicates that students have a positive level of readiness and interest in social-emotional learning. Details of the analysis results are presented in the following table:

Table 2. Results of Analysis of Students' Needs for Social-Emotional Learning

Indicator	Average	Standar Deviasi
Difficult to control emotions	3.47	1.01
Recognising strengths and weaknesses	3.53	1.11

Trying to stay calm when things go wrong	3.5	1.14
Easily make new friends	3.63	1.19
Apologise when wrong	3.63	1.03
Dare to speak the truth	3.23	1.1
Knowing the meaning of Maja Labo Dahu	3.13	1.11
Implementing Maja Labo Dahu	3.67	1.03
Enjoy learning with digital media	3.3	0.95
Interesting media makes you excited to learn	3.43	0.9

Source: Researcher Processed Data 2025

Based on the data in the table, the indicator with the highest score is in the aspect of applying Maja Labo Dahu values in daily life with an average ranging from 3.6 to 3.7. This finding shows that students have been able to internalise local cultural values in their behaviour and social interactions. In contrast, the indicator with the lowest score was in the aspect of understanding the meaning of Maja Labo Dahu with an average of around 3.1, which indicates a gap between conceptual understanding and application of local cultural values in the context of daily life. In addition, students showed high enthusiasm for digital-based learning, as reflected in the average score of around 3.5 on the indicator of interest in learning using digital media/AR and the perception of the attractiveness of media that increases the spirit of learning. This result confirms that the utilisation of technology-based interactive media can significantly contribute to improving students' learning motivation and engagement in the social-emotional learning process.

2. Design Stage

At the design stage, the development of the SEL-MLD-AR teaching module was carried out based on the results of the needs analysis that had been obtained at the previous stage. This stage aims to produce an initial design of the Maja Labo Dahu value-based social-emotional learning module integrated with Augmented Reality (AR) interactive media. The design process includes media selection, writing format, learning model, as well as the design of learning activities that are aligned with the characteristics and cognitive development of elementary school students in Phase C.

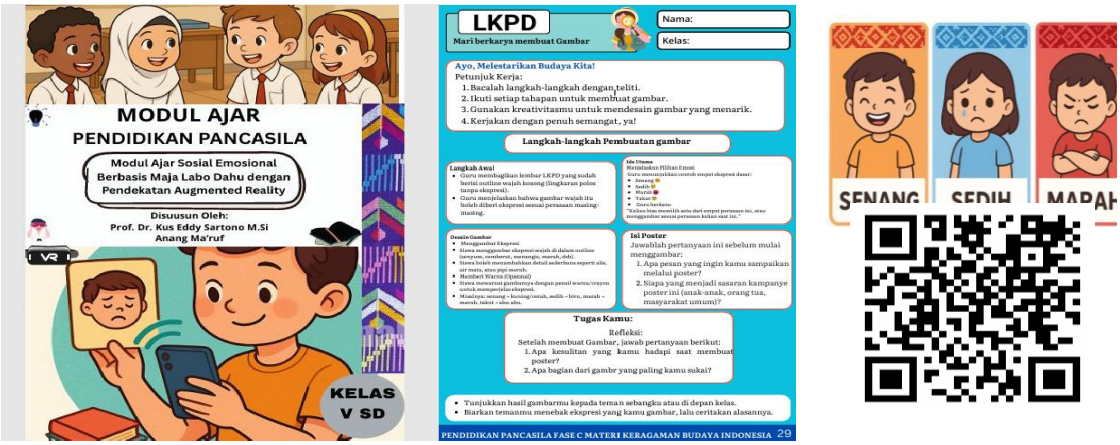
In addition, visual aspects such as layout, colours, and image illustrations are designed to be attractive and motivate students to actively participate in learning. The language used in the module is also adjusted to the level of understanding of phase C students. This teaching module is designed to be printed in A4 vertical format using 80 gram HVS paper, with adjustments to the font size and type to distinguish between the title, content, and activity components such as Learner Worksheets (LKPD) and supporting handouts. The material developed in this module focuses on the topic of Neighbourhood Cultural Diversity which is part of the Pancasila subject for class V Phase C elementary school.

The SEL-MLD-AR teaching module is designed comprehensively by including various important learning components, including module identity, Pancasila learner profile, learning outcomes, learner worksheets (LKPD), pretest and evaluation questions, answer keys, and supporting reading materials. The main component of this module is Augmented Reality (AR)- based interactive media, which can be accessed by learners through their smartphones by scanning the Quick Response (QR) code provided in each section of the module. In addition, the module is also equipped with an assessment instrument for learner worksheets and a glossary of terms to support a thorough understanding of concepts.

As an example of the SEL-MLD-AR module design, the following images illustrate the main components of the developed module. The first picture shows the cover of the module that displays the full title of the module as well as a visualisation of the theme that illustrates the integration between socio-emotional values, local culture of Maja Labo Dahu, and the use of AR technology. The cover design is designed to attract students' interest and illustrate the essence of local wisdom-based learning combined with interactive technology.

The second picture shows a Learner Worksheet (LKPD) that contains interactive tasks to help understand social-emotional concepts, connect learning with real life, and invite students to apply social-emotional values. The third picture shows an AR QR Code that students can scan to access Augmented Reality-based interactive content, facilitating visual and immersive understanding of social-emotional concepts.

The following are some of the design images of the SEL-MLD-AR module, including the cover, LKPD, and QR Code AR;



SEL-MLD-AR Module Design Picture

The SEL-MLD-AR teaching module serves as the main guide for teachers strengthening Social-Emotional competencies based on Local Wisdom. This module is titled "Social-Emotional Module Based on Local Wisdom Maja Labo Dahu with Augmented Reality (AR) Approach", which is intended for grade V phase C primary school students. The module cover design features a visual representation of the three main components developed, namely social-emotional competence, Maja Labo Dahu local wisdom values, and Augmented Reality (AR) interactive technology, which symbolically illustrates the integration between the dimensions of character, culture, and technology.

3. Development Stage

The teaching module that has been developed then enters the validation stage in the development phase (Develop) to ensure the feasibility of the content, appearance, and usability of the module in the learning context. The validation process was carried out by two expert validators, consisting of material experts and media experts, and one educational practitioner. The material expert validators assessed the integration of learning objectives, content, and socio-emotional values based on the local wisdom of Maja Labo Dahu. Media expert validators assessed the technical aspects, visual appearance, interactivity, and suitability of using Augmented Reality (AR) technology. Meanwhile, education practitioners provided input related to the practicality and implementation of the module in the primary school environment, including ease of use by teachers and the level of student engagement during the learning process.

Table 4. Validation Result

Aspek Validation	Presentase	Kategori
Expert Validation of SEL-MLD Material	96%	Very Valid
Media Expert Validation (AR)	81,9%	Very Valid
Validasi Practitioner	90%	Very Valid

Source: Researcher Processed Data (2025)

Based on the validation results presented in Table 4, it was found that the assessment from the material expert showed a percentage score of 96%, which is included in the very valid category. This assessment was conducted on 20 August 2025. The material expert validator recommended that the SEL-MLD-AR teaching module be tested in the field to determine the impact of its implementation and effectiveness on students' social-emotional learning process. Furthermore, the validation results from media experts showed a percentage score of 81.9%, which was also classified as very valid. This validation process was conducted on 25 August 2025. The input given by the media experts included the addition of a more detailed Augmented Reality (AR) usage guide at the beginning of the module so that teachers and students can understand the usage steps without requiring intensive assistance. In

addition, the validator also recommended improving the stability and loading time of the AR application, especially on devices with low specifications, so that the module can be used optimally in schools with limited facilities.

The results of validation by educational practitioners showed a percentage score of 90% with a very valid category. This assessment was conducted on 29 August 2025. Practitioner validators provide input so that classroom management is more adapted to the flow of learning activities that have been designed in the module, so that learning implementation can take place more effectively and interactively.

Based on the validation results conducted by material experts, media experts, and educational practitioners, it can be concluded that the developed SEL-MLD-AR teaching module shows high validity and is suitable for use in social-emotional learning. The material expert validators gave a positive assessment of the suitability of the content with the learning objectives as well as the integration of Maja Labo Dahu local wisdom values in social-emotional learning. Media expert validators rated the module as highly valid in terms of visual design and the use of Augmented Reality (AR) technology that can increase student interactivity. Education practitioners provided input related to classroom management, which is important to be implemented so that the module can run effectively in the field.

The results of this validation indicate that this teaching module has great potential to improve students' understanding and application of social-emotional values, and can be implemented well using AR-based digital media. Furthermore, although this module has been declared valid and feasible, some revisions and strengthening are still needed in the aspects of managing students' emotions and material integration so that this module can be more optimally used in the context of learning in elementary schools.

4. Practicality Test of the SEL-MLD-AR Module

The practicality of the SEL-MLD-AR module was evaluated through a small-group trial and a wider field trial involving elementary school teachers and students. The assessment aimed to determine the ease of use, clarity of learning instructions, attractiveness of learning activities, and feasibility of implementing the module in real classroom contexts. The quantitative results of the practicality test are presented in Table 5.

Table 5. Practicality Test Results of the SEL-MLD-AR Module

Trial Stage	Mean Score	Category
Small Group Trial	4.17	Very Practical
Field Trial (Wider Use)	4.43	Very Practical

The data in Table 5 show that the SEL-MLD-AR module achieved a mean score of 4.17 in the small-group trial, indicating that the module was already highly practical at the initial implementation stage. After minor revisions and broader application, the mean score increased to 4.43 in the field trial, which further confirms the module's very high level of practicality.

The high practicality scores obtained in both trial stages indicate that the SEL-MLD- AR module can be effectively used by teachers and students without major obstacles. The increase in the mean score from the small-group trial to the wider field trial suggests that the module became easier to use and more acceptable after refinement, which is a key indicator of successful product development in R&D-based educational research.

From the teachers' perspective, the module was considered practical because it provided a clear learning structure, systematic activity sequences, and explicit guidance for integrating Augmented Reality (AR) into classroom instruction. Teachers reported that the module did not require complex preparation and could be implemented within the existing learning schedule. This practicality is crucial in elementary school contexts, where teachers often face time constraints and diverse student needs.

From the students' perspective, the module's practicality was reflected in their positive engagement and ease of interaction with the learning materials. The AR features helped students visualize social-emotional situations and cultural values related to the Maja Labo Dahu philosophy, making abstract concepts more concrete and easier to understand. As a result, students were able to follow learning instructions independently and participate actively in discussions and reflective activities.

The integration of local wisdom also played a significant role in enhancing the module's practicality. By embedding familiar cultural values into learning activities, the module reduced cognitive load and increased students' sense of relevance and connection to the material. This contextual design contributed to smoother classroom implementation and stronger student responses, which is consistent with the high practicality scores observed in the field trial.

Overall, the findings presented in Table 5 demonstrate that the SEL-MLD-AR module is not only theoretically valid but also highly practical for real classroom use. The consistently high scores across both trial stages indicate that the module meets the practical requirements of elementary school learning environments and provides a strong foundation for further large- scale implementation and effectiveness testing.

5. Effectiveness Test of the SEL-MLD-AR Module

The effectiveness of the SEL-MLD-AR module was examined to determine its impact on students' social-emotional competencies after implementation. Effectiveness testing is a critical stage in research and development studies, as it provides empirical evidence that a learning product not only functions well in practice but also produces meaningful learning outcomes. In this study, effectiveness was measured using a pretest–posttest design, focusing on students' social-emotional competencies aligned with the SEL framework.

The improvement in students' social-emotional skills was analyzed using the Normalized Gain (N-Gain) score, which indicates the magnitude of learning improvement after the intervention. The results of the effectiveness test are presented in Table 6.

Table 6. Effectiveness Test Results of the SEL-MLD-AR Module

Trial Stage	N-Gain Score	Effectiveness Category
Initial Trial	0.62	Effective
Extended Field Trial	0.74	Highly Effective

Source: Researcher Processed Data (2025)

The data in Table 6 indicate that the SEL-MLD-AR module produced a substantial improvement in students' social-emotional competencies. In the initial trial, the N-Gain score of 0.62 falls within the effective category, suggesting that the module had a meaningful impact on students' ability to understand and apply social-emotional skills. In the extended field trial, the N-Gain score increased to 0.74, which is categorized as highly effective, demonstrating stronger learning gains after broader implementation and refinement of the module.

The effectiveness results demonstrate that the SEL-MLD-AR module significantly contributes to the improvement of students' social-emotional competencies. The increase in N- Gain scores from the initial trial to the extended field trial suggests that the module became more effective as it was implemented in a wider learning context. This finding indicates that the combination of structured learning activities, contextual cultural content, and interactive AR features creates a learning environment that supports deeper social-emotional development.

One important factor contributing to the effectiveness of the module is the integration of local wisdom values of Maja Labo Dahu into social-emotional learning activities. By grounding SEL concepts in familiar cultural norms and moral principles, students were able to relate abstract competencies such as emotional regulation, empathy, and responsible decision- making to real-life situations they encounter in their daily environment. This cultural relevance strengthens internalization processes and enhances learning outcomes, as reflected in the high N-Gain scores.

In addition, the use of Augmented Reality (AR) played a significant role in enhancing the effectiveness of the module. AR-based simulations and visualizations enabled students to observe and experience social situations, emotional expressions, and moral dilemmas in an immersive and engaging manner. This experiential learning approach helped students better understand the consequences of social-emotional decisions and supported the development of reflective thinking. The interactive nature of AR also increased students' attention and motivation, which are essential factors for achieving meaningful learning gains.

The improvement in effectiveness during the extended field trial further indicates that the module is adaptable to real classroom conditions. Teachers reported that students became more confident in expressing emotions, managing interpersonal interactions, and applying social-emotional values during learning activities. These qualitative observations align with the quantitative N-Gain results, reinforcing the conclusion that the SEL-MLD-AR module effectively supports social-emotional learning in elementary school settings.

Overall, the findings of the effectiveness test confirm that the SEL-MLD-AR module is not only valid and practical but also effective in improving students' social-emotional competencies. The consistent increase in learning gains across trial stages provides strong empirical support for the module's potential to be implemented on a larger scale. These results position the SEL-MLD-AR module as a promising instructional innovation that integrates local cultural wisdom and interactive technology to enhance social-emotional learning outcomes in primary education.

DISCUSSION

This research aims to develop SEL-MLD-AR teaching modules that integrate Maja Labo Dahu local wisdom values and Augmented Reality (AR) technology in social-emotional learning in elementary schools. The validation results obtained show that this teaching module is valid and feasible to use, with positive assessments

from material experts, media experts, and educational practitioners. However, although this module has been declared valid, some challenges and needs for further development are still identified.

The results of this study are in line with previous research that shows the importance of technology integration in social-emotional learning. For example, Dargan et al., (2023) Al- Ansi et al., (2023), found that the use of AR technology in learning can increase student engagement and deepen concept understanding visually and interactively. Likewise, research by Thresia et al., (2024) Prihatmojo et al., (2024), revealed that the value of local culture in learning can strengthen students' connection to the material being taught, which is similar to the approach adopted in this teaching modul.

A more significant finding in this study is the existence of gaps in students' emotion management, which reflects the common challenges found in other studies as suggested by Moncada, (2022) Carvalho-Simões, (2022) Richard, (2022), which shows that emotion management is often forgotten in social-emotional learning, even though it is very important for students' character development. Based on the module validation results, it was found that the indicator with the highest score was teachers' willingness to use AR-based modules, with an average score of 3.95. This shows that teachers strongly support the use of AR technology in social-emotional learning, which is in line with research by Shanmugasundaram & Tamilarasu, (2023) yang mencatat bahwa media digital dapat meningkatkan motivasi siswa dan mempermudah pemahaman materi.

There are challenges in the management of students' emotions, with the indicator "students find it difficult to control their emotions" obtaining a score of 3.15, which indicates that the aspect of emotional management still needs to be strengthened in the design of this module. This is in accordance with the findings of Azagra, (2019) Rkioua, (2022), which states that the lack of learning about emotion management can be an obstacle in achieving optimal social-emotional learning goals. Therefore, the addition of more specific emotional management material is needed in the developed teaching module. In addition, the results of the student needs analysis show that students have a high interest in AR media, with an average score of 3.43 on the indicator "interesting media makes the spirit of learning". This finding supports the theory expressed by Yun et al., (2023), that AR technology can increase student engagement and create a more interactive and fun learning experience.

Based on the results of validation and needs analysis, the developed SEL-MLD-AR teaching module has great potential to be used in social-emotional learning in primary schools, with the use of AR technology that can increase student engagement. However, the management of students' emotions is an area that needs more attention in the further development of the module. Material modifications that focus more on emotion management strategies and the application of local cultural values can further enrich students' learning experience and strengthen their social-emotional skills.

The developed SEL-MLD-AR teaching module was declared valid and feasible to use after going through a validation stage involving material experts, media experts, and educational practitioners. The findings of this study indicate that this module has great potential to improve social-emotional learning by integrating AR technology and local cultural values. However, the aspect of managing students' emotions needs to be further strengthened in the module design. The next research will enter the implementation and evaluation stage, to test the practicality of the module in the field as well as its effectiveness in improving students' social-emotional skills.

CONCLUSION AND FUTURE RESEARCH PLAN

Based on the validation results that have been carried out at the development stage, the SEL-MLD-AR teaching module developed is declared valid and suitable for use in social- emotional learning at the primary school level. Validation involving material experts, media experts, and educational practitioners showed that this module has good quality in terms of content and media design, as well as suitability to learning objectives. Although this module has been declared valid, this research has not yet included a wider field trial, which will be conducted at the implementation and evaluation stage in the next research.

1. Implementation Stage

In the implementation stage, the developed SEL-MLD-AR teaching module will be piloted in primary schools in Bima City to assess its practicality and effectiveness in the context of social-emotional learning. This trial will involve grade V students as the main subjects, with the classroom teacher acting as the facilitator who will use this module in the learning process. The assessment at this stage aims to understand how the module can be practically applied in the classroom and how effective it is in supporting the learning process.

The trial will be conducted in several learning sessions that include the introduction of social-emotional materials, the use of Augmented Reality (AR)-based digital media, and the application of Maja Labo Dahu local wisdom values in learning. Data on the practicality of the module will be collected through direct observation of student and teacher interactions during learning, as well as a questionnaire to assess teacher and student perceptions of the use of AR media and the ease of application of the material.

During the implementation stage, teachers will also be given a brief training to ensure that they can use this module well and can facilitate students effectively in AR-based learning. Feedback from teachers during this pilot will be crucial to identify challenges and barriers encountered in the implementation of the module.

2. Evaluation Stage

Once the implementation stage is complete, the next step is evaluation to assess the effectiveness of the teaching module in achieving the social-emotional learning objectives. This evaluation will be conducted using quantitative and qualitative methods to measure student learning outcomes as well as to assess student engagement and motivation in learning. Formative evaluation will be conducted on an ongoing basis during the implementation phase, by collecting data from classroom observations and discussions with teachers and students. It aims to improve and refine the module directly based on the challenges encountered during the learning process.

On the other hand, a summative evaluation will be conducted after the module has been taught, using a pretest and posttest to measure changes in students' social-emotional skills. The pretest will be administered before students follow the teaching module, while the posttest will be conducted after students have completed the entire learning session. Data from the pretest and posttest will be analysed to see the effectiveness of the module in improving students' social-emotional skills, including the ability to manage emotions, build social relationships, and understand local cultural values.

In addition, qualitative feedback from teachers and students regarding the use of AR media will be collected through interviews and questionnaires to assess their experience in using the technology and how it affects their learning motivation and understanding of the material. This information will be used to make improvements and refinements to the module, as well as ensuring that the module can be optimally applied in various school contexts.

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The assistance provided not only facilitated the development of this research, but also enriched invaluable academic and practical experience. We hope that the results of this research can make a real contribution to the advancement of science, technology in accordance with the objectives of this grant programme.

4. Conflict of Interest

The authors declare that in the conduct of this research, there is no conflict of interest that could affect the objectivity or results of the research. All procedures and results presented in this study are fully based on valid and objective data, without any influence or pressure from any interested party. The author also affirms that this research was conducted with high academic integrity, without any affiliation or financial relationship that could affect independence and honesty in every stage of the research.

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Supporting the Special Region of Yogyakarta High School Economics Teachers' Forum (MGMP Ekonomi SMA DIY) on Deep Learning's Implementation

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Abstract. This Community Service Program (CSP) aims to enhance the competence of high school Economics teachers in the Special Region of Yogyakarta in implementing Problem-Based Learning (PBL) integrated with a deep learning approach. The mentoring program is expected to assist teachers in developing more interactive, critical, and contextually relevant learning, while supporting the implementation of the Merdeka Curriculum and strengthening 21st-century competencies. The method applied in this CSP consisted of: (1) needs analysis through initial discussions with the Economics MGMP board, (2) delivering materials using interactive lectures and case studies, (3) training on the development of PBL-based lesson plans with deep learning integration, (4) direct mentoring in small groups through teaching simulations, and (5) reflection and evaluation to identify achievements and challenges. The program was conducted on Thursday, August 7, 2025, at the Graduate and Doctoral Program Building, 3rd floor, P4TKN room, and was attended by 34 Economics teachers from MGMP DIY. The results indicate that teachers gained improved conceptual understanding of PBL and deep learning, skills in designing innovative lesson plans, and the ability to connect economic concepts with real-world contexts more effectively. In addition, teachers became more motivated to shift from conventional teaching methods toward more participatory and analytical strategies. Therefore, this CSP activity proved relevant and beneficial in supporting the improvement of economics learning quality in schools.

Keywords: community service, problem-based learning, deep learning, High School, Economic Teacher's Forum DIY.

INTRODUCTION

The development of artificial intelligence (AI) technology is rapidly advancing and has a significant impact on various sectors, including education. One branch of AI that is currently being widely discussed is deep learning, a machine learning method that can mimic the way the human brain works in recognizing patterns and making predictions based on data. In the context of education, deep learning has the potential to improve the quality of learning by providing a more adaptive learning system, personalizing materials, and utilizing data analytics to understand students' learning needs. The Minister of Education, Culture, Research, and Technology (Mendikbudristek) has emphasized the urgency of integrating this technology into the curriculum to prepare students for a digital era full of new challenges.

However, the application of deep learning at the school level, especially in high schools, still faces various obstacles. One of the main challenges is the low level of understanding and skills among teachers in adopting this technology into their learning strategies (Rozi et al., 2022). Most teachers have not received sufficient training in the use of AI and deep learning, both in technical and pedagogical aspects. In addition, the absence of specific policies guiding the use of deep learning in economics education limits its adoption in the classroom (Andriana, 2021). In fact, with the right approach, deep learning can help students understand economic concepts more deeply, such as analyzing production trends, simulating markets, or utilizing economic data for decision-making.

To address these challenges, strategic efforts are needed in the form of training and mentoring for teachers to enable them to integrate deep learning into high school economics instruction (LeCun et al., 2015; Putri et al., 2024). The use of problem-based learning (PBL) combined with deep learning can be an innovative solution for developing critical and analytical thinking skills in students. Through outreach activities, training in creating learning media, and mentoring in classroom implementation, teachers can gain a better understanding of how to apply this technology effectively (Hao et al., 2016; Song et al., 2006; Zhang et al., 2016). Integrating deep learning into the curriculum not only improves the quality of learning but also prepares students with relevant skills for the future world of work.

The implementation of deep learning in school curricula, particularly at the high school level, has become a major focus in the education sector. The Minister of Education, Culture, Research, and Technology (Mendikbudristek) has highlighted the importance of adapting this advanced technology to learning. However, significant challenges arise because many teachers lack an adequate understanding of the concept and application

of deep learning in education (DetikEdu, 2024; Mendikdasmen, 2025; Prastiwi, 2024; Swawikanti, 2024; Yulianti, 2024).

1. Problem Identification
   Based on the situation analysis presented, the following problems can be identified:
   a. Lack of Teacher Understanding of Deep Learning: Many teachers do not yet understand the basic concepts and potential applications of deep learning in teaching. There is a lack of training and learning resources related to AI and deep learning in education.
   b. Difficulty Integrating the Curriculum: The curriculum does not explicitly support the application of deep learning in subjects. Teachers struggle to develop learning materials that combine economic concepts and AI technology.
   c. Lack of Support and Mentoring in Implementation: There is minimal guidance for teachers in implementing deep learning in problem-based learning. There is a lack of communities or forums that can serve as a forum for sharing experiences and challenges in implementing AI technology in the classroom.
2. Problem Formulation
   Based on the problem identification, several main questions can be formulated that form the basis for mentoring activities to implement deep learning for high school Economics MGMP teachers throughout Yogyakarta, namely:
   a. How can teachers improve their understanding of the concept of deep learning?
   b. How can deep learning be integrated into high school Economics lessons?
   c. How can deep learning be implemented in the high school Economics curriculum?

METHOD

1. Problem Solving Framework
   Based on the identification of problems that have been described, the CSP Team formulated the following problem solving framework:
   Table 1 Problem Solving Framework

No.	Problem	Solusion
1	Lack of Teacher Understanding of Deep Learning and difficulty integrating it into the curriculum	Conducting training and workshops for teachers on the basic concepts and applications of deep learning in education. Developing a guide for teachers on how to integrate AI into existing subjects.
2	Difficulty in creating learning media with deep learning content	Workshop on creating AI-based interactive learning media Development of deep learning-based learning modules that can be implemented in the classroom.
3	Lack of Support and Guidance in Implementation	Providing consultation and mentoring sessions for teachers interested in implementing AI in their teaching. Evaluating the effectiveness of AI implementation in the classroom through surveys and impact analysis.

2. Target Audience
   The target audience for this Community Service Program (CSP) is 34 high school economics teachers from the MGMP Economics Groups (MGMP) across the Special Region of Yogyakarta Province, spread across five regions: four regencies and one city. These high school MGMP teachers are the primary target group because they play a direct role in economics instruction in the classroom. Improving their understanding and skills in implementing Problem-Based Learning (PBL) with deep learning content will impact the quality of student learning. As a forum for economics teachers, MGMP will benefit from strengthened institutional capacity, improved discussion forums, and the formation of a more active learning community.

3. Solutions Offered
   This community service program aims to increase the capacity of high school economics teachers in understanding and applying deep learning in their teaching, particularly through a problem-based learning (PBL) approach to production materials. The implementation method consists of three main stages:
   a. Socialization of Deep Learning and its Integration into Problem-Based Learning: Providing a basic understanding of deep learning and how this technology can be integrated into problem-based learning.

Interactive seminars and discussions on the concept of deep learning, its benefits in economics education, and how this technology can support problem-based learning.
Presentation of examples of deep learning implementations in economic data analysis and industry trend prediction.
Simulation of learning scenarios with the application of deep learning in PBL for production materials.

b. Training on Creating Learning Media with Deep Learning Content: Improving teachers' skills in developing learning media that integrates deep learning technology to support economics learning.
Workshops on creating interactive AI-based learning media (e.g., AI chatbots for economic discussions, data-driven simulations, or production trend analysis using simple machine learning).
Training on the use of deep learning tools and platforms that can be adapted for teaching economics (e.g., Google Colab, TensorFlow, or data visualization tools like Tableau and Power BI).
Development of deep learning-based learning modules that can be implemented in the classroom.

c. Implementation Assistance in High School Economics Learning, Core Economic Issues: Assisting teachers in directly implementing deep learning-based learning media in the classroom.
Classroom observations to observe the implementation of learning using the created media.
Evaluating the effectiveness of using deep learning in economics learning through reflection and feedback from students and teachers.
Compiling implementation reports as a basis for scientific publications and sharing good practices in academic forums and social media.

4. Stages of CSP Implementation

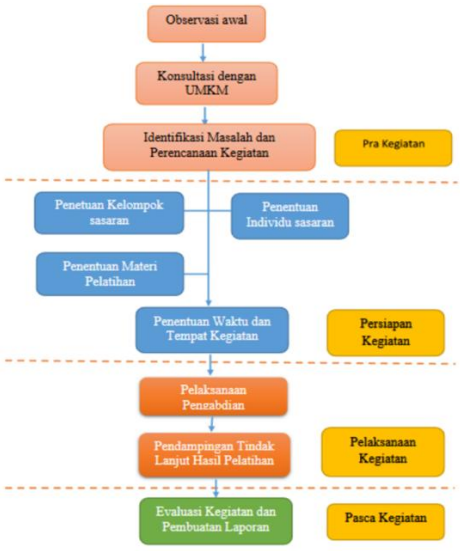

Image of the stages of implementing CSP

RESULT AND DISCUSSION

1. Activity Implementation
The Community Service (CSP) activity was held on Thursday, August 7, 2025, at the Master's and Doctoral Program Building, 3rd Floor, P4TKN room. Thirty-four participants, administrators and members of the Economics MGMP from across the Yogyakarta Province, participated in the activity. The atmosphere was full of enthusiasm, reflecting the passion of economics teachers to improve their teaching competencies. The selection of a representative location contributed to the smooth running of the activity, allowing participants to focus on each session prepared by the CSP team.

Figure 1. Teachers listen to presentations by speakers

The main topic presented in this activity was the application of Problem-Based Learning (PBL) and Deep Learning in economics instruction in high schools. The CSP team presented expert lecturers who provided in-depth explanations of concepts, implementation strategies, and practical examples that can be applied in the classroom. Participants were given the opportunity to discuss and ask questions, fostering productive interactions. This strengthened teachers' understanding of the importance of innovative learning approaches relevant to the demands of the Independent Curriculum.

Figure 2. Presentation by Guest Speaker Dr. Lilia Pasca Riani, M.Sc.

In addition to delivering the material, the activity also included a practical session on developing problem-based learning designs that integrated economic concepts with a deep learning approach. Teachers were divided into small groups to collaborate, creating an active and dynamic learning environment. Through this activity, participants not only understood the theory but also gained hands-on experience in designing more interactive, analytical, and contextual learning.

Figure 3. Presentation by Guest Speaker Prof. Dr. Endang Mulyani, M.Si.

This CSP activity yielded several important achievements. First, teachers' understanding of the concepts of PBL and Deep Learning and their importance in economics learning was enhanced. Second, the initial design of more creative and innovative learning tools was created. Third, a collaborative network was established among members of the Yogyakarta Economics MGMP to develop technology-based economics learning materials and critical analysis. Fourth, teachers' motivation to innovate and adapt to developments in 21st-century education grew.

Figure 4. Presentation by Best Practices Dwi Subekti, M.Pd.

Based on the results obtained, this activity can be said to have successfully made a tangible contribution to improving the competency of economics teachers. Going forward, follow-up activities such as mentoring implementation in schools and providing a forum for sharing good practices will further strengthen the impact of this activity. The CSP team is also committed to continuing to support teachers through relevant research and community service programs, so that the synergy between universities and schools can continue for the sake of improving the quality of education.

Figure 5. Audiences and Speaker
Source: Personal Documentation

2. Activity Evaluation

The Community Service Team conducted the evaluation by distributing a Google form link to participants to complete based on their perceptions. The following summarizes the results of the questionnaire, divided into 10 indicators:

Table 2. Community Service Evaluation

No.	Indicator	Audience Responses
1.	Response Indicators	90% of respondents understood the material presented.
2.	Material Application	86% of respondents stated they could apply the material in their businesses.
3.	Suitability to Needs	90% of respondents stated the material met their needs.
4.	Problem Solution	80% of participants found solutions to the problems they faced during this activity.
5.	Material Quality	80% of participants stated that the material presented by the resource person and the practical exercises were of high quality.
6.	Material Delivery	86% of participants stated that the resource person delivered the material in an interesting, simple, and easy-to-understand manner.
7.	Discussion with the Resource Person	80% of participants stated that the resource person was very open to discussion.
8.	Facilities Provided	80% of participants stated that the facilities provided during the CSP activity were very good.
9.	CSP Follow-Up	85% of participants stated their willingness to be mentored as a follow-up to the CSP activity.
10.	Willingness to Re-Participate	90% of participants stated their willingness to participate if CSP is held again in the future.

3. Supporting and Inhibiting Factors

Supporting Factors

a. Enthusiasm of Economics MGMP Teachers: Teachers are passionate about improving their learning competencies to better align with curriculum demands and student needs. Economics MGMP teachers in Yogyakarta demonstrated high enthusiasm in participating in mentoring activities. This was demonstrated by their eagerness to improve their learning competencies, particularly in mastering innovative learning models. This enthusiasm is crucial because teachers feel these activities are relevant to curriculum demands and student needs in the 21st-century learning era.
b. Relevance of the Community Service Program (CSP) Theme: The material on Problem-Based Learning (PBL) and Deep Learning is highly relevant to high school economics learning, which requires critical and contextual analysis. The CSP theme, which emphasizes the application of Problem-Based Learning (PBL) with Deep Learning, is highly aligned with the needs of high school economics learning. Economics material at the high school level, especially in grade 10, requires students to think critically, analyze problems, and connect them to real-world contexts. Therefore, this CSP theme is considered relevant and capable of having a tangible impact on the quality of economics learning.
c. Institutional Support: Support from universities, MGMPs, and participating schools, including the provision of venue facilities. This activity is supported by various parties, from universities and MGMPs in Economics to participating schools. This support includes permits, building facilities, and collaboration in preparing the technical requirements for the activity. This institutional support is a key success factor, as it allows the activity to run more organized and gain stronger legitimacy.
d. Involvement of a Team of Experts: The Community Service Program (CSP) team consists of lecturers with expertise in economics, education, and innovative learning models. The implementation of this CSP is strengthened by the involvement of a team of lecturers with expertise in economics, education, and the development of innovative learning models. The presence of this team of experts ensures that mentoring is provided systematically, research-based, and in line with the latest developments in education. Thus, teachers receive guidance that is not only theoretical but also practical for implementation in the classroom.
e. Availability of Technology and Learning Resources: Teachers and teams can utilize digital technology (LMS, collaboration applications, and presentation media) to enrich the activity. CSP activities are also supported by the availability of digital technology that can be utilized in learning. Teachers and teams can use Learning Management Systems (LMS), collaboration apps, and interactive presentation tools to enrich the learning experience. Access to these digital learning resources helps create more engaging, adaptive, and digitally-responsive learning environments.

Inhibiting Factors

a. Teacher Time Constraints: Busy teaching schedules often make it difficult for teachers to fully participate in mentoring. High school teachers generally have busy teaching schedules, coupled with significant school administrative duties. This often makes it difficult for them to find time to fully participate in mentoring. As a result, the sustainability of the Community Service Program (CSP) can be disrupted because not all teachers can consistently participate in every session.
b. Variations in Teacher Initial Competencies: Not all teachers have the same understanding of PBL and deep learning, so the adaptation process can vary. Teachers' levels of understanding of Problem-Based Learning (PBL) and Deep Learning vary. Some teachers are already familiar with their implementation, while others are still unfamiliar. These differences require a more adaptive mentoring approach so that all teachers can benefit according to their individual needs.
c. Unequal Facilities: Not all schools have access to adequate technology and resources to implement innovative learning models. Not all schools in the Special Region of Yogyakarta (DIY) have adequate technological facilities to support innovative learning. Some schools still have limited internet access, computer devices, or interactive learning media. This presents a challenge because the implementation of Deep Learning-based PBL often requires the support of digital technology.
d. Conventional Learning Habits: Some teachers are still accustomed to the lecture method, requiring time to transition to a more interactive model. Some teachers are still accustomed to using the lecture method as their primary learning approach. This habit requires more time and motivation to shift their mindset toward more interactive and student-centered learning. This paradigm shift is not an instant process, and therefore can be a barrier to PBL implementation.

CONCLUSION

The implementation of CSP, which was attended by 34 economics teachers from across the Province of DIY, has yielded significant results in improving understanding of Problem-Based Learning (PBL) with Deep Learning content. Teachers gained knowledge, skills in designing innovative learning tools, and built professional networks

that can support the sustainability of implementation in schools. Students, as indirect beneficiaries, will gain a more meaningful learning experience through contextual, critical, and creative learning. Meanwhile, for the CSP team, this activity demonstrates success in transferring knowledge, building partnerships with MGMP, and strengthening the role of higher education institutions in supporting the improvement of education quality.

Learning assistance with deep learning content for economics teachers contributes significantly to improving the quality of the teaching and learning process.

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Collaboration Between School Counselors and Parents to Enhance Students' Learning Comfort

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Abstract. Learning comfort is an essential factor influencing students' academic and emotional development. School counselors play a strategic role in creating a conducive learning environment by providing guidance and psychological support to students. The purpose of the training activity in this community service program, which focused on collaboration between school counselors and parents to enhance students' learning comfort, was to strengthen the synergy between counselors and parents in supporting students' holistic development. The target audience of this training program consisted of junior high school counselors who are members of the Guidance and Counseling Teachers' Forum (MGBK) of Sleman Regency. The training was carried out through a collaboration between the Community Service Team of the Faculty of Education, Yogyakarta State University, and the MGBK of Sleman Regency. A total of 40 junior high school counselors from various schools within the region participated in this activity. The training method employed in this community service program utilized instructional and mentoring techniques. The effectiveness of the program was demonstrated by an increase in the mean score from 80.73 to 89.73, representing an 11.15% improvement, along with Wilcoxon test results indicating a significant difference between the pre-training and post-training scores. Cognitively, counselors were able to understand the concepts, forms, and strategies for collaborating with parents; affectively, participants showed high levels of enthusiasm, openness, and motivation; and in terms of action, counselors successfully designed more applicable and systematic collaboration strategies. The main challenge encountered was parents' limited availability of time; however, this was addressed through flexible communication using online media and communication groups. Overall, the activity successfully strengthened school counselors' competence in building partnerships with parents, ultimately contributing positively to the creation of a more comfortable learning environment for students at school.

Keywords: Collaboration Between School Counselors and Parents, Students' Learning Comfort

INTRODUCTION

Learning comfort is a crucial factor influencing students' academic and emotional development. Guidance and Counseling teachers play a strategic role in establishing a conducive learning environment by providing appropriate guidance and psychological support (Damanik, 2024). However, these efforts cannot be fully optimized without strong collaboration between guidance and counseling teachers and parents. Parents serve as the primary agents in shaping children's habits and motivation, which significantly affect their learning comfort at school (Irawati & Kasingku, 2024). Collaboration between teachers and parents is essential for understanding and addressing students' academic, social, and emotional concerns (Grubbs, 2013). Effective communication provides teachers with important information about students' conditions at home, enabling them to design more targeted and relevant guidance strategies (Hasibuan & Khairuddin, 2024). Through strong synergy between schools and families, students are expected to receive optimal support both at home and at school (Maemunah et al., 2025; Moore & Day, 2010). Such collaboration contributes to students' learning comfort, motivation, confidence, and ability to manage academic and social challenges effectively (Baroroh, Putri, & Putri, 2024). Achieving these goals requires active involvement from multiple stakeholders, particularly teachers who function as key intermediaries between schools and parents. Effective collaboration can assist in identifying and overcoming barriers students encounter in the learning process. In this context, the Community Service Program partners consist of teachers from junior high schools affiliated with the Junior High School Guidance and Counseling Teachers Association in Sleman Regency. Interviews with teachers in Sleman Regency revealed several challenges in implementing guidance and counseling services, particularly concerning the lack of effective

communication between teachers and parents. Findings indicate that some parents interact with the school only when serious problems occur, resulting in reactive rather than preventive communication.

Additionally, parents' limited time and demanding work schedules hinder their participation in school-related activities. These constraints make it difficult for teachers to encourage parents to engage actively in programs designed to enhance students' learning comfort and academic performance. This situation aligns with the findings of Purnomo, Huda, Agnesti, and Fathoni (2025), who reported that some parents are less involved in their children's education due to limited time or insufficient understanding of their parental roles. Consequently, students may lack the motivation and guidance needed to overcome learning challenges. Furthermore, Purwaningrum, Surur, and Asrowi (2023) noted that many parents feel reluctant to communicate matters occurring at home to teachers. When students face difficulties, some parents show low awareness of seeking professional assistance from teachers. Certain parents perceive counseling services as unimportant, leading to limited engagement in collaborative initiatives. Technological literacy among parents and teachers remains another obstacle (Zakariyah & Hamid, 2020), and low parental education levels contribute to reduced parental involvement in school matters (Mangerang, 2021). These conditions highlight the importance of increasing parents' awareness and understanding of the role of guidance and counseling services in fostering effective collaboration for students' learning success. This issue is closely related to the challenges faced by teachers, namely establishing communication with parents, identifying collaborative forms of engagement, and facilitating students' holistic development through counseling services. The Community Service Program addresses these challenges by focusing on three priority areas to enhance effective collaboration between teachers and parents. Effective communication enables teachers to understand students' family conditions and provide interventions tailored to their needs (Astiti, Suminar, & Rahmat, 2018). Innovative strategies—such as flexible discussion forums—are needed to improve communication between schools and parents (Moran & Bodenhorn, 2015). Strengthening clear forms of collaboration is also essential, as parents must understand their roles in supporting their children's development through regular meetings, parenting seminars, or involvement in school guidance activities (Rahmawati, 2022; Syuhadatina, Rosita, Muhyatun, & Putri, 2024). Moreover, counseling services should be directed toward supporting students' holistic growth. Outreach efforts regarding the importance of guidance and counseling services can help parents better understand their children's learning needs (Mitchell & Bryan, 2007). Through this training program, teachers are expected to enhance their communication competencies and collaboration-based guidance strategies, while parents gain greater awareness of their role in supporting students' learning comfort. Ultimately, this initiative is anticipated to strengthen cooperation between schools and families in creating a learning environment that supports students' optimal development.

LITERATURE REVIEW

Collaboration between teachers and parents plays a decisive role in supporting students' academic success. Parents serve as the primary and earliest educators for their children, as they are the first to provide education within the family setting. Teachers, meanwhile, play an important role in encouraging students to develop their academic potential. According to H. Syarif Hidayat (2013), collaboration between parents and teachers is defined as "a communicative relationship that monitors students' learning progress throughout the teaching and learning process, as measured by: (1) the flow of communication between parents and teachers, (2) parents' involvement in resolving students' learning problems, and (3) parents' participation in enforcing school rules" (p. 95). In educational practice, cooperation between parents and teachers is essential because children's development cannot rely solely on the teacher's role. Children also require the involvement and guidance of their parents. This aligns with the view of Enda Permatasari (2019), who explains that collaboration between parents and teachers allows parents to gain important knowledge and experiences from teachers in educating their children. Conversely, teachers can obtain valuable information from parents regarding their children's characteristics and behavior at home. Such information is highly beneficial for teachers in guiding and educating their students effectively. Similarly, Nanat Fatah Natsir et al. (2018) state that the collaboration between teachers and parents in enhancing the quality of children's education requires synergy and integration between educators in the school (teachers) and educators at home (parents) (p. 317). Therefore, it is clear that collaboration between teachers and parents plays a vital role in improving the quality of students' education. Through such collaboration, teachers and parents can support each other in fostering students' academic development, as teachers can better understand students' progress through information provided by parents, while parents can assist teachers by supporting their children's learning at home—particularly during the pandemic period.

Collaboration between teachers and parents is based on shared goals and responsibilities in educating children so that educational objectives can be achieved effectively and efficiently. According to M. Ngalim Purwanto (as cited in Nur Khosiah, 2020), several forms of teacher–parent collaboration include: (1) organizing parent meetings on student admission day; (2) maintaining written communication between the school and the family; (3) providing report cards; (4) conducting home visits by teachers or school visits by parents; (5) holding school celebrations or exhibitions of students' work; and (6) establishing parent–teacher associations. In a similar vein,

Dwi Pratiningsih (2017) identifies additional forms of collaboration, including: (1) home visits, which strengthen student supervision and foster students' sense of being supported by their school; (2) inviting parents to the school to discuss the child's development directly; (3) case conferences, which involve parents in addressing students' problems collaboratively; (4) forming school support organizations involving parents and teachers; and (5) maintaining written communication between teachers and parents about students' progress. Consistent with these perspectives, Purwanto (as cited in Lestari, Nurhayati, & Udin, 2020) emphasizes similar forms of collaboration, such as parent meetings, written communication, report cards, school celebrations, and parent–teacher associations. Furthermore, Hery Noer Aly and Munzier (as cited in Suryani, 2012) highlight additional collaborative efforts, including: (1) home visits; (2) inviting parents to school events such as class meetings or competitions; (3) case conferences within guidance and counseling services; (4) forming parent–teacher organizations; (5) providing parents with information about their child's academic progress; (6) encouraging parents to report their child's behavior and learning activities at home; (7) providing counseling services for parents regarding effective strategies for supporting students at home; (8) sharing information about school programs and guidance services; (9) maintaining regular consultations between guidance teachers and parents; (10) providing report cards; and (11) creating open-house events to build mutual trust between parents and teachers. Based on the discussion above, forms of collaboration generally include teacher–parent meetings, written communication, and reciprocal home or school visits.

The objectives of teacher–parent collaboration are consistent across literature. According to Jalaludin (as cited in Witasari, 2013), collaboration aims to: (1) provide mutual support; (2) prevent undesirable student behaviors; and (3) jointly plan effective educational strategies for children (p. 37). Collaboration ensures coherence between school and home environments so that children do not experience conflicting expectations. Similarly, Yanti et al. (2013) state that the goals of teacher–parent collaboration include: (1) helping students improve their learning outcomes; (2) assisting students in overcoming learning difficulties; (3) supporting students in developing their potential; and (4) strengthening coordinated educational efforts across formal and informal settings.

RESEARCH METHOD

The training method used in this Community Service Program employed a combination of training and mentoring techniques, in which participants were provided with conceptual understanding, practical skills, and ongoing assistance in building collaboration between Guidance and Counseling teachers and parents to enhance students' learning comfort. Overall, the activities included planning effective communication strategies between teachers and parents, developing synergistic forms of collaboration, and facilitating student development through cooperative efforts within guidance and counseling services. These efforts were designed to improve students' learning comfort at school, particularly in the delivery of guidance and counseling services.

RESULTS AND DISCUSSION

The results of the activity implementation indicate that the training provided was able to improve school counselors' understanding of the importance of building collaboration with parents. Based on the SPSS analysis, there was an increase in the mean score of school counselors' understanding from 80.73 prior to the intervention to 89.73 after the intervention, reflecting an improvement of 11.15%. The Wilcoxon test results showed a Z value of −5.683 with a significance level of .000. This indicates that the significance value (.000) is lower than .05 (5% error level), suggesting that there was a significant difference between the pretest and posttest scores. Thus, the community service program (PkM) was effective in enhancing the competence of school counselors.

This improvement aligns with theories suggesting that parental involvement in children's education contributes significantly to both academic and non-academic development. School counselors who are able to establish effective communication and collaboration with parents can more easily understand students' conditions both at school and at home. Consequently, the interventions provided become not only reactive but also more preventive and comprehensive.

In addition, the discussion of the activity outcomes indicates that the primary challenges in developing collaboration between school counselors and parents are time constraints and parents' busy schedules. However, by implementing more flexible communication strategies such as the use of online platforms, communication groups (e.g., WhatsApp or Telegram), and adjusted meeting schedules, school counselors can maintain engagement with parents without requiring constant face-to-face interactions. This approach has proven to enhance parental participation and strengthen synergy in supporting students' learning experiences.

With the increase in school counselors' understanding and skills, collaboration with parents is expected to become more effective and sustainable. This improvement is likely to create a more conducive learning environment, as students feel supported by both the school and their families. Therefore, this community service activity not only contributes to the enhancement of school counselors' competencies but also improves the quality of guidance and counseling services that are more responsive to students' needs.

CONCLUSION

The community service activity in the form of training on collaboration between school counselors and parents proved effective in improving school counselors' understanding, attitudes, and skills. This was evidenced by an increase in the mean score from 80.73 to 89.73, representing an 11.15% improvement, as well as Wilcoxon test results indicating a significant difference between the pre-training and post-training scores. Cognitively, school counselors demonstrated an improved understanding of the concepts, forms, and strategies of collaboration with parents; affectively, participants showed high levels of enthusiasm, openness, and motivation; and in terms of action, school counselors successfully designed more applicable and systematic collaboration strategies. The main challenge encountered was parents' limited availability of time, but this was addressed through flexible communication using online platforms and communication groups. Overall, this activity successfully enhanced school counselors' competence in building partnerships with parents, which ultimately had a positive impact on creating a more comfortable learning environment for students at school.

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Antidepressant Activity of Various Indonesian Herbal Extracts in Male Mice Using the Forced Swimming Test

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Abstract. Depression is a prevalent mood disorder associated with dysregulation of monoamine neurotransmitters. Herbal medicines may offer alternative therapeutic options with fewer side effects than synthetic antidepressants. This study aimed to evaluate the antidepressant activity of several Indonesian medicinal plants such as Myristica fragrans, Clitoria ternatea, Piper longum, Plumeria obtusa, Morinda citrifolia, Staminur herbal mixture, and wedang abang, using the Forced Swimming Test (FST) in male mice. Extracts were prepared at concentrations of 1.25%, 2.5%, and 5%. A total of 210 male Sprague Dawley mice were divided into ten groups consisting of negative control, positive control (fluoxetine and imipramine), and extract-treated groups. Immobility time was recorded for 6 min during the FST. Percentage reduction in immobility was calculated relative to control groups. Staminur extract demonstrated a dose-dependent decrease in immobility time, with the 50% concentration producing the highest reduction (68.08%). Sugar solutions (12.5–50%) also reduced immobility but with less consistency, with 25% sugar showing the strongest effect (59.43%). Staminur consistently outperformed sugar at equivalent concentrations, indicating the presence of active phytochemical constituents. Indonesian herbal extracts, particularly Staminur and its constituent botanicals, show promising antidepressant effects in vivo. These plants may serve as potential candidates for development as natural antidepressant agents. Further studies involving phytochemical profiling and neurochemical assays are warranted.

Keyword: herbal antidepressant, forced swimming test, monoamine oxidase inhibitors, Staminur, Morinda citrifolia, Indonesian medicinal plants

INTRODUCTION

Depression is a common mental disorder characterized by persistent sadness, loss of interest or pleasure, feelings of guilt, low self-esteem, sleep disturbances, altered appetite, fatigue, and impaired concentration1. One of the major contributing factors to depression is biochemical dysregulation. Monoamine neuromodulators serve as the primary neural substrates that regulate communication between neurons. The major monoamines, including dopamine, norepinephrine, and serotonin, play crucial roles in the formation and regulation of basic emotional processes2. The dopaminergic system is associated with reward and pleasure, the noradrenergic system regulates the "fight or flight" response and contributes to anger and fear, while the serotonergic system modulates appetite and mood states3. Reductions in norepinephrine and serotonin levels may result in cellular imbalances that disrupt normal neuronal impulse transmission4,5. Dysfunction within the dopaminergic system has also been implicated in several psychiatric disorders, including depression6.

Pharmacological therapy to increase the availability of monoamine neurotransmitters such as dopamine, serotonin, and norepinephrine, forms the basis of modern antidepressant treatment. Antidepressant drugs act primarily by altering the concentration or receptor sensitivity of these neurotransmitters7. Although effective, synthetic antidepressants are frequently associated with significant adverse effects such as dependence, neurological symptoms, gastrointestinal disturbances, blood pressure alterations, sexual dysfunction, and hormonal imbalances8–10. These side effects may greatly reduce patients' quality of life, resulting in premature discontinuation of therapy11. Consequently, the development of natural, plant-based antidepressant alternatives with fewer side effects is of growing interest9.

Staminur contains Curcuma xanthorrhiza (temulawak), Caesalpinia sappan (secang), lemongrass, Zingiber zerumbet (lempuyang), cinnamon, cumin, and Pulowaras. This composition exhibits antioxidant and anti-inflammatory properties and has the potential to modulate neurotransmitter systems, thereby supporting antidepressant activity12–16. Secang contains Caesalpinia sappan, Amomum compactum (kapulogo), clove, cinnamon, lemongrass, and pandan leaves. The presence of essential oils, flavonoids, and alkaloids may contribute

to antidepressant effects through a combination of antioxidant, anti-inflammatory, and neuromodulatory activities13,14,16–18. The ethyl acetate extract of Morinda citrifolia (noni) fruit has been reported to inhibit monoamine oxidase A and B (MAO-A and MAO-B), resulting in antidepressant effects[19].

MATERIALS AND METHODS

1. Plant Materials

Extracts included: *Myristica fragrans* (nutmeg), *Clitoria ternatea* (butterfly pea), *Piper longum* (long pepper), *Plumeria obtusa* (frangipani), *Morinda citrifolia* (noni), Staminur herbal mixture, Wedang abang mixture.

2. Preparation of Extract

All plant materials were cleaned, dried, powdered, and macerated using 96% ethanol. Extracts were evaporated to dryness and dissolved to obtain concentrations of 1.25%, 2.5%, and 5%.

3. Experimental Animals

A total of 210 male Sprague Dawley mice were acclimatized for 7 days and randomly assigned to ten groups (n = 7 each): Negative control, Positive control (fluoxetine), Positive control (imipramine), Extract-treated groups.

4. Forced Swimming Test (FST)

Mice were individually placed in a cylindrical tank (15–20 cm water depth) for 6 min; immobility time during the final 4 min was recorded as the primary measure of depressive-like behavior.

5. Data Analysis

Data were expressed as mean ± SD. One-way ANOVA followed by post hoc analysis was used to assess differences. % reduction was calculated as:

$$\text{Reduction (\%)} = \frac{\boldsymbol{IT}_{\text{control}} - \boldsymbol{IT}_{\text{treatment}}}{\boldsymbol{IT}_{\text{control}}} \times \mathbf{100}$$

RESULTS AND DISCUSSION

Phytochemical screening demonstrated distinct secondary metabolite profiles among Staminur, Caesalpinia sappan (secang), and noni extract, which may underlie differences in their biological activities can be seen in TABLE 1.

TABLE 1. Qualitative phytochemical profile of Staminur, *Caesalpinia sappan* (secang), and pace extract

	Alkaloids	Flavonoids	Tannins	Saponins	Triterpenoids	Steroids
Staminur	-	+	+	+	-	-
Secang	+	+	+	-	-	-
Noni	+	-	+	+	-	-

Staminur contained flavonoids, tannins, and saponins, whereas alkaloids, triterpenoids, and steroids were not detected. Flavonoids are well documented for their neuroprotective effects, primarily through antioxidant activity and enhancement of serotonergic and dopaminergic neurotransmission20. The presence of tannins and saponins further supports the potential antistress activity of Staminur via oxidative stress reduction and modulation of the hypothalamic–pituitary–adrenal (HPA) axis21,22.

Secang tested positive for alkaloids, flavonoids, and tannins, but negative for saponins, triterpenoids, and steroids. Alkaloids are known to exert central nervous system effects, including antidepressant-like activity, potentially through inhibition of monoamine oxidase (MAO), leading to increased monoamine availability23. The concurrent presence of flavonoids and tannins may synergistically enhance neuroprotective and antistress effects through antioxidant mechanisms and neuroendocrine regulation20,21.

Noni extract contained alkaloids, tannins, and saponins, while flavonoids were not detected. Alkaloids may contribute to psychoactive or mood-modulating effects, whereas tannins and saponins are associated with antistress and adaptogenic properties, partly mediated by attenuation of oxidative stress and regulation of HPA axis activity23.

The antidepressant activity test was conducted using the Forced Swimming Test (FST), with immobility duration in male white mice as the primary parameter. Immobility duration was selected as an indicator of depressive-like behavior, in which a shorter immobility time reflects a stronger antidepressant effect of the treatment. The measurement results for each treatment group, including the control group (aquades, NaCMC, and Fluoxetine), Staminur, secang and noni solutions at various concentrations, are presented in FIGURE 1 below.

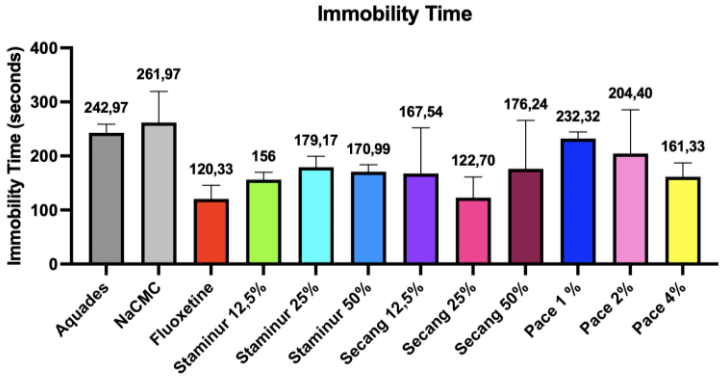

FIGURE 1. Mean immobility time in male white mice

The Forced Swim Test revealed clear antidepressant-like effects of the tested treatments, as reflected by reductions in immobility time compared with the negative controls. Animals receiving aquadest and NaCMC exhibited high immobility durations, confirming the absence of intrinsic antidepressant activity in the vehicle controls and validating the sensitivity of the model.

Fluoxetine, used as a positive control, produced a marked reduction in immobility time, consistent with its established selective serotonin reuptake inhibition and confirming the reliability of the experimental conditions. Notably, Staminur treatment resulted in a dose-dependent decrease in immobility time, with the greatest effect observed at the highest concentration. This pattern suggests a concentration-dependent antidepressant-like response, potentially mediated by the combined action of flavonoids, tannins, and saponins previously identified in the phytochemical screening. Flavonoids may enhance monoaminergic neurotransmission and exert neuroprotective effects through antioxidant mechanisms, while tannins and saponins are associated with modulation of stress responses via the hypothalamic–pituitary–adrenal (HPA) axis20.

Secang extract also significantly reduced immobility time, with the 25% concentration showing the most pronounced effect compared with lower and higher doses. This non-linear response may reflect an optimal concentration range for bioactive compounds, particularly alkaloids and flavonoids, which are known to influence central nervous system activity. Alkaloids may contribute through monoamine oxidase inhibition, leading to increased availability of serotonin and dopamine, thereby enhancing active coping behavior in the FST23.

Pace extract demonstrated a reduction in immobility time, with the strongest effect observed at the lowest concentration tested. Given the absence of flavonoids, the antidepressant-like activity of pace may be primarily attributed to alkaloids, supported by the antistress and adaptogenic properties of tannins and saponins20,21,23. The diminished effect at higher concentrations suggests possible saturation or counteracting effects at elevated doses.

To further quantify behavioral outcomes, the antidepressant-like effects were expressed as the percentage reduction in immobility time relative to the negative control, as shown in FIGURE 2.

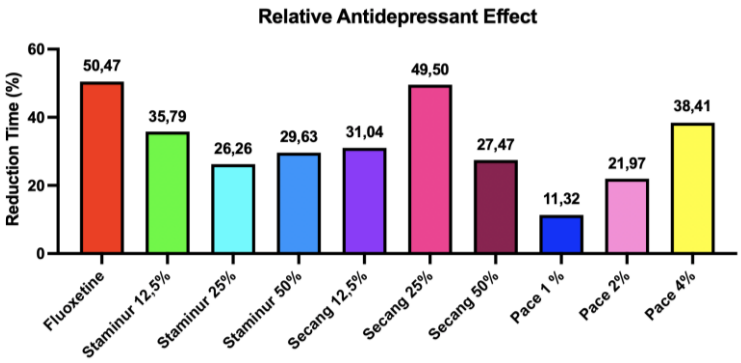

FIGURE 2. Relative antidepressant-like effects of fluoxetine, Staminur, secang, and pace extracts in the forced swim test

The relative antidepressant effect analysis provides a clearer comparison of treatment efficacy across groups. Fluoxetine produced the greatest reduction in immobility time, confirming its role as a robust positive control. Among the herbal preparations, Staminur showed a moderate antidepressant-like effect, with the highest reduction observed at the lowest concentration, suggesting that maximal efficacy may occur within a limited dose range rather than increasing linearly with concentration.

Secang exhibited a pronounced antidepressant-like effect, particularly at the 25% concentration, which approached the efficacy of fluoxetine. This finding indicates an optimal concentration at which bioactive constituents exert maximal behavioral effects. The reduced efficacy at higher concentration may reflect saturation or opposing pharmacodynamic interactions among its phytochemical components.

Pace extract demonstrated a lower overall effect compared with Staminur and secang, although a concentration-dependent increase was observed, with the highest reduction at 4%. Despite lacking flavonoids, the observed activity may be attributed to alkaloids and supported by the antistress properties of tannins and saponins.

In conclusion, the present findings demonstrate a clear concordance between phytochemical composition and behavioral outcomes. Extracts containing flavonoids, alkaloids, tannins, and saponins consistently reduced immobility time in the forced swim test and produced measurable relative antidepressant effects compared with the vehicle control. Variations in efficacy across treatments and concentrations highlight distinct dose–response patterns, with certain concentrations yielding optimal behavioral effects. The relative antidepressant effect analysis further enabled direct comparison of treatment potency, reinforcing the antidepressant-like potential of the tested herbal preparations. Collectively, these results suggest that the observed behavioral improvements are likely mediated by synergistic modulation of monoaminergic neurotransmission, antioxidant defense, and stress-related neuroendocrine pathways. Future studies incorporating quantitative phytochemical analyses, molecular target validation, and clinical evaluation are warranted to elucidate the precise mechanisms of action and translational relevance of these findings.

CONCLUSION

This study demonstrates that Staminur, secang, and pace extracts exhibit antidepressant-like activity in the forced swim test, as evidenced by reduced immobility time and measurable relative antidepressant effects. These behavioral outcomes are consistent with the presence of bioactive secondary metabolites, including flavonoids, alkaloids, tannins, and saponins, suggesting a mechanistic association between phytochemical composition and antidepressant-like efficacy. Distinct dose–response patterns were observed among the extracts, indicating the importance of concentration optimization. Overall, the findings support the potential of these herbal preparations as sources of bioactive compounds with antidepressant-like properties and provide a scientific basis for further mechanistic and translational investigations.

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Optimizing the Quality and Variety of Woodcraft Products Through Technology Training and Innovative Design for MSMEs in Triharjo Village, Wates, Kulonprogo

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Abstract. This Community Service Program (PkM) was implemented to enhance the quality, variety, and competitiveness of wooden craft products produced by MSMEs in Triharjo Village, Wates, Kulonprogo. The main challenges faced by the partners included limited production technology, lack of design innovation, underutilization of wood waste, and weak digital marketing strategies. The program was conducted in four stages: preparation, implementation, mentoring, and monitoring & evaluation. The results indicated significant improvements in four aspects: production efficiency (increased by 35%), product design variation (introduction of decorative items, minimalist furniture, and thematic products), utilization of wood waste into creative souvenirs (60% of participants successfully created new products), and digital marketing literacy (12 participants adopted online marketplaces and social media). These findings demonstrate that the PkM program not only improved technical skills but also encouraged a shift in mindset and market orientation among woodcraft artisans. Therefore, the program contributes to community empowerment, the strengthening of local cultural identity, and the achievement of sustainable development goals (SDGs).

Keywords: Community service, MSMEs, woodcraft, design innovation, digital marketing

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) are one of the main pillars driving Indonesia's economy, contributing significantly to national economic growth, job creation, and a more equitable distribution of welfare. Data from the Ministry of Cooperatives and SMEs indicate that MSMEs absorb more than 90% of the workforce in Indonesia and contribute more than 60% to Gross Domestic Product (GDP). However, despite this strategic role, MSMEs face fundamental challenges, particularly in competitiveness, technological adaptation, product innovation, and global market penetration. One MSME sector that has great potential yet faces similar challenges is the woodcraft sector, which is developing in many regions, including Triharjo Village, Wates, Kulon Progo, Special Region of Yogyakarta.

Woodcraft is a cultural heritage that not only has economic value but also carries social and symbolic meaning. Traditional woodcraft products—such as household tools, interior decorations, and furniture—reflect cultural identity while serving as a livelihood for rural communities. Triharjo Village in Wates Subdistrict, Kulon Progo, is known as one of the long-established centers of woodcraft artisanship. The community relies on woodcraft as its primary source of income; therefore, the sustainability and competitiveness of these MSMEs strongly determine family welfare as well as the continuity of local culture.

Initial observations and surveys conducted by the community service team revealed several issues that directly hinder the development of woodcraft MSMEs in the village. First, in terms of production technology, most artisans still use manual or traditional equipment in the manufacturing process. This limitation results in low production efficiency, inconsistent product quality, and an inability to meet large-volume market demand. Simple modern technologies that could increase productivity have not been widely adopted due to limited knowledge, limited access, and investment costs perceived as expensive. Second, in terms of design innovation, the woodcraft products produced are relatively monotonous and do not sufficiently follow market trends. This reduces product appeal among consumers, especially younger generations who tend to prioritize minimalist, multifunctional, and

environmentally friendly designs. Artisans also have difficulty accessing information on global design trends and rarely participate in training that could enrich their creativity. Third, in raw-material management, wasteful practices are still found because the wood waste generated has not been optimally utilized. In fact, wood waste has great potential to be processed into value-added products such as keychains, photo frames, small souvenirs, or household accessories. Failure to utilize this waste reduces cost efficiency and eliminates opportunities for product diversification. Fourth, in marketing, strategies remain traditional, relying on local networks or direct sales to customers who come to the production site. Limited use of digital platforms and social media restricts market access for woodcraft MSMEs, even though online marketplaces have become a major distribution channel for craft products in the digital era.

These issues indicate that woodcraft MSMEs in Triharjo Village face a gap between their potential and the limitations they encounter in production and marketing practices. To bridge this gap, an intervention is needed in the form of a community service program that not only provides technical solutions but also empowers the community to become more self-reliant in developing their businesses. This is the rationale for implementing the program titled "Optimizing the Quality and Variety of Wooden Craft Products Through Technology Training and Innovative Design for MSMEs in Triharjo Village, Wates, Kulon Progo."

The program emphasizes two main aspects: improving production quality and developing design innovations based on market trends. Production quality improvement is carried out through training in the use of simple modern tools, new finishing techniques, and the management of wood waste into new products. Meanwhile, design innovation development is directed to enable artisans to create products that are relevant to contemporary consumer needs. In addition, the program includes a digital marketing component that covers branding, use of online marketplaces, and the production of promotional content for social media. Thus, the activities not only strengthen technical skills but also equip artisans with digital literacy that is essential in the era of Industry 4.0 and toward Society 5.0.

Theoretically, this activity aligns with studies emphasizing the importance of integrating technology, design innovation, and digital marketing strategies for MSMEs (Rizal & Firmansyah, 2021; Hasibuan, 2022). Rizal and Firmansyah show that the use of simple production technologies can improve efficiency by up to 30%, while Hasibuan stresses that design innovation is key to the competitiveness of creative products in global markets. Research by Saputra and Dewi (2020) also indicates that eco-friendly trends and product personalization are preferences among modern consumers, making it important for artisans to adopt more environmentally friendly and innovative design approaches. On the other hand, digital marketing strategies have been proven to increase MSME visibility by up to 40% (Kurniawati et al., 2022), indicating that the adoption of digital technology is no longer optional but an urgent necessity.

By empowering woodcraft artisans through improved technical skills, product innovation, and access to digital markets, this program supports the creation of more decent jobs, increases local productivity, and strengthens the competitiveness of a culture-based creative economy. Based on the discussion above, the key questions addressed by this program are: (1) How can the quality of woodcraft production be improved through training in simple technologies and innovative finishing techniques? (2) How can woodcraft product designs be developed to align with market trends and become more varied? (3) How can digital marketing strategies be strengthened so that woodcraft MSMEs can reach wider markets? To address these questions, the PkM program offers an integrated set of activities involving outreach, training, mentoring, evaluation, and an exhibition of outputs.

The objectives of this program can be summarized as follows:

1. Improve the quality and variety of woodcraft products through the adoption of simple production technology and design innovation.
2. Encourage the use of wood waste as raw material for value-added creative products.
3. Equip artisans with digital marketing skills to optimize online platforms for product promotion.

With these objectives, it is expected that woodcraft MSMEs in Triharjo Village will become more competitive, develop innovative products, and remain resilient amid modern market dynamics. Ultimately, the program provides not only economic benefits but also strengthens local cultural identity as reflected in the community's woodcraft products.

METHODS

The implementation method of this Community Service Program (PkM) was designed comprehensively to address the main problems faced by woodcraft MSMEs in Triharjo Village, Wates, Kulon Progo. The methodological approach was participatory, collaborative, and oriented toward sustainability. This means that all stages of the program were not only carried out by the PkM team, but also actively involved partner artisans, supporting students, and relevant stakeholders. The main goal was to ensure effective knowledge transfer while building community capacity so that participants could independently develop new skills after the program ended.

The program was implemented over six weeks, from mid-July to late August 2025. The activities were divided into four major phases: preparation, implementation, mentoring, and monitoring and evaluation. These phases

were organized sequentially to form a systematic and continuous cycle. Each phase had clear objectives, core activities, and measurable indicators of achievement. The model was designed not only as a short-term activity but also as a foundation for the sustainable development of woodcraft MSMEs.

The first phase was preparation, which included a needs analysis through surveys and on-site discussions. The team conducted direct observations at MSME production sites to identify real problems related to production technology, product design, raw-material management, and marketing strategies. This phase also served to establish initial communication with partners, explain program objectives, and develop training modules. The outputs of this phase included a skills-needs map and a training curriculum framework. With this preparation, the program could be implemented in a targeted manner according to field conditions.

The second phase was implementation, which formed the core of the program. In this phase, artisans received a series of trainings covering simple production technologies, product design innovation, and digital marketing strategies. Production-technology training introduced the use of simple modern tools such as cutting machines, sanding machines, and spray-based finishing equipment. Activities were conducted through hands-on simulations in the workshop so that artisans could practice and master new techniques. Design training focused on introducing current market trends such as minimalist style, eco-friendly products, and personalization. Participants joined creative workshops that enabled them to produce new designs under the guidance of craft-design experts. In addition, artisans were trained to transform wood waste into value-added creative products, for example household accessories, souvenirs, and interior decorations.

Digital marketing was also an essential component in this phase. Participants were introduced to branding strategies, setting up marketplace accounts on popular platforms such as Shopee and Tokopedia, and creating promotional content for social media such as Instagram and Facebook. The training was facilitated by a marketing communication expert and included practice in producing product photos, writing engaging descriptions, and simulating online sales. The implementation phase emphasized learning by doing so that participants not only received theory but also directly applied it to their products.

The third phase was mentoring, intended to ensure that the knowledge and skills acquired could be implemented effectively. The team provided intensive assistance to artisans in developing new products, improving the quality of existing products, and designing promotional strategies that matched their product characteristics. The team also provided direct feedback on participants' works, identifying strengths and weaknesses and offering technical and aesthetic solutions. Mentoring was conducted both face-to-face and online through group communication, enabling continued interaction as participants worked independently.

The fourth phase was monitoring and evaluation, carried out in stages to assess program success. Monitoring was conducted during training by observing participant engagement, measuring skill mastery, and documenting changes in product quality. Final evaluation took place through an exhibition of works, where participants displayed the new products they had produced during the program. The exhibition served as an appreciation event, a reflection forum, and a benchmark for achievement. Indicators of success included increased production efficiency, the emergence of new design innovations, increased product diversification, and improved artisans' digital literacy.

Methodologically, these four phases formed an integrative learning cycle: preparation ensured program relevance; implementation delivered core skills; mentoring supported the application of knowledge; and monitoring and evaluation measured achievements and helped plan sustainability. With this design, the PkM program produced not only short-term outputs but also laid a foundation for woodcraft MSMEs to continue developing independently.

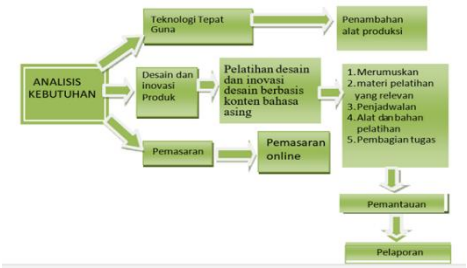

Figure 1. PkM implementation flow

RESULTS AND DISCUSSION

The PkM activities were carried out over six weeks. The program began with introductions and an opening session led by the implementation team together with the MSME partners and community members. The program leader presented the objectives, targets, and expected outputs, while also building commitment and a sense of togetherness. The implementation team then delivered an overview of wood production technology, product

design innovation, and diversification strategies through practical examples. This session provided foundational knowledge as a basis for artisans to innovate. In the next activity, an evaluation session was conducted on the artisans' existing work. The implementing lecturers, who are experts in craft (kriya), provided feedback on participants' previous products to identify technical weaknesses and opportunities for design innovation before the main activities began. Participants brought products they had made previously to be assessed in terms of materials, design, and finishing techniques. The team provided corrections as well as constructive input so that participants could recognize both weaknesses and potential areas for product development.

Figure 2. The implementation team provides feedback on the artisans' previous work.

The next technical training focused on: (1) using simple modern tools such as a mini grinder and a sanding machine to improve production efficiency; (2) applying new finishing techniques, including wood staining and clear coating, to strengthen the wood's natural character; and (3) utilizing wood waste as raw material for derivative products such as souvenirs, lamp frames, and high-value household items. At this stage, product innovation began to emerge through new creations with more creative designs.

Figure 3. Training on improving product quality.

In the following session, participants received training in digital marketing. The training covered creating marketplace accounts (Shopee, Tokopedia), producing promotional content based on professional product photography, and branding strategies using compelling narratives. This material was provided to address the main problem faced by MSMEs, namely that they had not previously utilized digital platforms optimally (Kurniawati et al., 2022). The discussion was interactive: participants not only listened but also directly practiced the steps for promoting products online.

Participants were divided into groups and worked using equipment provided by the team. They collaborated to create new products while also documenting product photos to be uploaded to digital platforms. At this stage, participants' collaborative spirit, creativity, and innovation were clearly visible, as they began to adapt to more modern production techniques while also understanding the importance of digital promotion.

Figure 4. Presentation and discussion on digital marketing.

At the end of the program, it was evident that several participants had begun to use Instagram as a promotional medium. This indicates that, with the mentoring provided by the PkM implementation team, artisans were able to adopt digital technology even though they had not previously been accustomed to it. These findings align with Putri & Nugraha (2021), who show that using marketplace platforms effectively expands MSMEs' market reach. Kurniawati et al. (2022) also emphasize that digital marketing can increase MSME sales by up to 40%. Therefore, the achievements of the PkM participants have positive implications for the sustainability of their businesses in the digital era. This can be seen in the following graph.

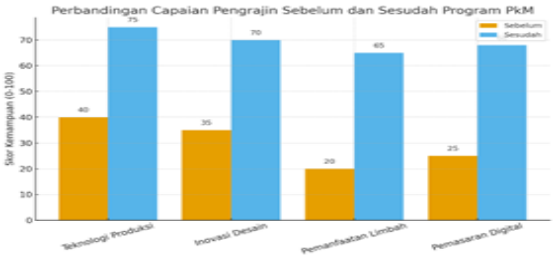

Figure 5. Graph of participants' competency improvement after participating in the PkM program.

From the graph above, it can be seen that the program provides a clear picture of the transformation experienced by the artisans. In terms of production, they shifted from manual methods to the use of more efficient simple technologies. In terms of design, they moved from monotonous patterns toward creative innovation. In terms of raw materials, they began to use waste to create new products. And in marketing, they transformed from local strategies to digital strategies. The improvement in production technology and design innovation indicates that artisans are becoming accustomed to technical changes, while the increase in digital marketing indicates an adoption of digital literacy which—although still new—has begun to be accepted by most participants. This is also reflected in the following table.

TABLE 1. Comparison of conditions before and after the PkM program.

Aspect	Before Program	After Program
Production technology	Mostly manual tools; limited efficiency and uneven finishing quality.	Adoption of simple tools and improved finishing; more consistent outputs and faster processing.
Design innovation	Product patterns relatively monotonous; limited exposure to market trends.	New variations developed (decorative items, minimalist furniture, thematic products) aligned with consumer trends.
Wood-waste utilization	Offcuts and waste often unused or discarded.	Waste converted into derivative products (souvenirs/household accessories); improved material efficiency and added value.
Marketing strategy	Primarily local/offline sales and personal networks.	Initial adoption of social media and marketplaces; improved product photography and branding materials.

Several factors supporting the success of the program include: (1) high participant enthusiasm, (2) the availability of competent resource persons, and (3) facility support from local partners. Meanwhile, inhibiting factors include the limited ability of some participants to master digital technology and limited time because they also had to continue working to fulfill daily orders. Nevertheless, these inhibiting factors can be addressed through intensive mentoring and follow-up training. In fact, the presence of these obstacles highlights the importance of program sustainability so that the changes achieved can truly take root and not stop once the program ends.

CONCLUSION

The Community Service Program (PkM) titled "Optimizing the Quality and Variety of Wooden Craft Products Through Technology Training and Innovative Design for MSMEs in Triharjo Village, Wates, Kulon Progo" has made a tangible contribution to empowering local artisans. The evaluation results show that the program not only improved technical competence, but also influenced participants' mindset, creativity, and marketing strategies.

In terms of production technology, artisans mastered the use of simple modern tools that made production processes more efficient and product results more consistent. In terms of design innovation, participants began to move beyond monotonous patterns and produced new products that align with market trends, including minimalist furniture, decorative items, and thematic products. In terms of wood-waste utilization, the program fostered awareness that waste can be processed into value-added products, reducing wastefulness while supporting sustainability principles. A local-wisdom-based approach to waste management not only increased value added but also supported environmental sustainability. Thus, these achievements provide not only economic benefits but also align with the principles of sustainable development (Santoso et al., 2022; Wahyuni & Putra, 2020).

Figure 6. Examples of artisans' products

From the digital marketing perspective, artisans successfully took initial steps toward digital transformation by using marketplaces and social media as channels for product promotion and distribution. Overall, these four achievements demonstrate a comprehensive transformation in the woodcraft MSME value chain, from production to marketing. This confirms that the PkM program effectively addressed the main problems identified at the outset: limited technology, minimal design innovation, insufficient waste utilization, and weak marketing strategies.

From an academic perspective, the program strengthens the community empowerment framework, which emphasizes active participation as a key to successful local capacity development. It also confirms the relevance of previous research (Prasetyo et al., 2020; Hasibuan, 2022; Kurniawati et al., 2022) regarding the role of technology, innovative design, and digital marketing as strategic factors in improving MSME competitiveness. Accordingly, the program provides practical impact while enriching academic discourse on technology- and local-culture-based empowerment strategies. In sum, this PkM activity shows that collaboration among universities, communities, and government can generate real change. Going forward, program sustainability is a key factor so that the transformation achieved is not temporary but becomes embedded in the everyday practices of woodcraft artisans in Triharjo Village.

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From an academic perspective, the program strengthens the community empowerment framework, which emphasizes active participation as a key to successful local capacity development. It also confirms the relevance of previous research (Prasetyo et al., 2020; Hasibuan, 2022; Kurniawati et al., 2022) regarding the role of technology, innovative design, and digital marketing as strategic factors in improving MSME competitiveness. Accordingly, the program provides practical impact while enriching academic discourse on technology- and local-culture-based empowerment strategies. In sum, this PkM activity shows that collaboration among universities, communities, and government can generate real change. Going forward, program sustainability is a key factor so that the transformation achieved is not temporary but becomes embedded in the everyday practices of woodcraft artisans in Triharjo Village.

RECOMMENDATIONS

To maintain the continuity of the achievements, ongoing mentoring is needed so that product innovation and quality are sustained and continue to develop. Local government is expected to provide support by facilitating exhibitions, organizing follow-up trainings, and building collaboration networks with marketplaces and creative communities. With such support, woodcraft MSMEs in Triharjo Village will be better able to develop, innovate, and compete more broadly at regional and national levels. In addition, products resulting from the training need a strong visual identity so they are easily recognized in digital markets. Local government can assist by creating labels or certification such as "Triharjo Crafts" as a form of recognition of quality and originality of local products. This can also serve as a promotional strategy for creative-economy tourism based on local wisdom (Wahyuni & Putra, 2020).

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THE EFFECT OF CIRCUIT TRAINING AND HURDLE DRILLS WITH ACTIVE AND PASSIVE RECOVERY ON IMPROVING VO_2MAX AND AGILITY IN BADMINTON ATHLETES

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Abstract. Background: Badminton is a high-intensity intermittent sport that places substantial demands on aerobic endurance and agility due to frequent accelerations, rapid changes of direction, and repeated explosive movements. Among physical fitness components, maximal oxygen uptake (VO_2Max) and agility are critical determinants of sustained performance and movement efficiency during prolonged match play. Coaches commonly apply circuit training and hurdle drill exercises to develop these capacities; however, empirical evidence comparing their effectiveness, particularly when combined with different recovery strategies, remains limited. Purpose: This study aimed to examine the effects of circuit training and hurdle drill combined with active and passive recovery on VO_2Max and agility in competitive badminton athletes. Materials and Methods: A controlled experimental study with a 2 × 2 factorial design was conducted involving 20 badminton athletes from the Aceh Provincial Training Center (Pelatda PBSI Aceh). Participants were allocated into four groups using Match Subject Ordinal Pairing based on pretest scores. The intervention lasted six weeks (18 sessions). VO_2Max was assessed using the Multistage Fitness Test, while agility was measured using the T-Test. Data were analyzed using Shapiro–Wilk tests, Levene's tests, and Two-Way ANOVA at a significance level of 0.05. Results: All groups demonstrated improvements in VO_2Max and agility from pretest to posttest. However, statistical analysis revealed no significant differences between circuit training and hurdle drill, no significant differences between active and passive recovery, and no significant interaction effects between training method and recovery type ($p > 0.05$). Conclusion: Both circuit training and hurdle drill, regardless of recovery strategy, are effective for improving VO_2Max and agility in badminton athletes. These findings suggest that coaches may flexibly select training methods and recovery approaches based on practical considerations without compromising physical performance outcomes.

Keywords: badminton, circuit training, hurdle drill, VO_2Max, agility, recovery strategies

INTRODUCTION

Badminton is a high-intensity intermittent sport characterized by rapid accelerations, frequent changes of direction, jumps, lunges, and repeated overhead strokes performed within relatively short rally durations interspersed with brief recovery periods. At the elite and sub-elite levels, match performance is strongly determined by the athlete's physical conditioning, particularly aerobic endurance and agility, which underpin the ability to sustain technical and tactical execution throughout prolonged competition. Recent performance analyses indicate that badminton rallies typically last between 5–15 seconds with rest intervals of approximately 15–30 seconds, imposing substantial demands on both aerobic and anaerobic energy systems (Phomsoupha & Laffaye, 2020; Abián-Vicén et al., 2021). Consequently, the development of optimal physiological capacity is a fundamental prerequisite for competitive success in badminton.

Among the components of physical fitness, maximal oxygen uptake (VO_2Max) represents a critical indicator of aerobic endurance and the efficiency of the cardiovascular and respiratory systems in supplying oxygen to working muscles. A higher VO_2Max enables athletes to delay fatigue, maintain high-intensity movement patterns, and recover more rapidly between rallies and sets. Contemporary studies in racket sports demonstrate that athletes with superior VO_2Max values exhibit better match consistency and reduced performance decrement across successive games (Metaxas, 2021; Nugroho et al., 2022). In badminton specifically, VO_2Max has been identified as a key determinant of repeated high-intensity actions, allowing players to sustain explosive footwork and stroke production under competitive pressure.

In parallel with aerobic endurance, agility is another dominant physical attribute in badminton performance. Agility encompasses the ability to rapidly change direction and body position with precision, balance, and neuromuscular control in response to external stimuli. Given the multidirectional movement demands inherent in badminton such as forward lunges, lateral shuffles, backward steps, and vertical jumps high levels of agility are

essential for effective court coverage and shuttlecock interception. Empirical evidence indicates that agility-oriented training interventions significantly enhance movement efficiency and reaction capability in badminton athletes, thereby improving both offensive and defensive performance (Doshi et al., 2021; Dewangga & Tomoliyus, 2020).

To optimize VO_2Max and agility, coaches frequently employ diverse conditioning methods, among which circuit training and hurdle drill exercises are widely utilized. Circuit training integrates multiple exercise stations targeting cardiovascular endurance, muscular strength, and coordination within a single session, offering time-efficient and sport-adaptable conditioning. Recent investigations have shown that circuit-based training protocols can effectively improve aerobic capacity and overall physical fitness in athletes engaged in intermittent sports (Yunus, 2023; Ariffin et al., 2020). Conversely, hurdle drill training, commonly classified within plyometric and agility-based exercises, emphasizes explosive lower-limb actions, neuromuscular efficiency, and rapid ground contact, which are directly relevant to badminton footwork patterns. Hurdle-based drills have been reported to enhance agility, power, and movement economy when applied systematically within training programs (Nugroho et al., 2022; Cakrawijaya, 2021).

Despite the recognized benefits of both training modalities, empirical findings comparing the relative effectiveness of circuit training and hurdle drill training on VO_2Max and agility in badminton athletes remain inconclusive. Moreover, training adaptation is not solely influenced by exercise modality but also by recovery strategies implemented between training bouts. Active and passive recovery represent two commonly applied approaches, each with distinct physiological implications. Active recovery is associated with enhanced lactate clearance and maintenance of muscle perfusion, whereas passive recovery prioritizes energy restoration and neuromuscular relaxation (Buchheit & Laursen, 2013; Monks et al., 2017). However, evidence regarding the differential impact of recovery type on aerobic and agility adaptations, particularly within short-term training interventions, is still limited and inconsistent.

Therefore, this study aims to examine the effects of circuit training and hurdle drill training combined with active and passive recovery on VO_2Max and agility in badminton athletes using a factorial experimental design. By addressing gaps in the existing literature, this research seeks to provide evidence-based insights for coaches and practitioners regarding the selection of effective training and recovery strategies to enhance physical performance in competitive badminton contexts.

METHODS

This study employed a controlled experimental approach designed to examine the effects of different training modalities and recovery strategies on physiological and motor performance outcomes in competitive badminton athletes. An experimental design was selected because it allows for causal inference by systematically manipulating independent variables while controlling extraneous factors. Specifically, a 2 × 2 factorial design was implemented to simultaneously evaluate the main effects of training method (circuit training vs. hurdle drill), recovery type (active vs. passive), and their interaction on VO_2Max and agility.

The factorial design was particularly appropriate for this study because physical performance adaptations in sport are multifactorial and rarely influenced by a single variable. By integrating training modality and recovery strategy within one experimental framework, this study offers a more ecologically valid representation of real-world training environments in elite badminton preparation. All procedures were conducted under standardized conditions to ensure measurement accuracy, participant safety, and methodological reproducibility.

Table. 1 Summary of Research Methods

Component	Description
Research Design	Experimental study using a **2 × 2 factorial design**
Independent Variables	(1) Training method: circuit training vs. hurdle drill; (2) Recovery type: active recovery vs. passive recovery
Dependent Variables	Aerobic capacity (VO_2Max) and agility
Participants	20 competitive badminton athletes from Pelatda PBSI Aceh
Sampling Technique	Total sampling (population sampling)
Group Allocation	Match Subject Ordinal Pairing (MSOP) based on pre-test VO_2Max and agility scores
Number of Groups	Four groups (n = 5 per group): A1B1, A1B2, A2B1, A2B2
Training Duration	18 training sessions
Training Frequency	3 sessions per week
Training Interventions	Circuit training program and hurdle drill training program
Recovery Protocols	Active recovery (low-intensity movement) and passive recovery (complete rest)

VO_2Max Measurement	Multistage Fitness Test (20-m shuttle run)
Agility Measurement	T-Test agility assessment
Data Collection Method	Pre-test and post-test measurement
Validity & Reliability	Instruments demonstrated high validity and reliability
Data Analysis	Shapiro–Wilk test, Levene's test, Two-Way ANOVA ($\alpha = 0.05$)
Ethical Considerations	Participant consent, injury prevention, and supervised testing

Participants consisted of 20 trained badminton athletes actively enrolled in the Aceh Provincial Training Center (Pelatda PBSI Aceh). A total sampling technique was applied to ensure representativeness and to avoid selection bias. Prior to group allocation, all athletes completed pre-tests assessing VO_2Max and agility. The Match Subject Ordinal Pairing (MSOP) method was then used to distribute participants evenly across four experimental groups, ensuring equivalence in baseline performance.

The intervention lasted six weeks, comprising 18 training sessions conducted three times per week. Circuit training consisted of multiple exercise stations targeting cardiovascular endurance, muscular endurance, and movement coordination, while hurdle drill training emphasized plyometric movements, rapid footwork, and change-of-direction speed. Recovery protocols were systematically manipulated: active recovery involved low-intensity movements to facilitate metabolic clearance, whereas passive recovery involved complete rest.

VO_2Max was measured using the Multistage Fitness Test, a widely accepted field test for estimating aerobic capacity, while agility was assessed using the T-Test, which reflects sport-specific change-of-direction ability relevant to badminton. Both instruments demonstrated acceptable validity and reliability, supporting data accuracy.

Data analysis followed rigorous statistical procedures. Normality was assessed using the Shapiro–Wilk test, homogeneity of variance using Levene's test, and hypothesis testing using Two-Way ANOVA with a significance level of 0.05. Ethical principles were upheld throughout the study, including informed consent, safety monitoring, and adherence to standardized testing protocols.

RESULTS

Physical Demands of Badminton Performance

Badminton is characterized as a high-intensity intermittent sport that requires repeated bouts of explosive movements interspersed with brief recovery periods. Modern badminton matches involve rapid accelerations, decelerations, lunges, jumps, and frequent changes of direction, placing substantial physiological and neuromuscular demands on athletes. Match analyses have shown that rallies typically last between 5–15 seconds, followed by short recovery intervals of approximately 15–25 seconds, with total match duration often exceeding 40 minutes in elite competition (Phomsoupha & Laffaye, 2020).

The energetic demands of badminton are underpinned by the combined contribution of aerobic and anaerobic energy systems. Although explosive actions rely heavily on anaerobic metabolism, the aerobic system plays a critical role in sustaining repeated high-intensity efforts, facilitating phosphocreatine resynthesis, and accelerating recovery between rallies (Abian-Vicen et al., 2021). Consequently, athletes with higher aerobic fitness are better able to maintain technical consistency and movement efficiency throughout prolonged matches.

In addition to aerobic capacity, agility is a defining physical attribute in badminton performance. Agility encompasses rapid changes of direction, body control, balance, and coordination, all of which are essential for effective footwork and court coverage. Studies have demonstrated that elite badminton players exhibit superior agility and movement efficiency compared with sub-elite players, enabling faster shuttlecock interception and improved defensive and offensive transitions (Nugroho et al., 2022).

Furthermore, fatigue accumulation during match play has been shown to impair reaction time, movement precision, and decision-making, particularly when aerobic endurance is insufficient (Ooi et al., 2020). Therefore, physical conditioning programs in badminton must simultaneously address aerobic endurance and agility to meet the sport's complex demands. Understanding these physical requirements provides a foundational rationale for investigating training interventions such as circuit training and hurdle drills, which aim to enhance both VO_2Max and agility in badminton athletes.

VO_2Max in Badminton Athletes

VO_2Max represents the maximal capacity of the cardiovascular and respiratory systems to deliver and utilize oxygen during intense exercise and is widely recognized as a key indicator of aerobic endurance. In badminton, VO_2Max is particularly important due to the sport's intermittent nature, which requires athletes to repeatedly

recover from high-intensity actions within short time frames. Higher VO_2Max values have been associated with superior match endurance, reduced fatigue accumulation, and improved consistency of performance (Metaxas, 2021).

Recent studies indicate that elite badminton players typically demonstrate moderate to high VO_2Max values compared to athletes in other racket sports, reflecting the significant aerobic contribution required to sustain prolonged match play (Abián et al., 2020). Adequate aerobic capacity enables faster recovery of heart rate and oxygen saturation between rallies, supporting repeated sprint ability and sustained movement quality.

Training interventions aimed at improving VO_2Max in badminton often incorporate interval-based and mixed-modality conditioning approaches. Circuit training has been identified as an effective method for enhancing cardiovascular fitness by combining resistance, plyometric, and endurance-based exercises in a structured format (Yunus, 2023). Similarly, plyometric-oriented drills, such as hurdle-based exercises, may indirectly contribute to aerobic adaptations when performed with sufficient volume and intensity (Nugroho et al., 2021).

However, the magnitude of VO_2Max improvement is influenced by several moderating factors, including baseline fitness level, training load, recovery strategies, and intervention duration. Buchheit and Laursen (2023) emphasized that aerobic adaptations are optimized when training stimuli are balanced with appropriate recovery to prevent excessive fatigue and maladaptation. In badminton athletes, insufficient recovery may blunt VO_2Max gains despite adequate training intensity.

Despite extensive research on VO_2Max development, limited studies have directly compared different training modalities while simultaneously considering recovery type in badminton populations. This gap underscores the importance of examining how circuit training and hurdle drills, combined with active or passive recovery, influence aerobic capacity in a controlled experimental setting.

Agility in Badminton

Agility is defined as the ability to rapidly change direction or speed in response to external stimuli while maintaining balance and control. In badminton, agility is a fundamental performance determinant due to the sport's requirement for quick multidirectional movements, explosive footwork, and precise positioning. Effective agility allows players to reach the shuttlecock efficiently, execute technical strokes accurately, and recover swiftly for subsequent actions (Dewangga & Tomoliyus, 2020).

From a biomechanical perspective, agility in badminton integrates multiple physical components, including speed, muscular power, coordination, reaction time, and dynamic balance. These components collectively enable athletes to perform rapid lunges, lateral shuffles, backward movements, and jumps under time pressure (Chaabene et al., 2020). Research has consistently shown that superior agility differentiates elite from sub-elite badminton players (Niyati Mukesh et al., 2021).

Agility training in badminton typically involves sport-specific footwork drills, ladder exercises, plyometric movements, and change-of-direction tasks. Such training has been demonstrated to improve movement efficiency and neuromuscular control, thereby enhancing on-court performance (Granacher et al., 2021). Plyometric-based exercises, including hurdle drills, are particularly effective in improving stretch–shortening cycle efficiency, which underpins rapid directional changes.

Despite its importance, agility is highly sensitive to fatigue. Accumulated fatigue can impair neuromuscular coordination and reaction speed, reducing agility performance during matches (Girard et al., 2021). Therefore, training programs must carefully balance intensity and recovery to maximize agility adaptations.

Although numerous studies have examined agility training independently, fewer have investigated agility improvements within combined conditioning programs that also target aerobic capacity. Moreover, the role of recovery strategies in modulating agility adaptations remains underexplored. This highlights the relevance of evaluating agility outcomes following circuit training and hurdle drills under different recovery conditions in badminton athletes.

Circuit Training in Sports Conditioning

Circuit training is a structured training method that involves a sequence of exercises performed at different stations with minimal rest between stations. This approach is widely used in sports conditioning due to its efficiency and versatility in targeting multiple physical components simultaneously, including aerobic endurance, muscular strength, power, and agility (Ariffin et al., 2020). In intermittent sports such as badminton, circuit training is particularly advantageous because it mimics the sport's physiological demands.

Several studies have demonstrated that circuit training can significantly improve VO_2Max when designed with appropriate intensity, volume, and work-to-rest ratios. Yunus (2023) reported notable increases in aerobic capacity following a six-week circuit training intervention, attributing the improvements to sustained cardiovascular stimulation and metabolic stress. Additionally, circuit training can incorporate agility-oriented exercises, thereby addressing movement efficiency alongside endurance.

From a neuromuscular standpoint, circuit training enhances motor unit recruitment and intermuscular coordination through varied exercise stimuli. This contributes to improved movement control and reduced injury

risk (Granacher et al., 2021). Furthermore, the varied nature of circuit training reduces monotony, which may improve athlete adherence and motivation.

However, the effectiveness of circuit training is influenced by recovery management. Insufficient recovery between sessions may lead to cumulative fatigue, potentially limiting performance gains (Buchheit & Laursen, 2023). Active recovery strategies may facilitate faster physiological restoration, whereas passive recovery may support long-term adaptation by allowing greater tissue repair.

Despite its widespread use, limited research has directly compared circuit training with plyometric-dominant methods, such as hurdle drills, in badminton contexts. Understanding the comparative effectiveness of these methods, particularly under different recovery conditions, is essential for evidence-based training prescription.

Hurdle Drill and Plyometric Training

Hurdle drills are a form of plyometric training that emphasizes explosive lower-limb movements, rapid ground contact, and neuromuscular efficiency. Plyometric training exploits the stretch–shortening cycle to enhance muscular power, speed, and agility, making it particularly relevant for badminton athletes who rely on explosive footwork and jumping actions (Chaabene et al., 2020).

Research indicates that hurdle-based plyometric training improves change-of-direction speed, reactive strength, and movement coordination. Nugroho et al. (2022) demonstrated that plyometric interventions significantly enhanced agility and VO_2Max in badminton athletes, suggesting that such training may elicit both neuromuscular and cardiovascular adaptations when applied with sufficient volume.

The dynamic nature of hurdle drills closely resembles badminton-specific movements, including rapid lateral transitions and forward–backward shifts. This specificity enhances transferability to on-court performance (Loturco et al., 2021). Additionally, hurdle drills may stimulate aerobic adaptations indirectly by increasing overall training intensity and metabolic demand.

Nevertheless, plyometric training imposes substantial mechanical stress on the musculoskeletal system, increasing the importance of appropriate recovery strategies. Inadequate recovery may elevate injury risk and attenuate performance gains (Monks et al., 2021). Active recovery may assist in lactate clearance and neuromuscular restoration, while passive recovery may support structural repair.

Despite promising findings, direct comparisons between hurdle drills and more comprehensive conditioning methods, such as circuit training, remain scarce in badminton literature. This gap supports the need for experimental investigations examining both methods under controlled recovery conditions.

Recovery Strategies in Training Adaptation

Recovery is a critical component of training adaptation, encompassing physiological, neuromuscular, and psychological restoration processes. In sports conditioning, recovery strategies are commonly classified as active or passive. Active recovery involves low-intensity movement to facilitate circulation and metabolic clearance, whereas passive recovery entails complete rest (Dupont et al., 2021).

Active recovery has been shown to accelerate lactate removal and heart rate normalization following high-intensity exercise, potentially enhancing readiness for subsequent efforts (Buchheit & Laursen, 2023). Conversely, passive recovery may promote greater energy restoration and tissue repair, particularly following mechanically demanding training such as plyometrics.

The effectiveness of recovery strategies depends on training intensity, volume, and individual athlete characteristics. Girard et al. (2021) noted that fitter athletes may benefit more from active recovery, while less-conditioned individuals may require longer passive recovery to avoid excessive fatigue.

In badminton, where training sessions often involve repeated high-intensity actions, recovery management is essential to sustain adaptation and prevent overtraining. However, empirical evidence comparing active and passive recovery in badminton-specific conditioning programs remains limited.

Importantly, recovery strategies may interact with training modality. For example, circuit training may benefit from active recovery due to its metabolic demands, whereas hurdle drills may require more passive recovery to accommodate mechanical stress. Investigating these interactions provides valuable insight into optimizing training efficiency.

This section presents the empirical findings obtained from the experimental study examining the effects of circuit training and hurdle drill combined with active and passive recovery on VO_2Max and agility in badminton athletes. Data were collected using a pretest–posttest design and analyzed descriptively and inferentially. The results are organized into three main subsections: (1) descriptive statistics of agility, (2) descriptive statistics of VO_2Max, and (3) hypothesis testing using Two-Way ANOVA.

Descriptive Results of Agility Performance

Before presenting the statistical comparison, descriptive analysis was conducted to examine changes in agility performance following the training interventions. Agility was assessed using the T-Test, which reflects an

athlete's ability to change direction rapidly while maintaining balance and speed. The descriptive statistics include mean values, standard deviations, and minimum–maximum scores for both pretest and posttest measurements across all experimental groups.

Table. 2 Descriptive Statistics of Agility Pretest and Posttest

Recovery Type	Training Method	Test Phase	Mean	SD	Min	Max
Active	Circuit Training	Pretest	11.720	0.492	11.1	12.3
		Posttest	10.460	0.885	9.5	11.5
Active	Hurdle Drill	Pretest	12.040	0.971	10.8	13.3
		Posttest	10.040	0.451	9.6	10.7
Passive	Circuit Training	Pretest	12.280	1.101	10.9	13.7
		Posttest	11.140	0.631	10.2	11.7
Passive	Hurdle Drill	Pretest	12.600	0.809	11.3	13.3
		Posttest	10.620	0.709	9.8	11.5

The descriptive data indicate that all training groups demonstrated improvements in agility, as shown by decreased T-Test completion times from pretest to posttest. Athletes undergoing hurdle drill with active recovery exhibited the greatest numerical improvement, while those in the passive recovery groups showed comparatively smaller reductions in agility time. Despite these observable trends, variability within groups remained moderate, suggesting inter-individual differences in response to training.

Although both circuit training and hurdle drill contributed positively to agility enhancement, the overlapping standard deviations and comparable mean reductions indicate that neither training method demonstrated a clear descriptive superiority. These findings suggest that agility improvements can be achieved through multiple training modalities when appropriately structured.

Descriptive Results of VO_2Max Performance

VO_2Max was assessed using the Multistage Fitness Test (MFT) to evaluate aerobic endurance adaptations resulting from the training interventions. Descriptive statistics were calculated to examine changes in aerobic capacity across training and recovery conditions.

Table. 3 Descriptive Statistics of VO_2Max Pretest and Posttest ($ml \cdot kg^{-1} \cdot min^{-1}$)

Recovery Type	Training Method	Test Phase	Mean	SD	Min	Max
Active	Circuit Training	Pretest	46.760	8.779	31.9	54.7
		Posttest	54.380	6.015	44.5	59.0
Active	Hurdle Drill	Pretest	42.320	3.443	37.1	45.6
		Posttest	48.660	2.405	46.2	52.2
Passive	Circuit Training	Pretest	41.880	6.691	34.6	49.6
		Posttest	48.340	3.850	43.3	52.5
Passive	Hurdle Drill	Pretest	43.120	4.974	34.7	47.1
		Posttest	50.640	6.311	40.2	56.5

The results demonstrate a consistent increase in VO_2Max values across all experimental groups, indicating that both training methods were effective in enhancing aerobic endurance. Athletes in the circuit training with active recovery group achieved the highest posttest VO_2Max mean, suggesting a strong cardiovascular stimulus from this training combination.

However, improvements were also evident in hurdle drill groups, reinforcing the aerobic contribution of plyometric-based movement patterns. The relatively wide range of VO_2Max values reflects differences in baseline fitness levels, yet the overall upward trend confirms the effectiveness of structured physical conditioning programs for badminton athletes.

Hypothesis Testing Using Two-Way ANOVA

To determine whether observed improvements differed significantly across training methods, recovery types, and their interaction, Two-Way ANOVA was conducted for both dependent variables.

Table. 4 Two-Way ANOVA Results for Agility and VO_2Max

Source of Variation	Variable	F	Sig.
Training Method	Agility	2.343	0.142
	VO_2Max	0.605	0.448
Recovery Type	Agility	4.209	0.057
	VO_2Max	0.853	0.369
Training × Recovery	Agility	0.027	0.873
	VO_2Max	3.329	0.087

The inferential analysis revealed that no statistically significant differences were found between circuit training and hurdle drill in improving agility or VO_2Max ($p > 0.05$). Similarly, active and passive recovery strategies did not produce significantly different outcomes for either variable. Furthermore, the interaction effect between training method and recovery type was not statistically significant, indicating that these factors operated independently rather than synergistically.

Despite the lack of statistical significance, the descriptive improvements observed across all groups underscore the practical effectiveness of both training modalities. These findings suggest that coaches may flexibly apply either circuit training or hurdle drill, with recovery strategies tailored to individual athlete needs rather than fixed prescriptions.

DISCUSSION

The present study examined the effects of circuit training and hurdle drill combined with active and passive recovery on VO_2Max and agility in competitive badminton athletes. The main findings indicate that although both training methods and recovery strategies resulted in meaningful improvements in VO_2Max and agility, no statistically significant differences were observed between training modalities, recovery types, or their interaction. These findings provide important insights into the nature of physical adaptations in badminton athletes and contribute to the ongoing debate regarding optimal conditioning strategies.

The results demonstrated that both circuit training and hurdle drill significantly increased VO_2Max values from pretest to posttest across all groups. However, inferential analysis revealed no significant difference between the two training methods. This finding suggests that both circuit training and hurdle drill provide sufficient aerobic stimuli to elicit cardiovascular adaptations in badminton athletes.

From a physiological perspective, circuit training is known to enhance VO_2Max through sustained cardiovascular loading, elevated heart rate responses, and increased oxygen demand resulting from multi-station exercises targeting large muscle groups. Meanwhile, hurdle drill training, although primarily classified as plyometric and agility-based, may indirectly improve aerobic capacity when performed repetitively with minimal rest, thereby increasing metabolic stress. This explanation aligns with the characteristics of badminton, which combines explosive movements with repeated high-intensity actions interspersed with short recovery periods.

The absence of significant differences between training methods is consistent with the concept that aerobic adaptations are highly responsive to overall training load rather than exercise specificity alone, particularly in short-term interventions. Given the six-week training duration, it is plausible that both training methods produced comparable cardiovascular stimuli sufficient to enhance VO_2Max but insufficient to create divergent adaptations.

Agility performance improved in all experimental groups, as indicated by reduced T-Test completion times. Although the hurdle drill combined with active recovery showed the greatest numerical improvement, statistical analysis did not reveal a significant difference between training methods. This finding suggests that agility improvements can be achieved through both general and specific conditioning approaches when appropriately structured.

Hurdle drills emphasize neuromuscular coordination, stretch–shortening cycle efficiency, and rapid ground contact, which are directly related to agility demands in badminton. However, circuit training can also enhance agility indirectly by improving muscular endurance, coordination, and movement control across multiple exercise stations. The comparable improvements observed in both groups highlight the multifactorial nature of agility, which depends not only on movement specificity but also on overall physical conditioning.

Furthermore, agility is sensitive to fatigue, balance, and coordination. Improvements observed across all groups suggest that the training programs were effective in enhancing neuromuscular efficiency without inducing excessive fatigue that could impair performance.

The findings showed no significant differences between active and passive recovery in improving VO_2Max or agility. Although active recovery theoretically enhances lactate clearance and accelerates physiological restoration, its advantages may be less pronounced in short-term training interventions with moderate training

volumes. Similarly, passive recovery allows sufficient energy replenishment and tissue repair, which may equally support adaptation.

The near-significant p-value observed for agility ($p = 0.057$) suggests that recovery type may exert a subtle influence on neuromuscular performance, although the effect was insufficient to reach statistical significance. This outcome may be attributed to individual variability in recovery capacity, baseline fitness levels, and adaptation rates among athletes.

The Two-Way ANOVA results indicated no significant interaction between training method and recovery type for either VO_2Max or agility. This finding implies that training modality and recovery strategy functioned independently, rather than synergistically, in influencing performance outcomes. Although visual inspection of interaction plots suggested potential trends, statistical evidence did not support a meaningful interaction effect.

The lack of interaction may be explained by the relatively small sample size and the homogeneous training background of participants, which can limit the detection of interaction effects. Additionally, the intervention duration may not have been sufficient to produce differentiated adaptations based on recovery strategy.

Despite the absence of statistically significant differences, the consistent improvements observed across all groups underscore the practical effectiveness of both circuit training and hurdle drill in enhancing VO_2Max and agility in badminton athletes. These findings suggest that coaches may flexibly select training methods based on available resources, athlete preferences, and periodization goals, without compromising physical performance outcomes.

Future research should consider longer intervention durations, larger sample sizes, and more individualized recovery prescriptions to further elucidate the nuanced relationships between training modality, recovery strategy, and performance adaptation in badminton athletes.

CONCLUSION

This study was designed to examine the effects of circuit training and hurdle drill combined with active and passive recovery on VO_2Max and agility in competitive badminton athletes using a 2×2 factorial experimental design. Based on the results obtained from pretest–posttest measurements and Two-Way ANOVA analysis, several important conclusions can be drawn regarding training effectiveness, recovery strategies, and their practical implications for badminton conditioning programs.

First, the findings demonstrate that both circuit training and hurdle drill training effectively improved VO_2Max and agility in badminton athletes. All experimental groups showed consistent increases in aerobic capacity and meaningful reductions in agility test times following the six-week training intervention. However, statistical analysis revealed no significant differences between circuit training and hurdle drill in their effects on VO_2Max or agility. This indicates that both training modalities provide sufficient physiological and neuromuscular stimuli to support performance enhancement in badminton, particularly within short-term training periods.

Second, the comparison between active and passive recovery showed that neither recovery strategy produced significantly superior outcomes for VO_2Max or agility. Although active recovery is theoretically associated with faster metabolic clearance and improved readiness for subsequent efforts, and passive recovery supports energy restoration and tissue repair, the results suggest that both recovery approaches were equally effective in facilitating adaptation under the training conditions applied in this study. These findings imply that recovery strategy selection may be flexible and adapted to individual athlete needs, training schedules, and contextual constraints.

Third, the analysis of interaction effects indicated that no significant interaction existed between training method and recovery type for either VO_2Max or agility. This suggests that the effectiveness of circuit training and hurdle drill was not dependent on whether active or passive recovery was applied. Training modality and recovery strategy appeared to operate independently rather than synergistically in influencing physical performance outcomes.

From a practical perspective, the results of this study provide valuable guidance for coaches and practitioners in badminton. Given the absence of significant differences between training methods and recovery strategies, coaches may select either circuit training or hurdle drill based on available facilities, athlete preferences, and periodization objectives without compromising improvements in VO_2Max and agility. Similarly, recovery strategies can be tailored individually rather than prescribed rigidly.

In conclusion, this study confirms that structured physical conditioning programs regardless of whether they emphasize circuit-based or plyometric-based training and whether they incorporate active or passive recovery can effectively enhance aerobic endurance and agility in badminton athletes. Future research is recommended to explore longer intervention durations, larger sample sizes, and individualized recovery prescriptions to further clarify training recovery interactions and optimize performance development in competitive badminton contexts.

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Dıgıtalızıng of Waste Bank Servıces to Improve The Operatıonal Effıcıency of Waste Management in The Yogyakarta City

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Abstract. The escalating waste crisis in Yogyakarta City, where 35% of 350 daily tons remains unmanaged, presents an urgent environmental and public health imperative. This critical gap underscores the necessity for innovative, scalable solutions to transform traditional waste management systems. This research and development (R&D) study responds to this urgency by developing and implementing "Bank Sampahku Version 2.0," a digital platform designed to overcome the severe inefficiencies of manual, fragmented waste bank operations. Employing the ADDIE model, the study engineered an Android application to automate core processes, enhance transparency, and incentivize community participation in sustainable waste practices. Pilot implementation results demonstrate significant efficacy: operational efficiency surged with a 67.5% reduction in transaction time and 95% data accuracy, while community engagement increased by 45%, leading to a 28% rise in managed waste volume. However, a socio-technical analysis reveals that technological success alone is insufficient. Persistent systemic barriers, including infrastructural deficits (affecting 76.9% of waste banks), low digital literacy (42.5% of managers requiring training), and inadequate fiscal-policy support (only 4.2% local budget allocation), threaten long-term viability and scalability. Therefore, this study asserts that the urgent digital transformation of waste management must be paralleled by an equally urgent investment in its ecosystem. Sustainable impact hinges on a systemic reconciliation through pentahelix collaboration, strategic capacity building, and strengthened regulatory frameworks to ensure these digital innovations translate into tangible, enduring progress toward urban sustainability and SDGs targets.

Keyword: digitalization, waste bank, sustainable waste management, socio-technical systems, ADDIE model, Yogyakarta.

INTRODUCTION

The city of Yogyakarta, as a cultural and educational hub, faces significant environmental pressures due to the high volume of waste generated by its dense population and tourism activities. The city's waste management system has failed to process daily waste, with only 65% of the 350 tons of daily waste being managed optimally, necessitating a more effective approach1. Waste banks, as community-based instruments based on the 3R principle (Reduce, Reuse, Recycle), have the potential to contribute to reducing this burden. However, its effectiveness in Yogyakarta is still hampered by a manual operational system, which is prone to inefficiency and errors, as well as suboptimal community participation.

In this context, the digitization of waste bank services has emerged as a strategic imperative. Transformation based on Information and Communication Technology (ICT) has the potential to revolutionize operational aspects, from registration and transaction recording to monitoring, thereby increasing accountability and transparency. The adoption of digital systems can boost operational efficiency by up to 40% and community participation by up to 30%2. However, the national reality shows that only about 20% of the 11,000 waste banks in Indonesia have utilized digital technology3. Therefore, accelerating digitalization is not only a technical solution to improve the effectiveness of waste management at the local level, but also a necessity to align these efforts with the achievement of sustainable development goals (SDGs).

TABLE 1. Distribution of the number of independent waste banks in the Special Region of Yogyakarta as of 2024[4]

No.	Regency / City	Number of Independent Waste Banks
1.	Yogyakarta City	82
2.	Sleman Regency	93
3.	Bantul Regency	84
5.	Gunungkidul Regency	76
6.	Kulon Progo Regency	56
	Total amount	391

Digital transformation has revolutionized information accessibility, with digital applications designed to simplify human work and change social interaction patterns5. The adoption of digitalization through the use of mobile phones and applications plays a crucial role in document management6 and can become a center for fulfilling daily needs due to its ability to provide integrated information and facilities7. The shift from analog to digital has changed the operational paradigm from human dependence to automation, enabling easy access through platforms such as the Play Store, which reconstructs socio-economic dynamics8. Digital services are a transformation of conventional services through the use of technology, information, and communication aimed at improving efficiency, accessibility, and service quality. The main characteristics of digital services include universal accessibility, efficiency through automation, interactivity, and personalization9. This concept is an integral part of a broader digital transformation, which is the process of integrating technology that changes an organization's operations, customer experience, and business model10.

However, empirically, declining digital literacy has become a critical and urgent problem. A limited ability to critically utilize digital media makes young people vulnerable to misinformation and problematic content on social media, necessitating education and active supervision from various parties11. Urban environmental challenges, such as waste issues that lead to flooding, also necessitate solutions that rely on public awareness. The 3R12 policy is implemented through Waste Banks, which convert waste into items of economic value to increase income and improve environmental cleanliness. These two issues demonstrate the need for a collaborative and educational approach that is sustainable.

Social harmony is achieved, among other things, through the creation of a comfortable, clean, and healthy environment, where the environment is a determining factor in individual well-being13. Collective responsibility in maintaining cleanliness is crucial because cleanliness, as a state free from dirt, requires a high level of awareness from the community. Waste, which is often perceived as disgusting objects that must be discarded or burned, actually requires proper management to prevent pollution14. Comprehensive waste management, from collection, transfer, transportation, to final processing, requires more than just individual awareness but also adequate systems and infrastructure, such as Temporary Storage Sites (TPS) for sorting and recycling15.

Various initiatives to digitize waste banks in Indonesia have emerged from various actors, including educational institutions such as the STEMPreneur Center at Prasetiya Mulya University, private companies such as PT Zerolim Tekno Lestari, and local governments such as the city of Kediri. However, critical evaluation of existing applications through user reviews reveals similar structural weaknesses, such as the absence of waste collection features, limited geographical coverage, slow call center responses, and technical problems in registration and access. This reality shows that the development of the digital waste bank ecosystem is still fragmented and does not yet fully address comprehensive and inclusive operational needs. More specifically, in the city of Yogyakarta, which has high waste pressure, there is still a gap in the need for an Android-based application that can specifically and effectively integrate waste bank managers with the community16.

In response to this gap, this study proposes the downstreaming and further development of the “Bank Sampahku” application prototype, which has been developed since 2023 in collaboration with industry partners. Prototypes 1.0 and 2.0 have undergone validation stages that demonstrate the feasibility and high level of usefulness of the technology, as assessed by waste bank managers, as well as significant user interest. These findings provide empirical justification for continuing development with a focus on three key aspects: strengthening server infrastructure capacity, massive promotion through digital media, and intensive assistance and diffusion to expand adoption. The “Bank Sampahku Version 2.0” product is designed with several strategic advantages that distinguish it from existing solutions, including open access, adoption of the latest digital platforms, an intuitive interface with a user-friendly switch system, and phone number-based activation to expand its reach. These advantages are not only aimed at improving operational efficiency and digital literacy but also at building pentahelix collaboration and encouraging sustainable innovation. This development is explicitly aimed at achieving Technology Readiness Level (TRL) 8, aligning with industry needs, and contributing to the key performance indicators (KPIs) of higher education institutions and the Merdeka Belajar Kampus Merdeka (MBKM) program.

To ensure academic accountability and sustainable impact, this study targets a number of concrete and measurable outcomes. This is expected to transform the research results from mere academic prototypes into

assets that are operationally and financially independent, while also contributing significantly to sustainable waste management in Yogyakarta. The research questions posed in this study are as follows: (1) How does the development of digital waste bank services contribute to sustainable waste management in Yogyakarta? (2) How does the digitalization of waste bank services improve operational efficiency in sustainable waste management in Yogyakarta? This study aims to develop the digitization of waste bank services to support sustainable waste management in the city of Yogyakarta. Specifically, this study will analyze the impact of digitization on improving the operational efficiency of waste management. In addition, this research is directed at producing sustainable outputs with a Technology Readiness Level (TRL) of 8, which strategically contributes to the achievement of Key Performance Indicators (KPIs) 2, 3, 4, and 5 of Yogyakarta State University (UNY) and creates potential sources of income for the institution.

RESEARCH METHODS

This study adopts research and development (R&D). The research and development method is a research method used to produce a specific product and test the effectiveness of that product17. The research and development method is a research method used to produce a specific product and test the effectiveness of that product. Data collection techniques were carried out through interviews, observations, and focus group discussions for primary data and secondary data through documentation. Data validity checks were carried out using source and method triangulation techniques18. The research location was in the city of Yogyakarta because, since 2022, the city of Yogyakarta has been facing a household waste emergency and limited waste bank capacity. The objective of developing the Bank Sampahku digital service product is to digitize waste bank services to improve operational efficiency and sustainable waste management in the city of Yogyakarta. The science and technology application used in this downstreaming and DUDI prototype research study is an Android-based application in the Software Development Life Cycle (SDLC).

The stages in the prototype are depicted in a circle, where these stages begin with identifying needs and then designing the prototype in the form of a mock-up. With the Bank Sampahku application, which uses semantic application technology, users can search for information about waste management and access waste banks and DUDI partners from a single application. The concept of the Bank Sampahku application developed in this prototype includes business functions (e-commerce, e-marketing), e-planning, e-management, and e-strategy involving community partners, waste banks, and DUDI. The classification of Android-based applications used adopts the business-to-customer (B2C) category because the end customer is on the other side of the transaction. The product development in this study uses the ADDIE model, which includes Assessment/Analysis, Design, Development, Implementation, and Evaluation19. Data collection techniques include observation, interviews, focus group discussions (FGD), and documentation. The data analysis stage used data analysis techniques, including data collection, data reduction, data presentation, verification, and conclusions20.

RESULTS AND DISCUSSION

Result

Results of the development of digitalization of waste bank services Development of digitalization of bank services in sustainable waste management in the city of Yogyakarta

The city of Yogyakarta is recorded as the main contributor to waste volume in the DIY region, with a contribution of 9,467 tons in December 2020. A significant increase of up to 12.43% from the previous month often occurs during the year-end holiday period. As a densely populated urban area, community consumption activities—especially of food and beverages (24.67% of per capita expenditure)—trigger waste generation, especially plastic packaging. Although 99.34% of Yogyakarta City's waste has been managed (270 tons/day), there is still a critical gap of 0.57% or 1.87 tons that has not been handled. On the other hand, data shows that the role of waste banks is still minimal, managing only 0.74 tons. In fact, waste production continues to increase from 644.69 tons/day (2019) to 1,231.55 tons/day (2023), while regional management capacity lags at 740 tons/day21. This situation, coupled with the history of pollution at the Piyungan TPST, highlights the urgency of optimizing the management system, including the more effective and widespread utilization of waste banks.

Sustainable waste management efforts in Yogyakarta City are carried out through 575 waste banks spread across 45 sub-districts, with a primary focus on inorganic waste, although some also handle organic waste. Although 87% of the community is aware of waste management, actual participation in processing is still below 60%. This challenge requires continuous education to change mindsets systematically, starting from various social lines. Waste banks are expected to manage all waste from customers in their area and distribute it to waste

collectors. For hazardous waste, the Environmental Agency provides seven dropbox locations with a special coloring system to prevent pollution.

Digital transformation in the waste management sector, particularly through waste banks, is a crucial strategy for improving efficiency and community participation. The city of Yogyakarta, with 565 waste banks at the neighborhood level, promotes household waste sorting policies, but still faces challenges in integrating its operations. Various digital applications such as Bank Sampah Digital (STEMPreneur Center), ZEROLIM, and E-Bank Sampah Kota Kediri have emerged, but critical evaluations reveal common shortcomings such as the absence of pickup features, limited geographical coverage, technical registration issues, and slow response times. Furthermore, Yogyakarta itself does not yet have an adequate dedicated platform.

To address this gap, a prototype application called "Bank Sampahku" (My Waste Bank) was developed. This application is designed not only as a recording tool but as a comprehensive platform that offers open access, the latest technology, and educational content to strengthen digital literacy and independent household-based waste management. Its strategic advantages lie in its pentahelix collaborative approach, ease of access, and user-driven design. Its implementation is aimed at creating a sustainable impact, contributing to the Key Performance Indicators (KPIs) of higher education institutions, the MBKM program, and the achievement of SDG targets in Yogyakarta. The application is managed through an admin and super admin system to classify waste bank manager accounts.

The implementation of the "Bank Sampahku Version 2.0" application by Yogyakarta State University in 2023 proves the transformative impact of digitalization. The results show a significant increase in operational efficiency: transaction recording time was reduced by 67.5% (from 3.7 hours to 1.2 hours/day) with data accuracy reaching 95%, thanks to automation and real-time validation. Community participation increased by 45% in the first three months due to ease of access and transparency. In terms of sustainability, the volume of managed waste increased by 28% and its economic value increased by 22%, in line with the World Bank's findings [22] on the potential of digitalization.

However, this study also revealed critical challenges: 76.9% of waste banks experienced infrastructure constraints (such as limited internet access), and 42.5% of managers required ongoing training. Long-term success depends not only on technology, but also on policy and institutional support. The allocation of the Yogyakarta City waste management budget, which is only 4.2% of the APBD [23], and the suboptimal implementation of regulations are obstacles to scalability. Therefore, policy integration is needed, including increased budgets (7-10% of the APBD), digital literacy training, and synergy among stakeholders to support the achievement of the SDGs. Limited implementation as a pilot project has been carried out in Cokrodiningratan Village for six months, providing an empirical basis for replication and wider development.

The impact of developing digitalization of waste bank services The development of digitalization of bank services in sustainable waste management in the city of Yogyakarta

In the context of anthropogenic pressure on the urban environment, the city of Yogyakarta faces a complex waste management paradox: high environmental awareness is not directly proportional to the operational effectiveness of the management system. Waste banks, which are conceptually positioned as community-based participatory instruments, are in practice hamstrung by inefficient manual recording systems, data fragmentation, and limited community adoption. In this framework, digitization emerges as a transformative discourse that promises operational rationalization, accountability, and scalability. However, digital transformation does not operate in a technological vacuum. Its implementation must be confronted with fundamental questions regarding the gap between the technical logic of an innovation and the socio-institutional logic of the ecosystem in which it is adopted. To what extent can digital solutions overcome infrastructural constraints, variations in human resource capacity, and the coherence of supporting policies?

This report presents a critical analysis of the implementation of the prototype application "Bank Sampahku Versi 2.0" (My Waste Bank Version 2.0) in the city of Yogyakarta. This study not only quantifies the achievements in terms of increased efficiency and participation but also dialectically dissects the tension between the technological capabilities offered and the existing material-institutional conditions. The central argument is that the sustainability and scalability of digital initiatives are not solely a function of algorithmic superiority, but rather the result of a systemic reconciliation process involving: (1) contextual technology adoption, (2) continuous human capacity building, (3) the provision of adequate supporting infrastructure, and (4) most crucially, political commitment manifested in a coherent policy framework and fiscal allocation.

TABLE 2. Impact and challenges of implementing waste bank digitization in Yogyakarta City

Aspek	Temuan & Dampak	Implikasi & Analisis Kritis
Operational Efficiency	1. Transaction recording time decreased by 67.5% (from 3.7 hours to 1.2 hours/day).	Digitalization has been proven to eliminate the inefficiencies of manual systems, in line with a World Bank study (2022). This

Aspek	Temuan & Dampak	Implikasi & Analisis Kritis
	2. Data accuracy increased to 95%. 3. Achieved through automation, real-time validation, and automated reporting.	efficiency is a basic prerequisite for scalability.
Community Participation	Increased by 45% in the first 3 months of implementation.	The increase was driven by ease of access and transparency of digital interfaces, demonstrating that user-friendly solutions can encourage engagement.
Sustainability Impact	1. The volume of managed waste increased by 28%. 2. The economic value of waste increased by 22%.	Standardized digital systems improve traceability and waste valuation, transforming waste from a burden into a valuable asset.
Challenges of Implementation	1. Infrastructure Challenges: 76.9% of waste banks reported problems with internet access/devices. 2. Human Resource Readiness: 42.5% of managers needed ongoing training.	These challenges are systemic and threaten sustainability. They highlight the gap between digital solutions and real-world conditions.
Policy and Institutional Support	1. The budget allocation for waste management is only 4.2% of the Yogyakarta City Regional Budget (TPPU, 2023). 2. The implementation of Local Regulation No. 28/2019 on Waste Management has not been optimal.	The success of technology depends on the supporting ecosystem. Low budgets and weak regulatory implementation are major obstacles to scalability and system integration.
Strategic Recommendations	1. Increase budget allocation to 7-10% of the regional budget. 2. Sustainable digital literacy training programs. 3. Policy synergy involving all stakeholders (pentahelix).	Digitalization is not the end goal, but rather a tool for systemic transformation. These recommendations are important for turning local innovations into sustainable policies that support the achievement of the SDGs.
Pilot Project & Methodology	Limited implementation in Cokrodiningratan Sub District, Jetis District, for 6 effective months.	Providing strong empirical evidence and proof of concept. However, further study is needed for replication in areas with different characteristics.

The implementation of "Bank Sampahku Version 2.0" has successfully demonstrated strong proof of concept that digitization can revolutionize the efficiency, participation, and economic value of waste banks. However, there is still a wide gap between technological readiness and ecosystem readiness (infrastructure, human resources, policies, funding). The long-term success and scalability of this solution absolutely depend on political commitment and integrated investment, not just on the technical excellence of the application alone.

DISCUSSION

The discussion on the findings of the implementation of the "Bank Sampahku Version 2.0" application in the city of Yogyakarta reveals a complex narrative, in which measurable technical success must be confronted with the reality of an ecosystem that is not yet ready in terms of social, institutional, and infrastructural aspects24. This critical analysis will examine these findings using the lens of Socio-Technical Systems (STS) theory25 and institutional theory26, to show that the success of digitization is not a linear function of technological sophistication, but rather the result of reconciliation and adaptation between technical and social subsystems.

1. Technical Efficiency vs. Ecosystem Gap: A Dialectic

At the technical-operational level, the "Bank Sampahku" application has successfully demonstrated a strong proof of concept. A 67.5% increase in recording efficiency and 95% data accuracy are empirical evidence that digitization can overcome the inefficiencies of manual systems that are operational bottlenecks for waste banks. This achievement is in line with the ideal characteristics of digital services described above, namely efficiency through automation and accountability through centralized data. Such a system enables real-time transaction recording, centralized data management, and transparent tracking, which are at the core of waste bank digitization[27].

However, STS theory reminds us that technical systems do not operate in a vacuum[28]. Success at the micro level (application use) immediately encounters challenges at the meso (organizational) and macro (policy) levels. The findings that 76.9% of waste banks experience infrastructure constraints (such as internet

access and devices) and 42.5% of managers need training are clear indicators of misalignment between technical and social subsystems. This gap reflects what is referred to in the Ghanaian context as a multifaceted challenge involving economic, institutional, and socio-cultural factors[29]. Digitalization, therefore, is not merely a matter of providing applications, but more about ensuring the readiness of the supporting ecosystem.

2. Participation, Incentives, and Behavior Change: Beyond Technology

A 45% increase in community participation in three months is a significant achievement that demonstrates the potential of digital platforms as catalysts for behavioral change. Ease of access, transparency of waste value information, and the possibility of gamification features (such as point and reward systems) serve as powerful non-material incentives[30]. The application has succeeded in changing the perception of waste from disgusting objects that must be discarded[31] to "assets with economic value," a crucial paradigm shift for sustainability.

However, this increase in participation remains vulnerable if not supported by a strong institutional foundation. Institutional Theory emphasizes the importance of regulative, normative, and cultural-cognitive pillars in shaping organizational and individual behavior[32]. In Yogyakarta, the regulatory pillar appears weak: the budget allocation for waste management is only 4.2% of the regional budget, and the implementation of Mayor Regulation No. 28/2019 has not been optimal. This condition is parallel to findings in Ghana, where policy success has been hampered by the absence of clear implementation guidelines, weak coordination, and budget constraints[33]. Without adequate regulatory and fiscal support, digital initiatives such as "Bank Sampahku" risk remaining isolated pilot projects, not integrated with comprehensive city waste management policies.

3. Strategic Recommendations: Towards Systemic Reconciliation

Based on the dialectic between technical achievements and ecosystem challenges, this discussion led to a series of systemic strategic recommendations. First, the implementation approach must be gradual and contextual. Before scaling up, a consolidation phase is needed to assist users, refine the system based on feedback, and, most importantly, build partnerships to overcome digital infrastructure constraints at the village level. The pilot project model in Cokrodiningratan Village must be evaluated in depth, not only in terms of technical metrics, but also in terms of social acceptance and institutional sustainability. Second, capacity building must be a priority. Training should not focus solely on how to use the application, but should also cover critical digital literacy[34], waste bank organizational management, and understanding of policy flows. This capacity building is a long-term investment to reduce dependence on external assistance and build community independence. Third, strengthen institutional pillars through Pentahelix collaboration. Long-term success requires stronger synergy between: (1) Government (increasing budget allocation, simplifying regulations, and integrating waste bank data into the city monitoring system), (2) Academics/UNY (not only as application developers, but also as partners in research and ongoing evaluation), (3) Private sector/DUDI (providing a stable off-taker market for recycled materials), (4) Community (as subjects of empowerment), and (5) Media (framing positive and educational narratives). Without this collaboration, technological innovation will struggle to create widespread transformative impact.

The implementation of "Bank Sampahku Version 2.0" clearly shows that digitization is a very promising tool, but not the ultimate goal of sustainable waste management. This application has successfully proven that digital transformation can drive efficiency, transparency, and participation. However, the findings also confirm the theory that technology adoption is always filtered and shaped by the surrounding social and institutional context35,36. The sustainable impact and scalability of this solution will never be achieved through algorithmic superiority alone. The future of waste bank digitalization in Yogyakarta, and more broadly in Indonesia, depends on a commitment to systemic reconciliation as a process that simultaneously strengthens digital infrastructure, human capacity, and most crucially, a coherent and supportive policy and institutional framework. Only through a holistic approach that acknowledges the complexity of the interaction between technology and society can waste banks truly realize their role as strategic instruments in achieving sustainable development goals (SDGs).

CONCLUSION

The implementation of the "Bank Sampahku Version 2.0" application prototype in the city of Yogyakarta has empirically proven the transformative potential of digitalization in revolutionizing community-based waste management. Measurable results—a 67.5% reduction in operational time, a 95% increase in data accuracy, a 45% surge in community participation, and a 28% increase in the volume and economic value of managed waste—clearly confirm that contextually designed technological solutions can overcome the inefficiencies of manual systems that have long hampered the effectiveness of waste banks. This application not only functions as a digital recording tool but has also successfully catalyzed a change in perception by transforming waste from an environmental burden into a measurable economic asset, while increasing transparency and accountability in

governance. However, the profound impact of this implementation lies in revealing the critical gap between technological readiness and ecosystem readiness. The findings that 76.9% of waste banks experience digital infrastructure constraints and 42.5% of managers require ongoing training confirm the thesis that technology does not operate in a vacuum. Success at the micro level (application) is hampered by realities at the meso (organizational) and macro (policy) levels, marked by a waste management budget allocation of only 4.2% of the Yogyakarta City Regional Budget and suboptimal implementation of regulations. Therefore, it can be concluded that although "Bank Sampahku" has succeeded as a strong proof of concept, its sustainability and scalability are by no means guaranteed.

Thus, the conclusion of this study confirms a paradox and a way forward: digitization is a very powerful instrument, but its transformative impact will only be realized if it is balanced with equivalent investment in building a supporting ecosystem. The future of sustainable waste management in Yogyakarta depends on the ability to carry out systemic reconciliation, which is a simultaneous and integrated process: (1) improving digital infrastructure and human resource capacity at the community level; (2) strengthening institutional pillars through significant budget allocation increases (7-10% of the local budget) and regulatory framework improvements; and (3) consolidating genuine pentahelix collaboration between the government, academia, the private sector, communities, and the media. Without this political commitment and holistic strategy, even the best digital innovations will risk remaining isolated pilot projects, rather than becoming a driver of systemic change that supports the achievement of sustainable development goals (SDGs) in the city of Yogyakarta.

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DIMENSIONS OF QUESTIONING IN TRIAL: QUESTIONING STRATEGIES PROSECUTORS AND LAWYERS ASK WITNESSES IN TRIAL

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Abstract. This study aims to investigate the various forms, strategies, and purposes of questions posed by prosecutors and lawyers to witnesses. The main focus of this study is the strategies of prosecutors and lawyers in asking questions to witnesses to strengthen their role in the trial, and the purposes of using questions by prosecutors and lawyers to strengthen their role in the trial. This study uses qualitative research methods. The data for this study are utterances in the form of questions posed by prosecutors, lawyers, and judges to witnesses in the courtroom during the trial. The data source for this study was the trial of the murder of Brigadier Josua and Jesica Wongso. The data source was a video recording published on YouTube. Data collection was carried out through observation and note-taking. Data were analyzed using theories of question types and strategies, as well as the purposes of their use in the trial. The results of this study show that There are five types of questions chosen as questioning strategies: tag questions, polar questions, declarative questions, wh- questions, and multiple choice questions. What differentiates the questioning strategies of prosecutors and lawyers is the information embedded in each question asked. Prosecutors will embed various information in their questions to strengthen the accusations and charges that will be filed against the suspect. The answers to the questions they ask not only serve to strengthen the main accusations against the suspect but also serve as a form of attack on the lawyers who defend the victim. Lawyers also carefully organize information and embed information in their questions that contradicts the information planted by the prosecutor. This method is done to weaken the prosecutor's position and strengthen the defense's position. In this way, lawyers will be able to weaken the prosecutor's accusations and can reduce the suspect's accusations. However, all of this will ultimately return to the judge as the power holder who will decide the case.

Keywords: lawyers, prosecutors, questions strategies, trial, witnesses.

INTRODUCTION

Conversations occurring during a trial between prosecutors, lawyers, judges, witnesses, and defendants are part of the forensic linguistics study. In the context of a trial, communication is influenced by three aspects: (1) a well-defined institutional role, in this case the courtroom; (2) a clear task to be performed, for example, the judge deciding whether the defendant is guilty or not guilty; the prosecutor is tasked with proving the defendant's guilt, and the lawyer is tasked with proving the defendant's innocence or mitigating the defendant's guilt; and (3) the competitive nature of each role, particularly between prosecutors and lawyers. In other words, the questions asked during a trial are crucial for determining the direction of communication and establishing it as legal fact, while also demonstrating the existence of a clear power relationship (Levinson 1992; Thomas 1986, 1995).

In normal conversation, according to Grice's principles, we assume that our questions will receive honest answers containing the requested information. Although it is also common to receive answers with "white lies," which include exaggerations and partial information, in social relationships, questions are asked to request information but do not require a response. From an informational perspective, the respondent has the information, while the questioner does not. Even in everyday conversations, the preferred response is one that contains all and only the requested information. However, unfavorable responses may also include responses that do not contain the requested information and will not be disclosed. Conversely, in court, witnesses, as respondents, must provide truthful answers because they swear "to tell the whole truth and to say nothing but the truth," and can be punished for perjury if they fail to do so. In other words, in everyday questions, we have a social relationship that allows for a request for information but does not require an answer, and an informational relationship in which the respondent has information while the questioner does not. However, in court proceedings, the legal counsel conducting the examination has the right to demand an answer and often assumes that they already have the information the respondent must provide (Gibbons,). This unusual personal relationship and information

significantly impact the nature of the question exchange and the form of the questions. Furthermore, from the respondent's (witness') perspective, in courtroom discourse, witnesses are typically not permitted to respond off-topic or to refrain from responding (unless such a response would incriminate themselves). In this discourse, only one party is typically permitted to ask questions, and the other party is only permitted to respond, and is usually required to respond. This means that in a courtroom examination, there is an asymmetrical social relationship, subject to certain exceptions: the prosecutor, defense attorney, and judge ask questions, while the witness answers (Atkinson & Drew, 1979).

Questions asked in this social relationship differ from those asked in a trial. In a courtroom examination, the prosecutor and defense counsel who ask questions have the right to demand answers and often assume they already have the information the respondent must provide (Gibbons, 2008). Conversely, in courtroom questions, the questioner already has the information to answer the question, while the witness or respondent does not necessarily have the answer. This is similar to a teacher asking questions to a student, which is typically a form of interrogation. The teacher already has the information and checks to see if the student has it (especially if the student has acquired it through instruction). In other words, courtroom questions also deviate significantly from the basic form and are part of the extreme difference between legal language and everyday conversation: Tiersma (1999).

Questions asked by prosecutors and defense attorneys have different purposes. That is, they are asked in order to construct conflicting versions of the same event or circumstance (Bennett and Feldman 1981). In criminal cases, prosecutors typically try to construct a version that will prove the defendant guilty, while defense attorneys typically try to construct a conflicting version of the same event that suggests their client is innocent or deserves lenient treatment. They are the legally authorized parties to ask questions. They control the flow of communication and can even serve an "accusatory" function (Harris 1984:6, 22). Furthermore, they may employ ambiguous language strategies that allow a question to have more than one possible interpretation (Lakoff 1989:113).

Therefore, the questions asked must be able to prove their respective claims. Based on this, it is necessary to examine the various forms, strategies, and purposes of the questions posed by prosecutors and lawyers to witnesses. Two things will be examined: the strategies of prosecutors and lawyers in asking questions to strengthen their role in the trial, and the purposes of the prosecutors and lawyers' use of questions to strengthen their role in the trial.

METHOD

This study adopted a qualitative research design focusing on courtroom questioning practices. The data comprised interrogative utterances produced by prosecutors, lawyers, and judges during trials, drawn from 30 YouTube video recordings of the Brigadier Josua murder case, the Jessica Wongso murder case, and the Hasto bribery case. Data were collected through listening and note-taking techniques, transcribed orthographically, and documented on data cards. The researcher served as the primary research instrument, supported by theoretical frameworks and parameters for classifying questions. Verbal data were analyzed using matching and distribution techniques to identify the intent and types of questions based on contextual meaning and linguistic structure. Data validity was ensured through triangulation of data sources, theories, and researchers to enhance accuracy and theoretical rigor.

RESULTS AND DISCUSSION

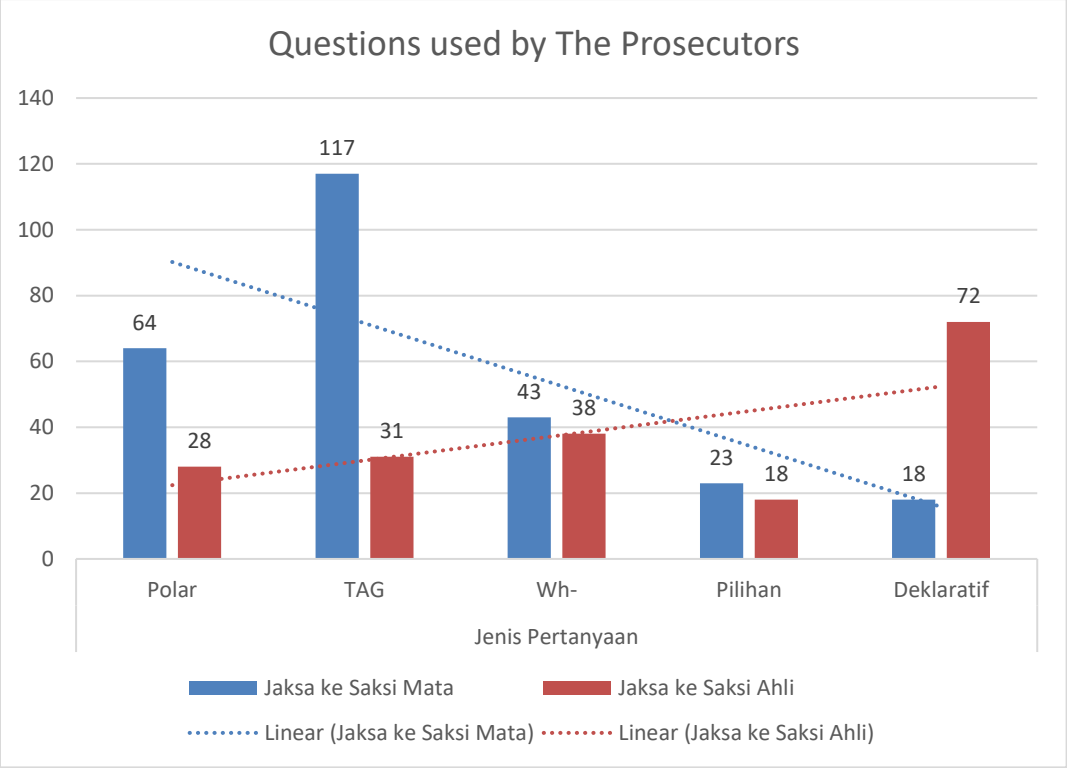
A. Result

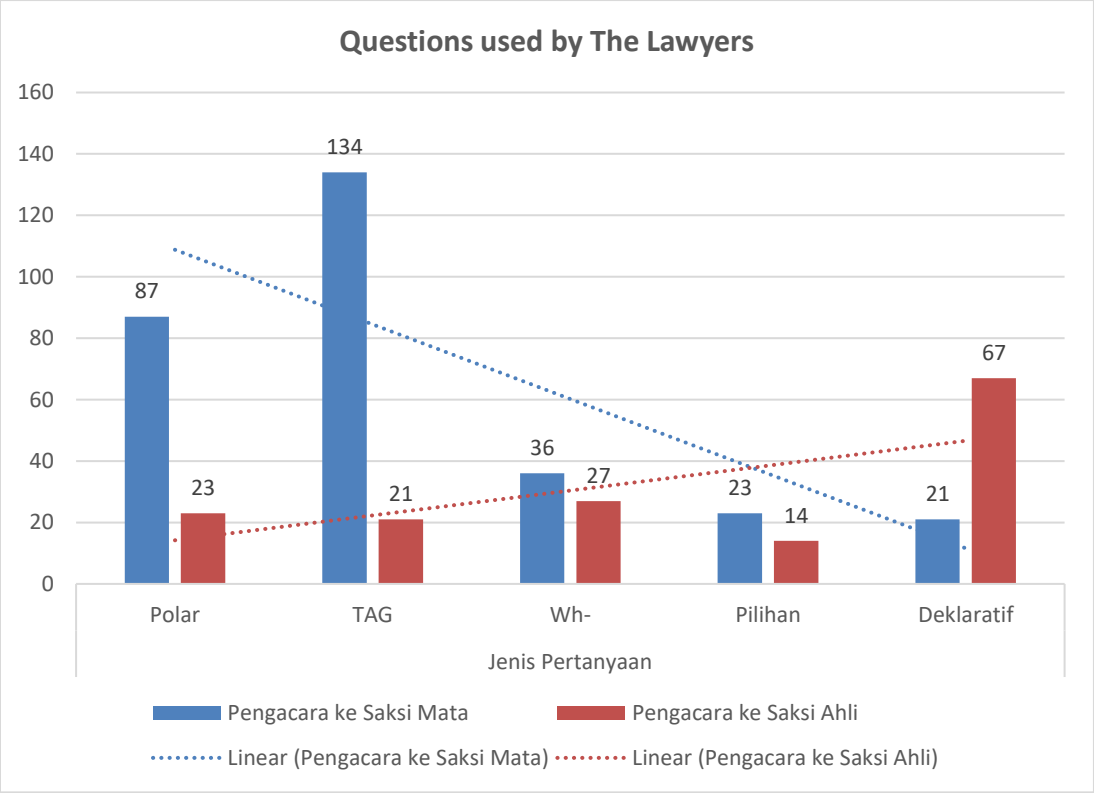
1. Questioning Strategies of Prosecutors and Lawyers in Trial

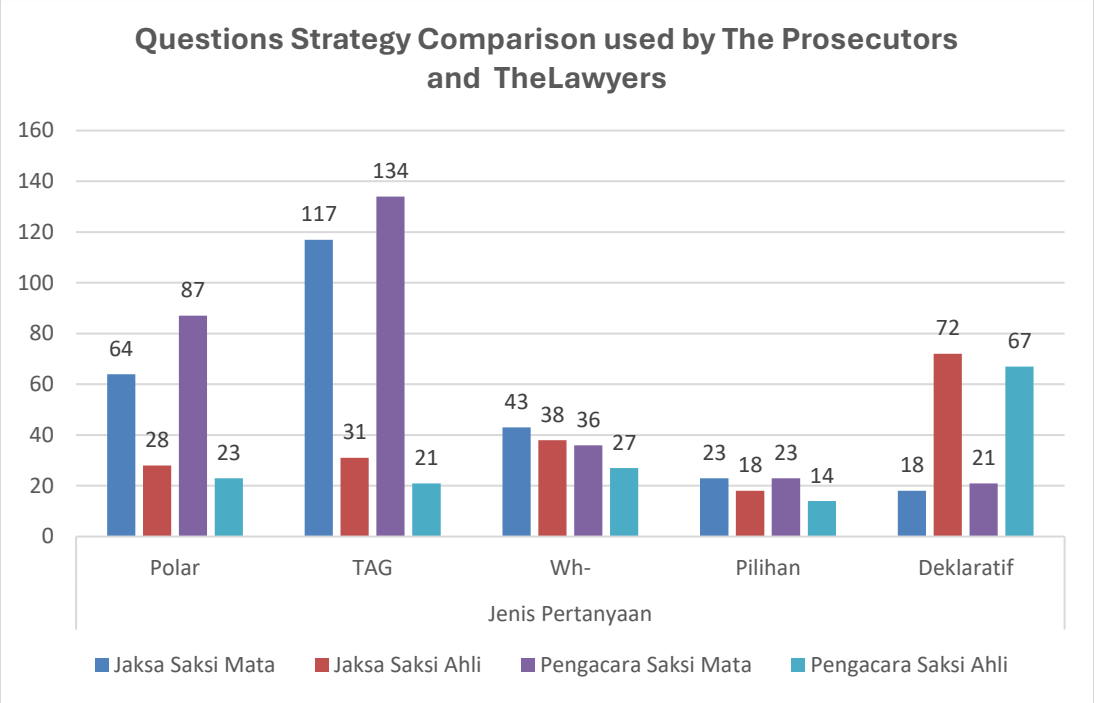
Data analysis shows that the questioning strategies used by prosecutors and lawyers when examining witnesses in court have similar tendencies. The strategies used in examining witnesses include five types of questions: tag, polar, wh-, choice, and declarative questions. Prosecutors and lawyers are more likely to use questioning strategies in the form of polar, tag, and declarative questions.

Polar and tag questions are more commonly used when examining eyewitnesses or factual witnesses. This is done to obtain certainty about the facts and the possibility of new facts that can support their arguments. Conversely, declarative questions are more commonly used when examining expert witnesses. This strategy is used to obtain corroboration of opinions to support the truth of assumptions they believe to be true. Although the questioning strategies used by prosecutors and lawyers are similar, the content or information embedded in the

questions has different purposes. A complete explanation of the questioning strategies of prosecutors and lawyers in court can be seen in the following diagram.







B. Discussion

Questioning Strategies of Prosecutors and Lawyers in Trial

In a trial, prosecutors and lawyers have different, even opposing, interests. Prosecutors will strive to present facts that support their charges against the suspect, while lawyers will strive to acquit the suspect of all charges, or at least mitigate the charges. The strategy they use to achieve this is to formulate questions whose answers support their respective versions of the case.

In general, the questioning strategies they employ are similar; the difference lies in the factual content embedded in their questions. Questioning strategies are strategies they employ to gain the strength of information and new information that supports their objectives. This strategy involves formulating questions. There are four types of questions they use to win the trial: tag, choice, wh-questions, polar, and declarative. Based on data analysis, it was found that there is a tendency for similarities in the types of questions prosecutors and lawyers frequently use with witnesses: tag, pattern, declarative, and polar questions as explained below.

a. Tag Questions

(1) What you said about the initial scenario of the shootout was that you were also directed by witness Ferdi Sambo, correct?

(2) And then, Mr. Saiful said, you set aside 170 million for Mr. Doni, 2 million for yourself, and gave the rest to Mr. Ilham. Is that what I've read so far? Correct, sir.

(3) No. The witness brought the money. So, where did this money come from? Mr. Harun?

(4) So, you communicated with Doni that he had deposited 170 million. Is that correct?

Tag questions are a type of question whose answer can be predicted by the questioner. In using these questions, prosecutors and defense attorneys embed information into the question to reinforce the question and pressure the witness to answer as they expect. As in data (1), the prosecutor tried to plant a fact containing information that there was an initial shooting scenario directed by witness Ferdi Sambo. The word "true" at the end of the question confirms that this fact is true. With this question, the witness is directed to answer "yes" as a form of agreement with all the information in the question. If the witness answers no, it could be interpreted as denying the facts cited by the prosecutor, which would diminish the witness's level of honesty. This question is crucial in supporting the primary allegation that Ferdi Sambo was directly involved in the shooting.

Data (3) and (4) also show the same thing as data (1). In data (3) and (4), the prosecutor also plants facts that are difficult to refute. In data (3), the prosecutor tests the fact that the witness brought money and that the money came from Harun. The mention of Harun's name at the end of the question confirms that the witness had no other answer than the name mentioned by the prosecutor, and this advantageous for the prosecutor in building their accusations. Data (4) is also very explicit; the prosecutor's tag question contains at least two facts: communication with Doni and the deposit of 170 million Rupiah.

b. Declarative Questions

One type of question used by prosecutors and lawyers is the declarative question. This question is expressed in the form of a declarative sentence or question, but is uttered with a questioning intonation. This type of question is generally used to convey information that is already known to the prosecutor/lawyer and the witness. Therefore, the prosecutor and lawyer will embed information that is presumed to be common knowledge. With this question, the witness will respond in agreement with the information in the question, as seen in the following data.

(5) Then, the 170 million rupiah for Mr. Doni was put into a plastic bag, and the rest remained in the gray suitcase?

(6) Now, what about the bitter almond smell? You said earlier that cyanide has a bitter almond scent, and that people poisoned by cyanide will have cherry red skin, like that redness, and there are always signs of that, are they definitely found?

(7) After drinking it, he immediately had convulsions, or was his breathing short, and so on, all of that data, even though it wasn't autopsied, can't be put together into one conclusion?

(8) Well, from your experience of having performed hundreds of thousands of autopsies, are there many people who refuse to be autopsied in Indonesia, or not in Indonesia or throughout the world?

Data (5) to (8) are questions posed by the prosecutor to the witness. In data (5), the prosecutor attempts to establish the facts through questions. There are four facts embedded in the declarative questions: (i) there was money for Mr. Doni, (ii) the amount of money was 170 million, and (iii) the money was put in a plastic bag, (iv) the remaining money remained in the gray suitcase. Questions containing these four facts are asked to verify the witness's truth. These facts also serve as pressure for the witness to agree with all of these facts by providing a true answer. If the witness answers no, the witness can be considered to have denied the facts. The witness's agreement with these facts can give the prosecutor an advantage in strengthening the allegation of bribery in the case.

In the case of murder by cyanide poisoning involving the defendant Jesika, the prosecutor attempted to strengthen the allegation by asking an expert about several characteristics of people affected by cyanide poisoning. In questions (6) and (7), the prosecutor attempted to obtain an expert's acknowledgement or agreement regarding the characteristics of cyanide poisoning. This question is important because the victim showed the same characteristics as mentioned in data (6) and (7). The expert's agreement on this will strengthen the prosecutor's suspicion that the victim was indeed poisoned by cyanide. The prosecutor's question number (8) is not a fact but a kind of view or estimate of the prosecutor's opinion on the autopsy process that exists in the world. This question is to ensure that an autopsy is a process that must be carried out or may not be carried out. This is because the case the prosecutor is handling does not require an autopsy. The answer to the expert witness who says that an autopsy is not necessary will provide support for the process he is handling.

c. Polar Questions

Polar questions are a strategy used by prosecutors and defense attorneys to ask witnesses. In these questions, the witness has no option but to answer yes or no. Prosecutors and defense attorneys intentionally embed information in the questions as arguments to pressure the witness to agree or disagree. The answer to agree or disagree is systematically guided by the information contained in the questions. These questions are crucial for prosecutors and defense attorneys to obtain facts that support their respective versions of the story.

(9) Could the 0.2 mg level in the stomach possibly be due to cyanide poisoning?

(10) Is an autopsy necessary to determine the victim's death?

The prosecutor's question (9) was motivated by the discovery of 0.2 mg of cyanide in the victim's body, which the prosecutor considered to be the cause of the victim's death. The polar question posed to the expert witness, which presented the fact that the 0.2 mg cyanide content in the victim's body was the victim's primary cause of death, expected the expert witness to agree that the 0.2 mg content was the primary cause of the victim's death.

The word "maybe" demonstrated the prosecutor's caution and also indicated the prosecutor's opinion. However, the prosecutor emphasized that the witness should answer yes, which meant they agreed with the information in the question. This question also served as a rebuttal to the lawyer's doubts regarding the 0.2 mg cyanide content, which can be found in food and is not fatal. In other words, for the prosecutor, the answer to this question was crucial to supporting their charges.

The prosecutor's question (10) was motivated by the fact that the victim was declared dead and caused by cyanide poisoning without an autopsy. Question (10) was posed to obtain expert recognition and judgment from the expert that the cause of death could be determined without an autopsy. The question was also intended to dispel the lawyer's assumption that without an autopsy, the cause of death cannot be determined. The prosecutor deliberately used the word "must," which has the same meaning as "must autopsy." This phrase implies that an autopsy is required to determine the cause of death; otherwise, the autopsy is illegal. However, not all causes of death require an autopsy, and many victims' families refuse an autopsy.

CONCLUSION

The questioning strategies used by prosecutors and lawyers to witnesses, both eyewitnesses and expert witnesses, are generally the same. They use various types of questions as strategies to construct stories according to their respective duties. There are five types of questions chosen as questioning strategies: tag questions, polar questions, declarative questions, wh- questions, and multiple choice questions. What differentiates the questioning strategies of prosecutors and lawyers is the information embedded in each question asked. Prosecutors will embed various information in their questions to strengthen the accusations and charges that will be filed against the suspect. The answers to the questions they ask not only serve to strengthen the main accusations against the suspect but also serve as a form of attack on the lawyers who defend the victim. Lawyers also carefully organize information and embed information in their questions that contradicts the information planted by the prosecutor. This method is done to weaken the prosecutor's position and strengthen the defense's position. In this way, lawyers will be able to weaken the prosecutor's accusations and can reduce the suspect's accusations. However, all of this will ultimately return to the judge as the power holder who will decide the case.

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TEACHING MATERIAL WRITING TRAINING FOR INDONESIAN LANGUAGE TEACHERS AT MTS THROUGHOUT KEBUMEN REGENCY, CENTRAL JAVA

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Abstract. The role of teachers in improving the quality of learning is closely related to their ability to develop effective, innovative, and curriculum-oriented teaching materials. However, observations indicate that many Indonesian language teachers at Islamic junior high schools (MTs) across Kebumen Regency still face difficulties in writing systematic and engaging teaching materials. To address this issue, this community service program was designed in the form of a training workshop on text-based teaching material development for members of the Indonesian Language MGMP (Subject Teacher Working Group) in Kebumen. The training applied an andragogical approach through a participatory workshop model consisting of three stages: (1) conceptual material delivery, (2) guided practice in writing teaching materials, and (3) mentoring and reflection through online discussions. The training materials covered principles and objectives of teaching material development, characteristics of print and digital materials, and components of material feasibility. Evaluation was conducted through participant engagement observation and satisfaction questionnaires. The results showed that 26% of participants agreed and 73% strongly agreed that the training improved their knowledge and skills in writing teaching materials. Participants also produced text-based teaching modules aligned with their respective classroom learning outcomes. Thus, the training effectively enhanced teachers' competence in writing teaching materials and fostered their sense of professional growth. Similar programs are recommended to continue with follow-up mentoring to further refine teachers' skills and optimize the classroom implementation of the developed materials.

Keywords: teaching materials, Indonesian language, teaching training.

INTRODUCTION

Every day, the world experiences rapid change. These changes encompass all areas, including economic, social, political, and cultural. Changes in these various fields indicate that there is no guarantee that the future will be the same as the present. However, education is one aspect that can keep pace with the rapid changes in all aspects of life by creating an informed society. An informed society is formed from students who are active during the learning process (Baltaoğlu & Güven, 2019). Students who are active in learning contribute to the role of education in adapting to changing times. The education system can adapt to changing times if it is implemented in a society where individuals are always active and engage in lifelong learning (Yıldız & Emre Ürün Arıcı, 2021). Therefore, the success of student learning requires teacher professionalism (Nurani et al., 2020). Professional teachers are able to create individuals who recognize that learning is a necessity and must be carried out continuously.

Teachers are key to the development of quality education and an informed society. Teachers have a significant influence on the success of the education system (Toraman & Çakmak, 2020). Previous research indicates that teachers need adequate skills to properly prepare students and achieve educational goals (Hamzeh et al., 2022). These skills include thinking skills, planning lessons, and responding to student needs. This aligns with Hoffman and Pearson's opinion that a quality educator is one who can think, plan, and adapt to students' needs when teaching (Hoffman & Pearson, 2000). Teachers must be able to set learning objectives, motivate students to learn, use effective strategies, and conduct assessments. Teachers are required to implement meaningful learning so that students receive a positive learning experience through quality instruction. In addition to teaching skills, teachers must also be able to plan lessons. Lesson planning can determine the success or failure of learning. One aspect of planning that can determine the success of student learning is the quality of the teaching materials (Şimşek & Yazıcı, 2021).

Teachers, as the spearhead of learning, play a crucial role in creating teaching materials that align with the curriculum and capture students' attention. Therefore, the skill of writing teaching materials is one of the competencies that teachers must master. Teaching materials play a crucial role because they can assist students in

teaching and learning. Teaching materials can serve as a comprehensive source of knowledge, and the content of the learning material can be adapted to student development and needs (Situmorang et al., 2015). Unfortunately, many teachers still encounter difficulties in developing teaching materials that are coherent, interactive, and relevant to developments in educational technology.

Teaching materials contain information, texts, or tools that teachers need in lesson planning. Teaching materials are essential tools that support the teaching and learning process by making learning more engaging, effective, and interactive. Furthermore, teaching materials also encourage language skill acquisition, in addition to providing students with the information they need. Accordingly, according to Tomlinson, teaching materials refer to anything used by teachers and students to facilitate the language learning process, increase their knowledge, and enhance their language experience (Tomlinson, 1998).

Teaching materials encompass a variety of resources, such as textbooks, handouts, worksheets, infographics, posters, modules, digital books, leaflets, and even physical objects. Teachers can adapt these materials to meet learning needs, as learning outcomes are determined by the appropriate use of teaching materials. Therefore, teachers need to master the skills of selecting, implementing, and even compiling quality teaching materials. However, teachers face challenges in providing teaching materials for learning.

Initial observations at MTs Kebumen indicate that many teachers lack a sufficient understanding of writing teaching materials, both technically and methodologically. Teachers often struggle to balance their time between teaching duties, administrative work, and writing activities. Limited access to reading and literature sources also poses a barrier. Furthermore, not all teachers receive specific training in teaching materials writing during their formal education. As a result, some teachers still struggle to structure teaching materials according to academic standards, collect supporting data, or adapt formats suitable for publication.

Another obstacle that frequently arises is the limited opportunity to evaluate and revise the teaching materials that have been prepared. Furthermore, a lack of support and motivation from the school environment makes it even more difficult for teachers to complete teaching materials effectively. However, providing appropriate training and mentoring can be a solution to improving teachers' writing skills and publishing their work.

Table 1. Partner Issues Related to Writing Teaching Materials

Partner Issues
Needs for Improving Teacher Writing Skills
Teachers at partner schools, namely MTs (Islamic junior high school) throughout Kebumen Regency, need to improve their teaching material writing skills so they can share experiences, knowledge, and effective learning methods, which not only benefit their personal development but also enrich the educational community.
Teacher Needs in Providing Teaching Materials in the Classroom
Teachers at partner schools, namely MTs (Islamic junior high school) throughout Kebumen Regency, need to be empowered through outreach on teaching material writing so they understand the proper methods for compiling teaching materials and the steps involved in creating them.

To address these issues, the Community Service Program (PkM) aims to provide outreach regarding the importance of writing teaching materials. This outreach is expected to develop knowledge and skills in writing teaching materials based on feasibility components by providing training in teaching materials writing for Indonesian language teachers at MTs throughout Kebumen Regency. This activity is crucial because it provides a space for teachers to hone their skills in creating more effective, innovative, and modern teaching materials (Majid, 2011; Sukiman, 2012). Furthermore, this training is expected to encourage teachers to produce teaching materials that are engaging, interactive, and directly beneficial for improving the quality of learning (Arsyad, 2016).

Through this activity, teachers are expected to not only understand the importance of writing teaching materials but also develop the basic skills to write them independently. This program is also expected to foster a culture of writing among teachers and support the improvement of educational quality through the development of educator professionalism.

METHOD

This training was attended by Indonesian language teachers from Islamic Junior High Schools (MTs) throughout Kebumen Regency, Central Java. Participants were teachers who registered voluntarily through the coordination of the Indonesian Language Teachers' Group (MGMP). Based on the selection process, approximately 40 teachers actively participated in this activity.

To achieve the goal of community service (PkM), the method used was guided training. In addition, the principles of adult learning (andragogy) were applied, referring to the process approach model (Tomkins, 1994). This method was chosen to allow participants to experience firsthand each stage of the teaching materials writing process.

The series of training and workshop activities was implemented in several stages. First, participants were provided with basic knowledge regarding the purpose of teaching materials writing and the challenges faced in practice, along with prompting questions to foster critical awareness. Second, participants practiced writing teaching materials through guided practice in accordance with relevant learning objectives. Third, the teachers' writing was presented, allowing them to reflect on, interpret, and make sense of their learning experiences. Through this process, teachers gained practical skills and strategies for writing interactive teaching materials.

Training evaluation is conducted in two forms: process evaluation and product evaluation. Process evaluation focuses on participant motivation and engagement during the activity, while product evaluation is directed at assessing the quality of the teaching materials produced according to the facilitator's guidance. These two forms of evaluation are used complementaryly. The teaching materials writing training for MTs teachers in Kebumen Regency will be held from March to October 2025, covering the planning, implementation, and reporting stages. At the end of the program, a joint reflection and closing ceremony will conclude the series of activities.

The material presented in this training will include (1) principles and objectives of teaching materials development, (2) forms and characteristics of teaching materials, (3) types or kinds of teaching materials, (4) steps in developing teaching materials, (5) components of teaching material suitability, (6) differences between printed and digital teaching materials, (7) evaluation and revision of teaching materials, and (8) discussions and presentations.

RESULTS AND DISCUSSION

This Community Service activity was carried out smoothly according to the established plan. This activity focused on training in writing teaching materials for Indonesian language teachers at the MTs level and was attended by approximately 70 participants. This activity was held from July 11 to 13, 2025. The material presented to the training participants included (1) Principles and Objectives of Teaching Material Development, (2) Forms and Characteristics of Teaching Materials, (3) Types or Kinds of Teaching Materials, (4) Analysis of Steps in Compiling Teaching Materials, (5) Components of Teaching Material Feasibility, (6) Differences between Printed and Digital Teaching Materials.

1. Phase 1 Material Delivery (July 11, 2025, Offline)

The material provided in the training includes a discussion of the principles, objectives, forms, and varieties of teaching materials. Participants are also introduced to aspects of teaching material suitability, including content, presentation, language, graphic design, and other supporting elements. Following this, participants receive an explanation of the steps for developing text-based teaching materials. The text types used are adapted to teaching materials at the junior high school level or Phase D, including announcements, descriptions, narratives, reports, argumentative texts, news, expositions, procedures, advertisements, conversations, explanations, and scientific texts.

In the process of preparing and developing teaching materials, teachers are guided to remain grounded in the curriculum or learning outcomes (CP), student needs, learning approaches, methods, media, and assessment techniques. The purpose of delivering this material is to ensure teachers understand the basic concepts of teaching materials and are able to apply them. This way, participants can write or compile text-based teaching materials appropriate to their grade level.

The training then continues with a discussion session. The presenters engaged teachers in a discussion about developing teaching materials. Teachers were allowed to ask questions about any unfamiliar material. The presenters assisted by answering the questions. This activity served as a way to check participants' understanding of the material presented. To reinforce the discussion, the presenters provided examples of creating text-based teaching materials relevant to students' lives and local wisdom.

Figure 1. Presenting Learning Materials

2. Stage 2: Discussion of Obstacles and Difficulties in Class (July 12, 2025, Offline)

After gaining an understanding of the teaching materials and the steps for developing teaching materials, the presenter invited participants to discuss the obstacles and difficulties they had encountered in developing teaching materials on the second day. This activity included an in-depth discussion session on developing ideal teaching materials, providing relevant examples and challenges encountered during classroom learning, particularly in writing teaching materials.

Figure 2. Discussion on Obstacles to Writing Teaching Materials

3. Stage 3: Developing Teaching Materials (July 13, 2025, Offline)

On the third day, the presenter invited participants to create a draft or outline of teaching materials. In the practical session, participants put the theory of developing text-based teaching materials into practice. Teachers

teaching grade 7 can develop teaching materials using texts taught to grade 7 students. The same applies to teachers teaching grades 8 and 9. The time allotted for the practical development of teaching materials is 525 minutes. Participants practiced several activities, such as checking the curriculum or curriculum implemented in the class they were teaching, designing drafts of teaching materials, selecting texts to use in developing teaching materials, and practicing compiling text-based teaching materials.

In the implementation phase, teachers need to write teaching materials, starting with establishing the subject identity, learning objectives, and CP. Next, teachers select more specific texts. The text selection can be tailored to the class they are teaching. Next, teachers write the components of the teaching materials, such as objectives, instructions, activities, and evaluation.

Figure 3. Practical drafting of teaching materials

4. Stage 4 of Guided Training Regarding Progress in Writing Teaching Materials (July 25, 2025 Online)

After practicing compiling teaching materials, the next activity was consultation and monitoring of the process. This consultation and monitoring session lasted 360 minutes. The following aspects were emphasized in this activity:

a. Consultation on drafting teaching materials.

b. Regular and equitable monitoring of each participant regarding the drafting of teaching materials and texts to be developed.

c. Discussion of text-based teaching material designs and their suitability with the CP, TP, approaches, and learning strategies used.

These consultation and monitoring activities are conducted not only during the in-person training but also online. Participants can continue to draft or outline their teaching materials independently and are allowed to ask questions to the presenter if they encounter difficulties during the process.

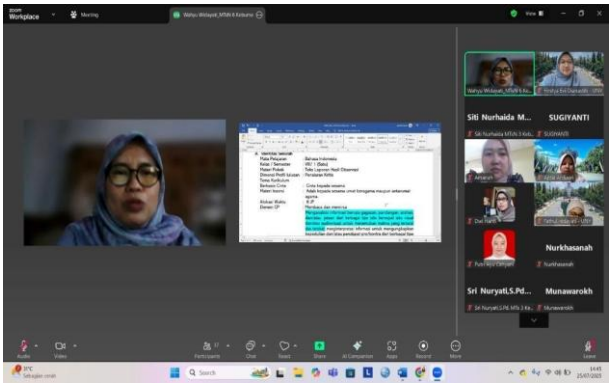

Figure 4. Teaching Material Writing Progress Report and Consultation Session

5. Stage 5: Presentation and Feedback on Teaching Material Writing (August 1, 2025, Online)

To monitor and evaluate the progress of teaching material development by teachers, guided online discussion sessions are also provided. These sessions are held twice, two weeks after the in-person meeting, on July 25 and August 1, 2025. Participants report their progress on teaching material development online via Zoom to the presenter and share any obstacles and challenges in developing teaching materials independently.

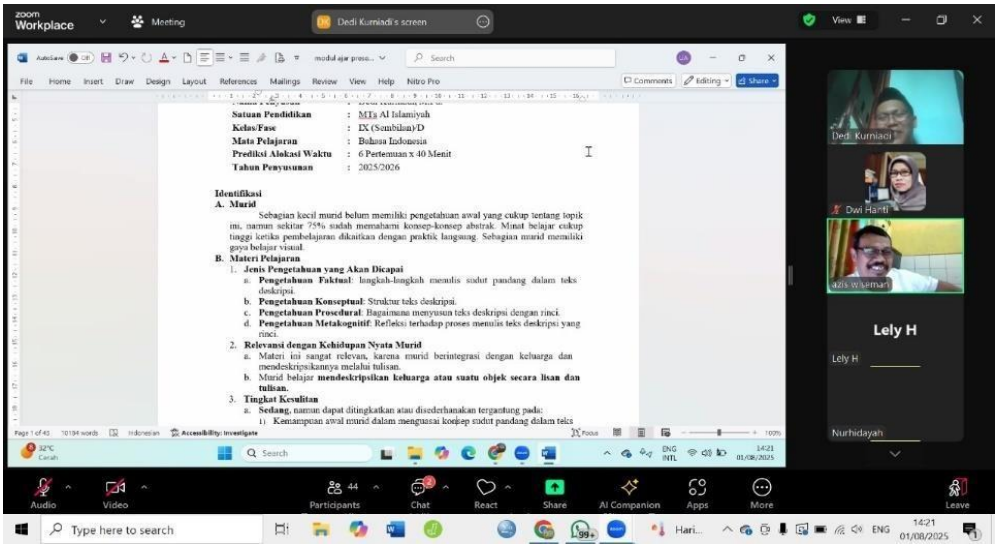

Figure 5. Guided discussion and presentation of teaching material development results via Zoom, August 1, 2025

Through guided online discussions, participants were able to develop ideal teaching materials in accordance with the feasibility criteria for developing teaching materials. Furthermore, they received feedback from the presenters. The presenters listened to their presentations and provided suggestions and input regarding the teaching materials. They emphasized aspects of the feasibility criteria, their suitability to the CPL (Current Learning Outcomes) and learning objectives, and the content of the teaching materials.

The teaching materials development training was carried out according to plan and went smoothly from the beginning through the presentations. All participants enthusiastically participated in the training and submitted their assigned assignments. The training was also well-received by teachers seeking knowledge about teaching materials and how to develop them.

To evaluate the success of the training, participants completed a questionnaire provided by the presenters via Google Forms. Of the 66 respondents, 100% stated that the teaching materials presented were aligned with the training topic. This is illustrated in the following figure.

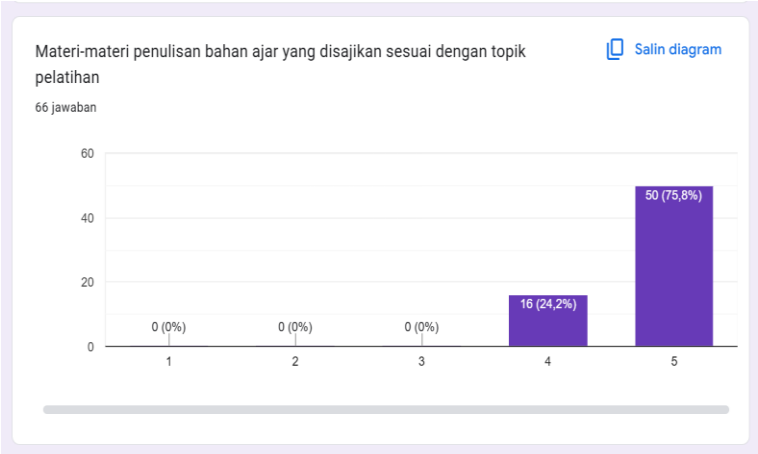

Figure 6. Questionnaire Results Regarding Writing Teaching Materials in Accordance with the Training Topic.

Based on this figure, all respondents agreed that the teaching material was appropriate for the training topic. Furthermore, the material presented to participants was comprehensive and easy to understand. This is demonstrated in the following figure.

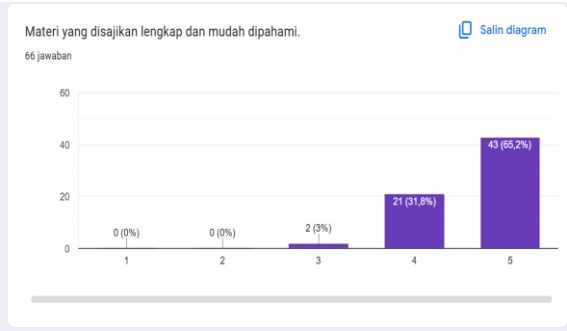

Figure 7. Questionnaire Results Regarding Completeness and Ease of Understanding of Materials

Based on this figure, 65% and 32% of respondents strongly agreed and agreed, respectively, that the material presented was comprehensive and easy to understand. Based on these findings, the comprehensiveness and effectiveness of the material presented were well-conveyed to the training participants. This aspect is crucial to evaluate because the training materials serve as a foundation for teachers in writing teaching materials. Before writing good teaching materials, teachers need to have comprehensive and easy-to-understand materials.

In addition to being easy to understand, the material presented was also engaging for the training participants. This is evidenced by the majority of respondents' responses, which indicated that the training materials were interesting to them.

This training was also beneficial for participants because the materials learned were easy to apply. This is demonstrated by the percentages of 54% and 41% who strongly agreed and agreed that the materials presented were easy to apply.

After receiving the training materials, participants wrote text-based teaching materials tailored to the grade level they were teaching. Below are some examples of teaching materials written by participants in the teaching materials writing training after receiving guided training.

Figure 8. Examples of Teaching Materials Written by Participants

CONCLUSION

This community service activity was conducted by providing intensive training on the development of text-based teaching materials to MTs teachers in Kebumen Regency. The results of this training were an understanding of teaching material development and the skills to develop effective teaching materials. Participants were highly enthusiastic and eager to participate in each stage of the teaching materials training. Through this training, teachers are expected to be able to develop ideal teaching materials based on adequate knowledge and theory. Teachers can also implement the developed teaching materials in their lessons, integrating them with effective learning models, appropriate methods, suitable media, and appropriate assessments. It is hoped that teachers can deliver meaningful learning using appropriate and high-quality teaching materials. Ultimately, students gain knowledge

and are able to explore their potential through the use of teaching materials that maximize achievement in line with current developments.

This training received high enthusiasm from participants and improved teachers' knowledge and skills. A total of 26% and 73% of training participants agreed and strongly agreed that the materials presented improved their knowledge and skills. The product produced by the students was a teaching module containing text-based teaching materials tailored to the class being taught.

Based on the results of the community service implementation, it is hoped that this training can be continued through a mentoring program. Teachers need to continue practicing independently and receive guidance to become more skilled in developing and implementing teaching materials. This ongoing mentoring will help ensure that the skills gained from this training contribute to improving the quality of learning. A follow-up to this training will be the implementation of teaching materials in classroom learning with students directly. This training also received feedback from respondents regarding the training's duration, which was insufficient to facilitate material presentation, the need for ongoing training, especially regarding digital teaching materials, adjustments to the delivery to be more effective and not too fast, and the provision of more examples. This input will serve as a reference for future training to ensure participants can experience and maximize the benefits of the training.

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Community Service Program: Women's Empowerment through Medicinal Plant Cultivation and Marketing of Herbal Products Based on SDGs No. 3 (Good Health and well-being)

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Abstract. Gantiwarno District, Klaten Regency, has significant potential in the cultivation of medicinal plants such as turmeric, temulawak (Curcuma xanthorrhiza), ginger, lemongrass, and kencur (Kaempferia galanga). However, this potential has not been optimally utilized due to limited community knowledge regarding product processing and marketing strategies. This community service program aims to enhance community capacity, particularly among women, through appropriate technology-based training covering medicinal plant cultivation, instant herbal drink production, packaging techniques, and digital marketing. The program was implemented through socialization activities, workshops, hands-on practice, and intensive mentoring involving 50 participants from the women's group of BUMDESMA UPK Gantiwarno. Evaluation was conducted using pre-tests, post-tests, and participant satisfaction questionnaires. Data analysis employed a two-sample t-test assuming equal variances ($\alpha = 0.05$) for each training module, along with descriptive analysis for the satisfaction questionnaire. The results indicate a significant increase in knowledge in the herbal drink production module, a non-significant increase in mean scores for the rhizome cultivation module, and no change in scores for the digital marketing module. Overall, participant evaluation showed a very high level of satisfaction, achieving a score of 88.34%. This community service program has proven effective in improving skills, motivating entrepreneurship, strengthening women's empowerment, and contributing to the achievement of Sustainable Development Goal (SDG) No. 3, namely good health and well-being.

Keyword: herbal antidepressant, forced swimming test, monoamine oxidase inhibitors, Staminur, Morinda citrifolia, Indonesian medicinal plants

INTRODUCTION

Community empowerment through the utilization of local resources is an important strategy for enhancing welfare and economic self-reliance, particularly among women's groups 1. This approach aligns with the United Nations (UN) Sustainable Development Goals (SDGs), especially SDG No. 3 on good health and well-being, SDG No. 5 on gender equality, and SDG No. 8 on inclusive and sustainable economic growth. One local resource with both health and economic value is medicinal plants, which have long been used as ingredients in traditional medicine and herbal remedies (jamu)2,3. As a megabiodiversity country, Indonesia is home to more than 2,000 species of medicinal plants and 32,000 documented herbal formulations (jamu) at the national level4. According to the 2024 Medicinal Plants and Herbal Medicine Research Data (RISTOJA) released by the Indonesian Ministry of Health, approximately 50% of the Indonesian population uses jamu. This condition highlights the substantial potential of medicinal plants as both a community-based health resource and an economic opportunity.

One area with considerable potential is Gantiwarno District, Klaten Regency, Central Java, which has leading commodities such as turmeric (Curcuma longa), temulawak (Curcuma xanthorrhiza), ginger (Zingiber officinale), kencur (Kaempferia galanga), and lemongrass (Cymbopogon citratus). Geographically, Gantiwarno District covers an area of 25.64 km² consisting of 16 villages, 127 neighborhood units (Rukun Warga/RW), and 306 community units (Rukun Tetangga/RT), with a population of 38,620 people. The availability of both natural and human resources presents significant opportunities for the development of medicinal plants and community-based economic activities. However, to date, the utilization of medicinal plants in this area has been largely limited to the sale of raw materials without structured cultivation planning, resulting in low economic value added and limited contribution to improving household income.

The Women's Group of BUMDESMA in Gantiwarno District represents a community group with strategic potential for the development of household-based economic activities. This group consists of approximately 718 women with diverse educational backgrounds and livelihoods. Around 85% of the members have attained secondary education or below, and the majority work as agricultural laborers, market traders, livestock farmers, tailors, and housewives. More than 80% of the group members are of productive age, indicating substantial potential for engagement in economic empowerment programs and the development of local resource–based enterprises.

Preliminary mapping and field observations indicate that the BUMDESMA UPK Gantiwarno women's group continues to face limitations in knowledge and skills related to medicinal plant cultivation, processing of medicinal plants, and digital marketing strategies. These constraints have resulted in a limited capacity to develop medicinal plant–based enterprises as alternative sources of income. Most medicinal plant products are marketed in fresh form at relatively low prices, meaning that opportunities for value-added processed products, such as instant herbal drinks, have not yet been fully utilized.

Limited understanding of income-generating activities through the processing of medicinal plants into market-ready products further weakens the competitiveness of local products. In contrast, global consumption trends indicate increasing demand for instant herbal products, which are considered more practical, hygienic, and have longer shelf life. Processing medicinal plants into instant herbal powder has been shown to significantly increase product economic value, expand household business opportunities, and promote women's economic independence 5. Marketing also remains a major challenge for women's groups in Gantiwarno District. The rapid development of digital technology requires micro-enterprises to utilize social media and online marketing platforms to reach wider markets. However, most women group members lack adequate marketing skills, resulting in local herbal products struggling to compete with commercial products that have adopted modern marketing strategies and more attractive product visualization.

Based on these conditions, a comprehensive intervention through training and mentoring programs is required, encompassing medicinal plant cultivation, processing and packaging of instant herbal products, and digital marketing. This integrated approach is expected to enhance the capacity of women's groups to optimize local resource potential, create added value for herbal products, and expand market access in a sustainable manner. Therefore, the community service program in Gantiwarno District is relevant as a model of women's empowerment based on local medicinal plant cultivation, medicinal plant processing, and digital marketing. This empowerment model is expected not only to contribute to improved community health and well-being, but also to strengthen household economies and support local economic development aligned with the Sustainable Development Goals.

MATERIALS AND METHODS

This community service activity was implemented using a group-based mentoring approach focused on enhancing capacity in medicinal plant cultivation. The program partners were members of the BUMDESMA UPK Gantiwarno LKD Women's Group from Gantiwarno District, Klaten Regency. The group-based mentoring approach was selected to encourage active participant involvement, facilitate the exchange of experiences among participants, and support the application of medicinal plant cultivation practices that are appropriate to local environmental conditions. The implementation method was structured into several stages, including initial identification, training and mentoring activities, and evaluation.

1. Participant Characteristics

A total of 52 participants took part in this community service program. All participants were members of the BUMDESMA UPK Gantiwarno LKD Women's Group and represented 16 villages in Gantiwarno District, Klaten Regency. The participants were within the age range of 40–50 years, reflecting a productive age group. In terms of educational background, approximately 80% of participants had attained secondary education, while the remainder had primary or higher education levels. The participants' occupational backgrounds were predominantly farmers, traders, and housewives. These participant characteristics served as the basis for designing simple and practical training materials and mentoring methods for medicinal plant cultivation

2. Stages of Program Implementation

The initial identification stage was conducted through field observations and discussions with BUMDESMA management and village representatives to obtain an overview of the existing conditions of medicinal plant cultivation within the partner community. This stage included mapping the types of medicinal plants currently cultivated, the planting patterns applied, and the availability of home garden land as a cultivation medium. The

purpose of this stage was to identify training needs and align the training materials with the actual conditions of the community.

The implementation stage focused on training and mentoring in medicinal plant cultivation practices. The materials covered the introduction of local medicinal plant species, seed selection and propagation, preparation of planting media and home garden land, planting techniques, and plant maintenance, including watering, simple fertilization, and natural pest control. The activities were conducted through a combination of theoretical instruction and hands-on practice, enabling participants to apply cultivation techniques independently in their respective environments. Mentoring was carried out gradually to ensure participants' understanding and skill development in medicinal plant cultivation.

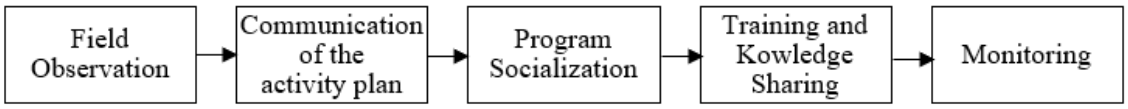

Figure 14. Research Framework

3. Evaluation and Data Analysis

The evaluation was conducted to assess the effectiveness of the mentoring program in improving participants' knowledge and skills related to medicinal plant cultivation. Knowledge evaluation was carried out using pre-test and post-test instruments consisting of 10 questions administered to the same participants before and after the training activities. In addition, observations were conducted to assess participants' practical skills in applying medicinal plant cultivation techniques.

Pre-test and post-test data were analyzed quantitatively using the Statistical Package for the Social Sciences (SPSS) software. The Wilcoxon signed-rank test was employed to examine differences in participants' knowledge levels before and after the mentoring program, with a significance level of 5% ($\alpha = 0.05$). The results of the analysis were used to evaluate changes in participants' understanding and served as the basis for the results and discussion presented in this article.

RESULTS AND DISCUSSION

The implementation of the community service program focusing on enhancing the capacity of the BUMDESMA UPK Gantiwarno LKD women's group demonstrated several notable outcomes in three main areas: medicinal plant cultivation, instant herbal drink production, and digital marketing. All activities were attended by representatives from sixteen villages in Gantiwarno District, with a total of 50 planned participants who actively engaged in all stages of training and field practice.

1. Improvement in Knowledge and Skills of Instant Herbal Drink Production

The training results indicated a highly significant improvement in participants' knowledge related to instant herbal drink production. Based on the pre-test and post-test results, the average score increased from 67.84 to 86.27, representing an improvement of 18.43 points, which reflects a substantial increase in participants' understanding following the training. Statistical testing confirmed that this improvement was scientifically significant ($p < 0.05$), indicating that the instant herbal drink production module played a major role in enhancing participants' competencies.

This finding is consistent with the characteristics of the training material, which was practical, closely related to daily activities, and supported by the availability of local herbal raw materials. Participants were not only able to understand the theoretical aspects but also successfully applied the procedures for processing and packaging instant herbal drinks in accordance with established standards.

The success of this training was further supported by the workshop-based approach and direct mentoring, which allowed participants to practice each production stage, including raw material preparation, boiling, drying, and packaging. This approach contributed to the achievement of key performance indicators, where more than 75% of participants were able to correctly produce and package instant herbal drinks, and more than 90% demonstrated a clear understanding of standardized production procedures.

2. Strengthening Capacity in Medicinal Plant Cultivation

Training in medicinal plant cultivation also yielded positive outcomes, although the magnitude of improvement was smaller compared to the instant herbal drink production training. The average pre-test score of 88.27 increased to 91.73, representing a gain of 3.46 points. Statistical analysis showed that this increase was not statistically significant ($p = 0.20$), suggesting that many participants already possessed basic knowledge of

medicinal plant cultivation prior to the program. This is understandable, as most participants were housewives living in agrarian areas and were already familiar with local rhizome plants such as turmeric, ginger, and kencur.

Despite the modest increase in test scores, the training played an important role in standardizing participants' knowledge, particularly regarding hygienic and productive cultivation techniques, including the selection of high-quality seedlings, land sanitation, natural pest control, and post-harvest handling. Through this training, medicinal plant cultivation practices are expected to become more systematic and capable of producing higher-quality raw materials to support the production of instant herbal drinks.

3. Challenges in Digital Marketing Training

In contrast to the previous two areas, the digital marketing training did not result in an improvement in scores, with the average score remaining at 77.31 for both the pre-test and post-test. This result indicates that there was no increase in participants' competence in digital literacy, and statistical analysis confirmed that the change was not significant ($p > 0.05$).

Several factors contributed to this stagnation, including low levels of digital literacy among some participants, limited access to smartphones capable of supporting digital marketing applications, and participants' lack of experience in creating visual content or managing online marketing accounts. Nevertheless, the training still provided initial benefits in the form of introducing digital marketing concepts, developing basic understanding of promotional content, and establishing a simple online store managed collectively as a practical exercise. Strengthening digital-based marketing capacities requires continued mentoring to enable participants to apply these skills consistently and effectively

4. Participant Satisfaction with Training Activities

Evaluation results indicate that the level of participant satisfaction with the training activities was categorized as very good, with an average score of 4.42 out of 5, equivalent to 88.34%. The highest score was recorded for the perceived benefits of the program (4.60), while the lowest score was related to the technical clarity of the activities (4.11). These findings suggest that the program was considered relevant and beneficial by participants, although certain aspects still require clearer technical explanations or extended practice time.

5. Achievement of Program Success Indicators

Overall, the community service program successfully met most of the success indicators established at the outset. Participants' understanding of instant herbal drink production procedures reached a very high level, with more than 90% of participants able to accurately explain the production steps. In addition, the practical implementation of instant herbal drink production and packaging yielded satisfactory results, with more than 75% of participants able to independently complete all production stages, including raw material preparation, cooking, drying, and packaging using various packaging models. These outcomes demonstrate that hands-on, practice-based training is highly effective in enhancing participants' skills, particularly for technical and application-oriented materials.

Participants' motivation to engage in entrepreneurship related to instant herbal drinks also increased. Based on evaluation results, more than 10% of participants expressed interest in producing instant herbal drinks regularly as a home-based business opportunity. This indicates that the program not only improved knowledge and skills but also expanded participants' economic perspectives. Furthermore, several participants began exploring partnerships with offline retail stores through consignment systems, enabling the achievement of the minimum target of 5% of participants placing products in physical stores. Another notable outcome was the establishment of a simple online store managed collectively by participants as an initial step toward strengthening digital marketing capabilities. Although further mentoring is still required, this achievement demonstrates participants' initial readiness to utilize digital platforms for marketing herbal products.

Overall, the achievement of program indicators indicates that this community service activity has generated tangible impacts on community capacity building, particularly in production skills and entrepreneurial motivation. Digital marketing remains the aspect requiring further strengthening; however, the initial phase of digital literacy development was successfully initiated through the creation of an online store and digital content training. Thus, the program can be considered successful in achieving most of its planned targets and in providing a strong foundation for the sustainable development of instant herbal drink enterprises in Gantiwarno District.

CONCLUSION

Overall, the results confirm that instant herbal drink production training was the most effective component in enhancing participants' competencies. Participants' relatively strong prior knowledge of medicinal plant cultivation meant that this training functioned primarily as reinforcement rather than transformation. Meanwhile, the persistently low level of digital literacy highlights the need for long-term mentoring programs. This program proved effective as a model of women's empowerment based on the utilization of local resources, appropriate technology, and the strengthening of household economies, in alignment with SDGs No. 3 (Good Health and Well-being) and No. 5 (Gender Equality).

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Dynamics Of Regional Elections In Indonesia (A Study On The Old Order, New Order, And Reform Era)

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Abstract. this study explores the dynamics of regional elections in indonesia through three key historical periods: the old order, the new order, and the reform era. each era represents a different phase in indonesia's political landscape, influencing the mechanisms, policies, and political participation in local governance. the old order period (1945–1966) marked the initial establishment of regional elections, where local governance was heavily centralized, and elections were limited in scope and function. the new order period (1966–1998) saw significant political control by the central government, with regional elections being more symbolic, as power was concentrated in the hands of the central authority under president suharto. the era was characterized by limited political freedoms and the suppression of local political movements.in contrast, the reform era (1998–present) brought about substantial political changes, including the decentralization of power, enhanced democratic processes, and more direct participation in regional elections. reforms in this period, particularly the direct election of regional heads, have led to a more competitive political environment, allowing for greater regional autonomy. this study analyzes how these transitions have shaped regional elections, focusing on changes in electoral systems, political party dynamics, and the role of civil society in influencing local governance. it concludes by assessing the challenges and opportunities presented by indonesia's evolving regional election landscape.

Keywords: regional elections, old order, new order, reform era, decentralization, local governance, democracy

INTRODUCTION

The political landscape of Indonesia has undergone significant transformations, particularly in the way regional elections are conducted. During the Old Order (1945–1966), local governance was highly centralized, and regional elections were either limited or nonexistent. Under President Sukarno's leadership, political authority was concentrated at the center, leaving little room for regional autonomy. This centralized power structure continued into the New Order (1966–1998) under President Suharto, where regional elections were largely symbolic, with the central government maintaining strict control over political participation and governance. The New Order period was characterized by the suppression of local political movements and limited political freedoms, further diminishing the importance of regional elections.

In contrast, the Reform Era (1998–present) brought substantial changes, particularly with the decentralization of power and the introduction of direct elections for regional heads. These reforms aimed to strengthen democracy by giving local governments more autonomy and allowing citizens greater involvement in the political process. Similar transformations have been seen in other regions globally, such as Afghanistan, where political landscapes have shifted dramatically in recent years (1). Likewise, studies on Persian Twitter reveal how political discourse shapes electoral dynamics (2). In Indonesia, these changes have led to a more competitive political environment, but challenges remain, including political fragmentation and corruption at the local level.

This study explores the dynamics of regional elections in Indonesia, focusing on three key periods: the Old Order, New Order, and Reform Era. These distinct periods reflect the changing nature of local governance and the role of regional elections in shaping Indonesia's political system. During the Old Order (1945–1966), regional elections were limited in scope, and local governance was heavily centralized under the leadership of President Sukarno. The New Order (1966–1998), led by President Suharto, saw even greater centralization, with regional elections becoming largely symbolic, and political freedoms were severely restricted.

In contrast, the Reform Era (1998–present) ushered in substantial political reforms that significantly impacted regional elections. This period introduced decentralization, shifting more power to regional governments, and enhanced democratic practices, particularly through the direct election of regional heads. These reforms allowed for more direct participation by citizens in local governance and contributed to greater political competition and regional autonomy. This study aims to analyze the evolution of regional elections across these three periods, examining changes in electoral systems, political party dynamics, and the role of civil society in shaping local political landscapes.

METHOD

This study employs a qualitative research methodology, using historical and comparative analysis to examine the dynamics of regional elections in Indonesia. Data were gathered from archival sources, previous studies, and reports on political transitions in Indonesia. The research focuses on comparing the key political characteristics and electoral systems of the Old Order, New Order, and Reform Era. It also looks at the shifts in political power dynamics, the role of regional political parties, and the involvement of civil society in local elections during each period. The study further considers the impact of decentralization on the political autonomy of regional governments, highlighting the significant changes in electoral systems and their influence on governance structures.

To analyze these changes, the study reviews key reforms such as the introduction of direct regional head elections in the Reform Era, as well as the centralization of power under Suharto. The method also involves assessing the broader socio-political environment, including the role of civil society in promoting democratic values and holding local governments accountable. Through this analysis, the study aims to provide insights into the evolution of regional elections in Indonesia and the challenges faced in ensuring democratic participation at the local level.

RESULTS AND DISCUSSION

The results of this study show significant shifts in the regional election landscape over the three political periods in Indonesia. During the Old Order (1945–1966), regional elections were largely not implemented, and local governance was heavily centralized under the control of the central government. Local leaders were appointed by the central authority rather than elected, significantly hindering local political participation and suppressing democratic processes. The New Order (1966–1998) further deepened this centralization, with regional elections becoming largely symbolic. Under President Suharto's regime, political power remained concentrated at the center, and political freedoms were suppressed. As a result, regional elections played a limited role in fostering local political engagement, as local political movements were stifled during this period, creating a highly controlled political environment (3).

In contrast, the Reform Era (1998–present) brought transformative changes, particularly with the introduction of decentralization and the direct election of regional heads. These reforms significantly contributed to creating a more competitive and participatory political environment, allowing regional governments to exercise more control over local governance. The direct election of regional heads, in particular, has fostered a more dynamic and democratic political atmosphere, encouraging citizens to actively engage in political processes. Despite these positive developments, challenges remain, such as ensuring equitable representation, overcoming local power struggles, addressing political corruption, and tackling weak institutional capacities in some regions. These ongoing challenges underscore the complexities of fully realizing a democratic and inclusive political system at the regional level (4; 5).

CONCLUSION

In conclusion, the dynamics of regional elections in Indonesia have undergone significant changes from the Old Order to the New Order and into the Reform Era. Each period reflects different approaches to local governance, with varying levels of political freedom and decentralization. The Reform Era, in particular, has been marked by substantial political reforms, including decentralization and the direct election of regional heads, which have enhanced democratic participation and regional autonomy. However, challenges such as political fragmentation, corruption, and institutional weaknesses continue to pose obstacles to the full realization of democratic governance at the regional level. This study highlights the importance of continuing reforms to strengthen the capacity of regional governments and ensure that regional elections are truly reflective of the will of the people.

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Early Nationalism and Legal Awareness Education: Street Crime Prevention Education and Outreach in RT 07 RW 59 Sengkan Joho, Condongcatur, Sleman, Yogyakarta

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Abstract. This program focused on early nationalism and legal awareness education, aiming to prevent street crime through community outreach in RT 07 RW 59 Sengkan Joho, Condongcatur, Sleman, Yogyakarta. The initiative involved educating local residents, particularly youth, about their legal rights and responsibilities while fostering a sense of national identity. By engaging the community in discussions about the importance of law and civic responsibility, the program aimed to raise awareness of street crime prevention methods. Ultimately, the initiative sought to empower individuals to actively participate in maintaining public order and contribute to a safer, more cohesive community.

INTRODUCTION

The increasing rate of street crime in urban areas, particularly in RT 07 RW 59 Sengkan Joho, Condongcatur, Sleman, Yogyakarta, has become a critical issue for local communities. To address this, the community service program focused on promoting early nationalism and legal awareness education. By engaging the community in discussions about legal rights and the significance of upholding national values, the initiative aimed to foster civic responsibility. The program sought to equip residents, especially youth, with the necessary knowledge and tools to prevent street crimes and contribute to public order. This approach reflects broader efforts to combine legal education with a sense of national identity, as seen in similar community-based initiatives (1). In addition, the program highlighted the need for sustained efforts to maintain community engagement beyond the duration of the initiative. By linking legal education with national values, it encouraged participants to take ownership of their roles in preventing street crime and enhancing public safety. This holistic approach to community service aligns with similar educational programs, like the 79th Independence Day competition in Condongcatur, which emphasized the importance of nationalism and active participation in civic life. These initiatives demonstrate how combining legal awareness with national pride can effectively address social issues and strengthen community bonds (4).

PROBLEMS

One of the main problems addressed by this program was the lack of legal awareness among residents, especially regarding their rights and responsibilities within the context of street crime prevention. Many individuals were unaware of the legal implications of street crimes or the role they could play in preventing them. Additionally, there was a gap in understanding how national values, such as unity and justice, could contribute to a safer environment. The program also identified a lack of community engagement in discussions about crime prevention and legal rights, which limited the effectiveness of local crime-reduction efforts.

COMMUNITY SERVICE METHOD

The community service program employed a participatory approach, where local residents, especially youth, were actively involved in the learning process. Workshops, group discussions, and role-playing activities were conducted to teach legal awareness and the importance of nationalism in crime prevention. These sessions focused on educating participants about street crime, legal consequences, and their roles as responsible citizens. In addition, the program utilized local leaders to facilitate discussions, ensuring the messages were culturally relevant and easily understood. Educational materials and resources were provided to enhance the learning experience and promote long-term awareness.

RESULTS AND DISCUSSION

The program showed positive results, as participants demonstrated increased awareness of both legal matters and their responsibilities in preventing street crime. Feedback indicated that many youth began to understand the implications of their actions and the importance of adhering to legal norms. This aligns with the findings in research by Ningrum and Sunarso (2), which emphasizes the role of education in fostering a deeper understanding of civic responsibility and the implications of legal adherence, especially in contexts where marginalized groups, including youth, are involved.

Figure 1 community service process

Furthermore, discussions around nationalism and civic responsibility fostered a deeper sense of community solidarity. However, challenges remained in sustaining engagement beyond the program's duration, highlighting the need for continuous education and community involvement in crime prevention initiatives. The success of this program underscores the importance of combining legal education with a strong sense of national identity. This approach aligns with the findings in (3).work, which emphasizes the role of civic education in strengthening socio-economic contributions and national spirit. In particular, her research on community-driven educational initiatives, such as the celebration of Indonesia's Independence Day, highlights how these activities can cultivate a deeper understanding of civic values and national pride

The discussions around nationalism and civic responsibility during the program led to a deeper sense of community solidarity, as participants began to recognize the importance of contributing to the collective good. However, challenges remained in maintaining long-term engagement, especially after the program concluded. This highlighted the need for continuous education and sustained community involvement in crime prevention initiatives. The program's success emphasized the importance of integrating legal education with national identity, encouraging individuals to understand not only their rights but also their responsibilities as citizens. This approach resonates with the findings in Hidayah's work, which underscores how educational initiatives can strengthen both socio-economic contributions and national spirit (5).

CONCLUSION

In conclusion, the program successfully raised awareness about legal rights and street crime prevention while promoting early nationalism among community members in RT 07 RW 59 Sengkan Joho. By educating youth and other residents on the importance of legal norms and civic responsibility, the program contributed to creating a safer, more informed community. The positive outcomes suggest that similar programs, with a focus on legal awareness and national values, can be effective in preventing street crime and fostering a sense of responsibility among residents. Future efforts should aim to expand community engagement and ensure the sustainability of these educational initiatives.

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EFFECTIVENESS OF PEMANTIK LEARNING MEDIA (ANTI-CORRUPTION EDUCATIONAL GAMES) ON INFLUENCING INTEGRITY VALUES IN THE HIGH SCHOOL CURRICULUM

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Abstract. this study aims to assess the effectiveness of the "pemantik" educational game, designed to instill integrity values among high school students within the curriculum. as part of efforts to combat corruption, it is essential to integrate character education into the school system, particularly focusing on integrity as a core value. "pemantik" is an anti-corruption game that aims to engage students interactively, offering a unique approach to teaching integrity and ethics. by using game-based learning, students are expected to better understand the importance of integrity in real-life situations and develop strong ethical principles.the research was conducted with high school students, where the game was incorporated into the learning process. pre- and post-tests, as well as surveys, were utilized to measure changes in students' understanding and attitudes toward integrity before and after using the game. data analysis revealed that students demonstrated a significant improvement in their understanding of integrity and its importance in society. the game proved to be an effective tool for engaging students, promoting active learning, and fostering a deeper connection to the values of honesty and responsibility. the results suggest that integrating interactive learning media, like "pemantik," into the curriculum can significantly contribute to character development, particularly in building integrity among high school students.

Keywords: anti-corruption education, learning media, integrity values, educational game, high school curriculum.

INTRODUCTION

The increasing prevalence of corruption in various sectors of society has made it essential to instill values of integrity and ethics in the younger generation. corruption not only hampers development but also undermines public trust in institutions, making it crucial for educational systems to focus on cultivating integrity among students. the younger generation plays a vital role in shaping the future of the nation, and it is essential to equip them with the moral compass to fight corruption. this aligns with the views expressed by chowdhury, banerjee, and nagarkoti (1), who emphasize the role of grassroots efforts and education in combating corruption. by embedding values of integrity into the education system, it becomes possible to nurture ethical behavior from an early age, creating a generation that prioritizes honesty and transparency in all aspects of life.

in addressing the issue of corruption, the integration of integrity-based education is a critical step in fostering a culture of accountability. wiyono, purnomo, and lestari (2) discuss the pervasive culture of corruption in governance systems and the need for systemic changes. they argue that a shift in cultural attitudes toward ethics and integrity, starting from education, is crucial to combatting corruption effectively. this can be achieved by incorporating anti-corruption education into curricula and using interactive methods like educational games to engage students. the pemantik educational game, designed to teach anti-corruption values, serves as an example of how educational tools can be used to instill integrity, making it an important strategy in the fight against corruption

high school students, as future leaders, must be equipped with strong moral values to contribute to the development of a fair and just society. one effective approach to teaching these values is through character education, which includes the integration of integrity as a core value in the school curriculum. this study focuses on evaluating the effectiveness of pemantik, an anti-corruption educational game, in instilling integrity values among high school students. pemantik is a game designed to engage students in interactive learning, offering them an innovative way to understand integrity and ethical behavior through gameplay. The importance of incorporating game-based learning into the education system has gained recognition in recent years. games, by nature, engage students in problem-solving and decision-making, allowing them to apply ethical concepts in simulated real-world scenarios. this study aims to explore how pemantik serves as a tool to promote integrity and responsibility, assessing its impact on students' understanding of these values. through pre- and post-tests, as well

as surveys, the research evaluates the changes in students' attitudes and comprehension of integrity before and after using the game. the findings of this study aim to provide valuable insights into the role of interactive learning media in character education, specifically in fostering integrity among high school students.

METHODOLOGY

This study employs a qualitative research methodology using literature study as the primary approach to assess the effectiveness of the pemantik anti-corruption educational game in instilling integrity values within the high school curriculum. the research is based on the analysis of existing studies, educational resources, and theoretical frameworks regarding game-based learning, character education, and anti-corruption education. relevant literature from various sources, including academic journals, books, government reports, and previous research on educational games and integrity, were reviewed and synthesized to gather insights on how the pemantik game aligns with current educational strategies and its potential impact on students.

the literature study approach focused on examining how game-based learning can influence students' ethical behavior and the development of integrity. the research explored existing examples of educational games used in character education, especially those focused on anti-corruption, and their effectiveness in fostering values like honesty and responsibility. by reviewing studies on the role of games in promoting civic virtues and ethics, the research aimed to provide a comprehensive understanding of how pemantik could contribute to character development in the high school setting. the study also analyzed the integration of such games into curricula and how they engage students in active learning, thereby influencing their understanding of integrity in both personal and societal contexts.

RESULTS AND DISCUSSION

The results of the study showed a significant improvement in students' understanding of integrity and their ability to apply ethical principles in real-life scenarios. post-test results revealed that students demonstrated a deeper understanding of integrity and its importance in society compared to their responses before using the game. additionally, the surveys indicated that students felt more engaged with the topic of integrity due to the interactive nature of the game. many students reported that the game helped them visualize the consequences of unethical behavior and encouraged them to think critically about the role of integrity in their personal and future professional lives. this aligns with the findings of numerato (3), who discussed the importance of understanding the implications of unethical behavior in various contexts, including public secrecy and corruption. through active participation in the game, students were able to explore these consequences, fostering a deeper connection to the topic.

the discussions around the results highlighted the effectiveness of game-based learning in fostering active participation and deeper engagement with educational content. teachers noted that students were more motivated and interested in the subject matter when it was taught through an interactive medium like pemantik. however, challenges such as ensuring that all students had equal access to the technology and making time for reflective discussions in the classroom were noted. despite these challenges, the overall feedback from students and educators suggested that pemantik was a successful tool for promoting integrity and raising awareness about corruption. this finding supports the work of oboro-offerie, toklo, and allor (4), who emphasized the importance of interactive learning methods in increasing awareness about corruption and promoting ethical behavior. the integration of such tools into educational systems can be crucial in cultivating responsible citizens who are equipped to challenge corruption in various forms (5).

CONCLUSION

In conclusion, the Pemantik educational game proved to be an effective tool for instilling integrity values in high school students. The game successfully engaged students in active learning, allowing them to explore ethical issues and develop a deeper understanding of the importance of integrity in their lives. The study suggests that integrating interactive learning media, such as Pemantik, into the high school curriculum can significantly enhance character education, particularly in fostering ethical principles among young learners. Despite some challenges in implementation, the positive feedback from students and teachers indicates that game-based learning can play a vital role in shaping the moral and ethical development of students, making it a valuable addition to the education system.

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MENTORING AND DIGITAL LITERACY EDUCATION FOR CHILDREN IN CONFLICT WITH THE LAW: RAISING LEGAL AWARENESS AND DIGITAL SECURITY IN RT 07 RW 59 SENGKAN JOHO, CONDONGCATUR, SLEMAN

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Abstract. This program aims to provide digital literacy education and legal mentoring to children in conflict with the law, focusing on building awareness of legal rights and digital security. By fostering safer, more responsible digital presence. Held in RT 07 RW 59 Sengkan Joho, Condongcatur, Sleman, this community-based effort seeks to equip young individuals with necessary skills to navigate both the legal and digital landscapes safely and responsibly.

INTRODUCTION

The rapid development of technology has brought both opportunities and challenges, especially for children who are at a vulnerable stage of development. with the increasing use of digital platforms, children are exposed to various online risks, including cyberbullying, online exploitation, and the violation of their digital rights. in response to this growing concern, the community service program aimed to provide digital literacy education and legal mentoring to children in conflict with the law in rt 07 rw 59 sengkan joho, condongcatur, sleman. this initiative seeks to empower children by equipping them with the necessary tools to understand both their legal rights and responsibilities in the digital realm. by promoting legal awareness and digital safety, the program aims to prevent future legal issues and ensure that the children are equipped to navigate the digital world safely. in addition, the program also emphasizes the importance of building a responsible online presence and understanding the consequences of one's actions both offline and online. this initiative is not only focused on educating children about their rights but also seeks to promote a culture of respect for the law and digital ethics within the local community (1). the program aligns with existing research emphasizing the importance of civic education and the role of digital literacy in preventing online threats. by addressing these concerns through community engagement, the program also supports broader educational goals, such as fostering awareness and critical thinking among students regarding their roles as responsible digital citizens. this community-based approach aims to create lasting change by instilling values that protect children from the dangers of the digital world, thus ensuring their safe and ethical participation in the online environment (2).

PROBLEMS

The primary issue addressed by this community service initiative was the lack of awareness among children, particularly those in conflict with the law, about their legal rights and the risks associated with the digital world. Many children in the target area were unaware of the potential dangers of the internet, such as cybercrime, identity theft, and online harassment. This lack of knowledge makes them vulnerable to exploitation and makes it difficult for them to make informed decisions regarding their online activities. In addition, there was a gap in legal understanding, especially related to the consequences of violating laws in both the physical and digital spaces.

Another challenge identified was the lack of accessible resources and mentorship for children involved in legal issues. Without proper guidance, these children often faced difficulties in understanding the legal procedures they were going through and the potential impacts on their futures. The community service program aimed to address these issues by providing relevant education on digital safety, legal rights, and the consequences of digital misconduct, ensuring that children could make responsible choices moving forward.

COMMUNITY SERVICE METHOD

The program utilized a combination of interactive workshops, group discussions, and one-on-one mentoring sessions to deliver its content. Workshops were designed to teach children about their legal rights, digital safety practices, and the consequences of online behavior. These sessions were structured to engage children in hands-on learning experiences, where they could ask questions and participate in discussions related to real-life scenarios. Additionally, the program provided resources such as educational materials, digital security guides, and legal handbooks to help reinforce the knowledge shared during the sessions.

In terms of implementation, the community service method involved close collaboration with local community leaders, teachers, and legal experts who facilitated the educational sessions. Mentors were assigned to work with smaller groups of children to provide personalized guidance and answer specific legal and digital security questions. This method ensured that the children not only received theoretical knowledge but also practical advice that could be applied in their daily lives. The program was designed to be both educational and empowering, ensuring that children left with a stronger understanding of how to protect themselves both legally and digitally.

RESULTS AND DISCUSSION

The results of the community service program were highly positive, as the children who participated demonstrated a significant increase in their understanding of digital safety and legal rights. This aligns with previous research, such as the study by Kurniawan et al. (3), which emphasized the importance of community-based initiatives in enhancing legal awareness and digital literacy among vulnerable groups. The program's success in improving children's understanding of these crucial topics highlights the effectiveness of combining legal education with digital safety training in fostering responsible behavior, especially in a digital environment where children are increasingly exposed to various risks. The findings suggest that such programs are essential in empowering young individuals to navigate both legal and digital challenges confidently. feedback from participants indicated that they felt more confident in navigating the internet and understood how to protect themselves from potential online risks.

Figure 1 community service process

The shift in mindset reported by the children, where they demonstrated a greater awareness of their legal responsibilities and the potential consequences of violating laws in both physical and digital spaces, mirrors the objectives discussed in the work of Suyato, Firmasyah, and Yudha (4). In their study on improving numeracy literacy skills through the Campus Teaching Program at Clumprit Public Elementary School, they emphasized the importance of preparing students with critical thinking skills necessary for responsible citizenship. Similar to the impact of the community service program, their research underscores how educational initiatives can foster long-term behavioral changes, helping students not only understand their rights but also recognize the consequences of their actions in a broader societal context, both in digital and physical environments.

The discussions during the program revealed that while the children were initially unaware of the risks and legal aspects of their digital interactions, they became more engaged as the sessions progressed. This shift in awareness aligns with the findings from a similar community initiative, where the importance of legal mentoring and digital literacy was emphasized for vulnerable groups, particularly children. As noted in a study by the Faculty of Law UPN "Veteran" Jakarta, such programs can effectively equip participants with critical legal knowledge and digital safety skills, fostering a greater sense of responsibility (5). The success of the program highlights the need for continued efforts in promoting digital literacy and legal awareness among children, especially those at risk of falling into legal troubles. Overall, the program proved to be an effective means of equipping children with the necessary tools to protect themselves in the digital world while also fostering a deeper understanding of their legal rights and responsibilities.

CONCLUSION

This initiative has successfully raised awareness about the importance of legal rights and digital security among children in conflict with the law. By providing mentoring and digital literacy education, it has empowered the children to make informed decisions and foster a safer online presence. Through community involvement in RT 07 RW 59 Sengkan Joho, Condongcatur, Sleman, the program has not only equipped the participants with crucial knowledge but also encouraged a culture of responsibility in both legal and digital spaces. This effort underscores the importance of proactive education in preventing future legal issues and promoting digital well-being.

ACKNOWLEDGMENTS

We would like to express our deepest gratitude to Yogyakarta State University (UNY) for their support of this community service project. Special thanks to the local community in RT 07 RW 59 Sengkan Joho, Condongcatur, Sleman, whose cooperation and enthusiasm made this project a success.

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WORKSHOP ON THE DEVELOPMENT OF ETHNO-STEAM-BASED SCIENCE LEARNING MATERIALS

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Abstract. Science education in Indonesia continues to face a number of challenges, including limited instructional innovation, low levels of student engagement, and the underutilization of local wisdom in teaching and learning processes. Therefore, strategic efforts are needed to integrate the STEAM approach (Science, Technology, Engineering, Arts, and Mathematics) with ethnoscience in order to create learning experiences that are more contextual, meaningful, and culturally grounded.This program was designed to strengthen the capacity and competence of science teachers in developing innovative teaching materials that incorporate local ethnoscience within a STEAM framework. The community service initiative involved 30 teachers from the Science Teachers Working Group (MGMP IPA) of Kulon Progo Regency and was conducted at SMP Negeri 1 Pengasih. The implementation of the program consisted of two phases. The initial phase was conducted online and focused on enhancing conceptual understanding of STEAM-based science learning, the strategic role of local ethnoscience, and integrative approaches to instructional material development. The subsequent phase took place offline in the form of a workshop, in which participants collaboratively designed science learning tools—such as teaching modules and student worksheets (LKPD)—using an Ethno-STE(A)M approach. Data were collected through assessment of the products developed, participant reflections, and observations throughout the activities. Evaluation results indicate that more than 75% of participants successfully integrated elements of ethnoscience into science learning and accurately mapped relevant STEAM components within their instructional designs. Furthermore, the teachers demonstrated a high level of engagement through group discussions, collaborative work, and presentations of their instructional product prototypes. This program also had a positive impact on improving teachers' confidence in designing contextual and innovative learning activities. Overall, the initiative effectively strengthened teachers' abilities to develop Ethno-STE(A)M–based science instruction, while enhancing their pedagogical competence and deepening their awareness of the importance of integrating local wisdom into science education. Participants acknowledged that the program provided significant new perspectives and insights that support the advancement of innovative, culturally grounded, learner-oriented science education aligned with the demands of 21st-century learning.

Keywords: Ethno-STE(A)M, science education, science literacy, teacher professional development, Ethnosains

INTRODUCTION

Natural Science (IPA) is one of the core subjects taught in schools. Science learning aims to equip students with knowledge, ideas, and concepts about the natural environment, obtained through direct experiences and a series of scientific processes such as investigation, planning, and idea development (Lestari, T., 2019). Through science education, students are guided to understand scientific knowledge, facts, concepts, and principles, while also mastering inquiry processes and cultivating scientific attitudes (Ali, D., 2020). This is in line with the nature of science, which encompasses three essential components: scientific attitudes, scientific products, and scientific processes (Sayekti, I. C., 2019).

However, the implementation of science learning in schools has not yet reached its optimal potential. Various challenges continue to emerge in classroom practice, including limited innovation and variation in teaching methods, low student interest and motivation, poor learning focus, insufficient learning resources, and inadequate learning support (Winangun, 2022). These findings are consistent with preliminary observations conducted by the researchers on science teachers in Kulon Progo Regency, which revealed several difficulties in the learning process. One of the major concerns is the need to strengthen the dissemination and utilization of science teaching materials that align with technological and informational developments while still embracing local cultural wisdom.

Amid today's increasingly complex educational landscape, strengthening knowledge and technology has become essential for improving the quality of education in Indonesia. Science education plays a strategic role in shaping students' critical, logical, and systematic thinking skills. Nevertheless, empirical evidence shows that the competence of science teachers in developing teaching materials and integrating ethnoscience remains insufficient. According to a study by the Educational Quality Assurance Agency (LPMP) in 2022, approximately 40% of science teachers in Indonesia reported lacking confidence in incorporating ethnoscience elements into their teaching.

One of the significant challenges teachers face is their limited understanding and skills in designing contextual teaching materials. Data from the Ministry of Education indicate that only around 30% of teachers are able to develop materials that are relevant to students' local environments and cultural contexts. As a result, science learning often becomes less engaging, leading to low student involvement and reduced interest in the subject matter.

The Etno-STE(A)M approach offers a promising solution by integrating scientific concepts with local wisdom that has been practiced and validated within the community. This approach makes learning more contextual, applicable, and meaningful. A study conducted by the Indonesia University of Education in 2021 showed that implementing the Etno-STE(A)M approach increased students' learning motivation by up to 25% and improved conceptual understanding compared to conventional instruction. By integrating ethnoscience, teachers do not merely deliver abstract theories; they connect science concepts to students' real-life experiences and daily practices.

In response to these challenges, the Workshop on Developing Ethno-STE(A)M-Based Science Teaching Materials was designed as a collaborative forum that brings together educators, curriculum developers, and various stakeholders to promote the development of more contextual science curricula. This workshop provides participants with the knowledge and skills needed to design and implement teaching materials that not only meet academic standards but also reflect local cultural values. Additionally, it serves as a space for participants to exchange ideas, share experiences, and discuss best practices in science education.

Overall, this initiative is expected to contribute to improving the quality of science education and encouraging greater student engagement and enthusiasm in learning. Science learning should no longer be perceived merely as the transfer of knowledge, but rather as a meaningful and relevant learning experience connected to everyday life. In line with this foundation, the workshop aims to enhance teachers' competence in developing contextual and relevant science teaching materials; deepen their understanding of the importance of ethnoscience and strategies for its integration; and foster collaboration between teachers and education experts in designing science curricula rooted in local wisdom.

Through the implementation of this workshop, educators are expected to develop teaching materials that not only meet academic demands but also nurture students' appreciation for local culture and their surrounding environment. Ultimately, the enhancement of teacher competence is anticipated to have a direct positive impact on the overall quality of science education in Indonesia.

METHODOLOGY

Method of Implementing the Community Service Program

The Workshop on Developing Ethno-STE(A)M-Based Science Teaching Materials was implemented through a series of structured activities designed to enhance teachers' capacity and professional competence. The sequence of activities consisted of several key components as follows.

1. Teacher competency enhancement training.
   This activity involved intensive training sessions for science teachers aimed at strengthening their skills in designing and developing relevant and contextual teaching materials. The training covered topics such as the application of innovative instructional methods, strategies for integrating ethnoscience into science learning, and curriculum development based on local potentials and characteristics.
2. The implementation of an applicative workshop.
   The workshop was designed to provide teachers with hands-on experience in preparing and developing Ethno-STE(A)M-based science teaching materials. During this activity, participants received guidance on designing teaching modules that connect science concepts with local wisdom and cultural values.
3. The provision and development of learning resources.
   Teachers were given access to various supporting references, including books, scientific articles, and examples of teaching materials that had integrated ethnoscience. These resources were intended to assist teachers in adapting learning materials to students' needs and the surrounding environment.
4. Collaboration with ethnoscience experts.
   The workshop involved experts in ethnoscience and science education as speakers and facilitators. Their

involvement aimed to deepen participants' understanding of the vital role of local wisdom in science education, while also providing guidance throughout the process of developing teaching materials.

5. The application of student-centered learning models.
   Teachers were encouraged to implement active learning strategies that emphasize student participation, such as project-based learning, contextual case studies, and community-based projects, to increase students' interest and motivation in learning.\
6. The implementation of mentoring and continuous evaluation programs.
   A mentoring program was developed to enable teachers who had completed the training to support their peers in applying the Etno-STE(A)M approach. Periodic evaluations were also conducted to assess the effectiveness of the teaching materials and to make necessary improvements.
7. The establishment of a teacher learning community.
   This activity encouraged the formation of learning networks among teachers across various schools as a platform for sharing experiences, learning resources, and best practices in science instruction. The community is expected to strengthen collaboration and foster a sense of professional solidarity among educators.
8. The development of instructional guidelines and modules.
   The workshop also produced systematic guidelines and learning modules outlining the application of ethnoscience within the science curriculum, providing teachers with a clear framework for implementing culturally grounded science instruction.

Through this series of activities, the development of Ethno-STE(A)M-based science teaching materials is expected to be implemented optimally, enhance teachers' professional competence, and foster students' motivation through contextual, engaging, and meaningful learning experiences. Ultimately, this program is anticipated to make a significant contribution to improving the quality of science education in Indonesia.

Method of Implementing the Community Service Workshop on Developing Ethno-STE(A)M-Based Science Teaching Materials

The implementation of this community service program employed several complementary instructional methods, described as follows.

1. The cooperative learning method was applied to encourage collaboration among participants in sharing knowledge and skills throughout the development of teaching materials. Through collaborative activities, participants were able to learn from one another and generate more creative and innovative ideas.
2. The case study method was utilized by drawing upon real-world problems relevant to the local context. This approach helped participants understand how to integrate ethnoscience into science learning in a more concrete and applicable manner, while also enriching group discussions.
3. Simulation and role-play methods were implemented to provide participants with direct, experiential engagement in handling authentic classroom situations. These activities enabled teachers to explore potential challenges and solutions in applying the Etno-STE(A)M approach in instructional practice.

A STE(A)M-based science teaching material development workshop was conducted to facilitate participants in designing learning projects oriented toward the integration of ethnoscience. This activity allowed participants to translate theoretical concepts into practical instructional applications. In addition, a panel discussion featuring expert speakers provided insights and professional perspectives on ethnoscience and effective science teaching practices. This session fostered constructive dialogue and broadened participants' understanding of the subject matter.

Practical Steps for Implementing the Program

The initial stage of the program began with the establishment of an implementation team responsible for planning and organizing the workshop, including coordinating activities, identifying resource persons, and disseminating information to prospective participants.

The next step involved identifying and selecting participants, consisting of science teachers from various schools, curriculum developers, and other educational stakeholders. Invitations were distributed through official letters as well as digital communication platforms.

The subsequent stage included the delivery of introductory materials outlining the objectives of the program and the importance of applying the Etno-STE(A)M approach. The materials presented covered fundamental concepts, the role of ethnoscience in science learning, and examples of classroom implementation.

The core activity consisted of a hands-on workshop in which participants were divided into small groups. Each group was tasked with designing science teaching materials that integrate elements of ethnoscience, with direct

guidance from facilitators. Upon completing the design process, each group presented its work to the other participants to receive feedback and suggestions for improvement through an open discussion forum.

A reflection and evaluation stage followed, providing participants the opportunity to share their experiences, challenges, and insights gained throughout the program. This evaluation also served as a basis for improving future activities. As a follow-up, participants were encouraged to develop concrete implementation plans for applying the Etno-STE(A)M approach in their respective classrooms after the workshop.

Finally, a professional learning network was established as a communication and information-sharing platform among participants, utilizing both online platforms and periodic in-person meetings to ensure program sustainability. Through these methods and stages, this community service activity is expected to have a positive impact on enhancing teachers' competence in developing Ethno-STE(A)M-based science teaching materials and in fostering more meaningful learning experiences for students.

Results of the Community Service Program

The community service program (PKM) in the form of a Workshop on Developing Ethno-STE(A)M-Based Science Teaching Materials was conducted in mid-July 2025. Kulon Progo Regency was selected as the location for this activity, which aimed to promote the transformation of Natural Science (IPA) learning to make it more contextual and innovative.

The implementation of the program was supported by a community service team led by Prof. Dr. Asri Widowati, S.Pd.Si., M.Pd., with members including Dr. Laifa Rahmawati, M.Pd.; Dita Puji Rahayu, S.Pd., M.Pd.; Dr. Winarto, M.Pd.; Yuli Arti, M.Pd.; Dea Cindy Shonia, S.Pd.; M. Fahrezy, S.Pd.; and Nurinda Aqmalia Hafidza, S.Pd. The program also involved several students as supporting personnel, namely Akbar Nata Nagoro, Alya Dwiyussa Herdiyani, Angelina Pratama, and Firyal Amani Azzahra.

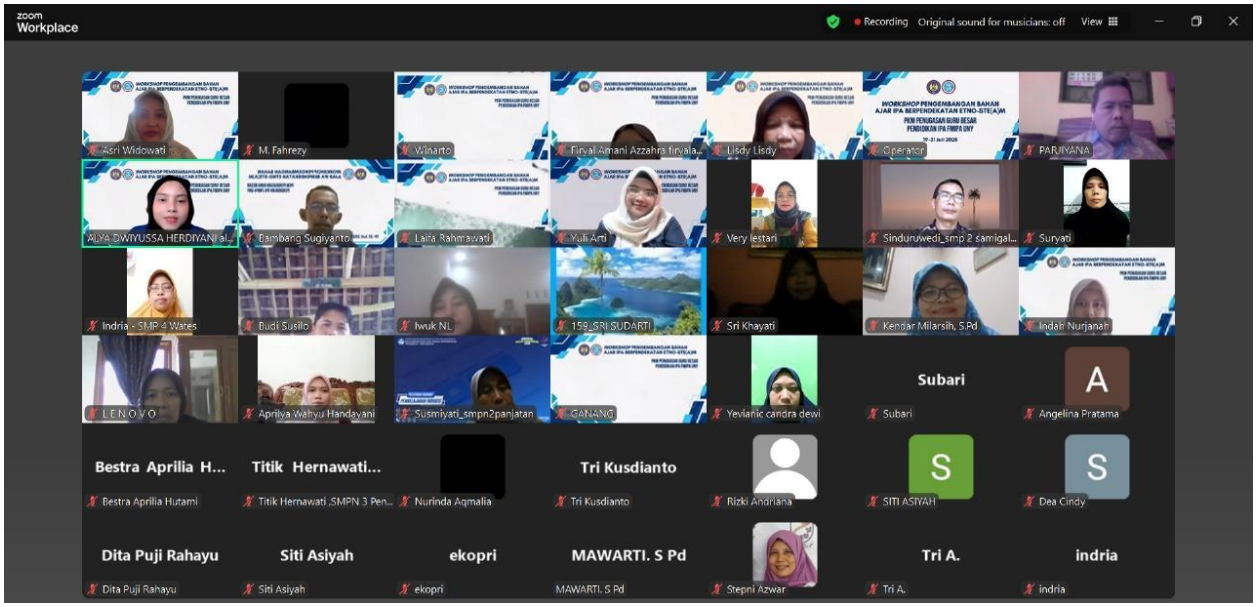


Figure 1. Online *Workshop*

The workshop was implemented in two formats: online and offline sessions. The online session, as shown in Figure 1, was conducted via the Zoom Meeting platform on 19 July 2025 and was attended by 32 teachers from the Science Teachers' Working Group (MGMP IPA) of Kulon Progo Regency. The event began with opening remarks delivered by Prof. Dr. Asri Widowati, S.Pd.Si., M.Pd., serving as both the Chair of PPII DIY and the head of the implementation team, followed by a welcome address from Parjiyana, S.Pd., the Chair of MGMP IPA Kulon Progo.

The online session proceeded in an interactive atmosphere. The activities began with a presentation by Yuli Arti, M.Pd., who discussed the foundational concepts of the Ethno-STE(A)M approach. This was followed by a presentation from Prof. Dr. Asri Widowati, S.Pd.Si., M.Pd., who elaborated on various forms of instructional materials within the STE(A)M framework and strategies for mapping science content into the STE(A)M model. During this session, examples of STE(A)M-based Student Worksheets (LKPD) were also showcased. The session concluded with active discussion and the assignment of tasks to participants to deepen their understanding of the materials presented.

Figure 2. Offline Workshop Session

Figure 2 illustrates the implementation of the face-to-face (offline) workshop session, which was held on 26 July 2025 at the Multipurpose Hall of SMP Negeri 1 Pengasih and attended by 35 teachers from the Science Teachers' Working Group (MGMP IPA) of Kulon Progo Regency. In this session, participants were introduced to the use of Virtual Reality (VR) technology through Oculus devices and the MilleaLab platform, a digital laboratory that provides interactive simulations of science experiments.

During the session, teachers not only had the opportunity to experience the technology firsthand but also received guidance from the Universitas Negeri Yogyakarta (UNY) team to explore the potential application of VR in science learning. In addition, participants were encouraged to design instructional narratives that integrate local phenomena—such as batik, agricultural activities, and community traditions—with scientific concepts presented in a digital, engaging, and contextual format.

The results obtained from the pretest and posttest are presented in Table 1 below.

Tabel 1. Hasil *pretest* dan *posttest*

No	Question	Pre (%)	Post (%)	Change (%)
1	What does STEAM stand for in an educational context?	78.8	96.7	17.88
2	The main difference between the STEM and STEAM approaches is:	72.7	90.0	17.27
3	The main goal of the STEAM approach in science learning is:	93.9	100.0	6.06
4	What is meant by ethnoscience in the context of science learning?	81.8	96.7	14.85
5	What are examples of ethnoscience integration in STEAM-based science learning?	0.0	0.0	0.00
6	What are the main benefits of incorporating ethnoscience in the development of STEAM-based science teaching materials?	90.9	96.7	5.76
7	In the ethno-STEAM approach, traditional technologies can be exemplified through:	90.9	96.7	5.76

There was a significant increase in basic understanding of STEAM concepts, as demonstrated by an increase in the proportion of correct answers. Understanding of the STEAM acronym increased from 78.8% in the pretest to 96.7% in the posttest, while understanding the difference between STEM and STEAM increased from 72.7% to 90%. Furthermore, participants' understanding of the concept of ethnoscience also showed a significant increase, from 81.8% to 96.7%. These findings indicate that the online phase, which emphasized theoretical

aspects—including the urgency of STEAM, ethnoscience, and strategies for packaging teaching materials—successfully improved teachers' conceptual literacy. Overall, the achievement of teacher competency targets exceeded the minimum threshold, which was more than 75%.

The results of the validation of learning tools and observations during offline activities indicated that the majority of participants (more than 75%) were able to integrate ethnoscience into science teaching materials and accurately map STEAM components. These findings align with the quantitative data on conceptual questions, which showed significant improvement across the majority of indicators. However, there were some items where improvement was still limited. One such item, the item related to concrete examples of ethnoscience integration, showed a 0% percentage in both the pretest and posttest. This condition is likely due to the very specific criteria for correct answers or because participants' understanding of this aspect has not yet developed optimally. This underscores the need for further strengthening of the application dimension, for example, through providing more intensive and sustained contextual practical experiences.

From an affective and participatory perspective, observations indicate a very high level of enthusiasm. Nearly all participants were actively involved in discussions, group work, and learning simulations. These findings confirm that the implementation of a digital edugame approach oriented toward higher-order thinking skills (HOTS) and containing ethnoscience not only contributes to improved conceptual understanding but also motivates teachers to innovate in designing science lessons that are contextual, relevant to local culture, and religiously nuanced.

Furthermore, the quantitative data is presented graphically, as shown in Figure 3.

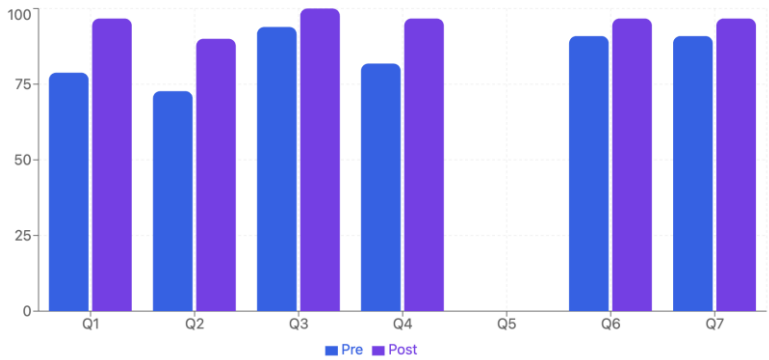


Figure 3. Graph of Pretest and Posttest Score Results of Ethno-STEM Workshop

Significant improvements in understanding of basic STEAM and ethnoscience concepts indicate that the Ethno-STE(A)M-based workshop was effective in strengthening teachers' scientific literacy. The increase in the proportion of correct answers, ranging from 6 to 18 percentage points, indicates that the combination of theoretical reinforcement and practical experience in the training was able to shape teachers' new perspectives on science learning that were more contextual and meaningful. This finding aligns with the research findings of Lee et al. (2022) which stated that implementing a STEAM approach can improve both scientific literacy and student creativity, and is supported by the study of Huang et al. (2021) which emphasized that the integration of ethnoscience can strengthen the connection between learning and students' real lives. Meanwhile, the results of product development in the form of Student Worksheets (LKPD) are presented in Figure 4.

SEKOLAH MENENGAH PERTAMA
KELAS 8 FASE D

LEMBAR KERJA PESERTA DIDIK

SISTEM PENCERNAAN MANUSIA

NAMA ANGGOTA KELOMPOK 4:

1.ANIK SRI MULYANI, S.PD
2.SUSMIYATI, S.PD
3.SRI KHAYATI, S.PD
4.LISDIYANTI, S.PD, M.ENG
5.INDAH NURJANAH, S.PD

CAPAIAN PEMBELAJARAN :

Menganalisis sistem organisasi kehidupan, fungsi, serta kelainan atau gangguan yang muncul pada sistem organ

TUJUAN PEMBELAJARAN :

1.mengidentifikasi organ-organ pencernaan
2.menjelaskan fungsi masing-masing organ pencernaan
3.membedakan proses pencernaan secara mekanis dan kimiawi
4.menganalisis proses pencernaan makanan dalam tubuh manusia

IDENTIFIKASI MASALAH

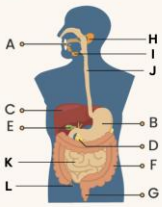
Sudahkah kalian makan hari ini? Apa saja yang sudah kalian makan? Mengapa ketika kalian makan kalian akan merasa kenyang?

Makanan yang kalian makan setiap hari ternyata harus dicerna terlebih dahulu lho. Adakah yang sudah tahu bagaimana prosesnya? Yuk kita cari tahu

KEGIATAN 1. IDENTIFIKASI ORGAN SISTEM PENCERNAAN DAN FUNGSINYA

Amatilah Organ Sistem Pencernaan berikut ini untuk membantu kalian dalam mengidentifikasi organ pada sistem pencernaan pada gambar di samping

SCAN ME



Tuliskan hasil identifikasi organ-organ Sistem Pencernaan pada tabel di bawah ini! Lengkapi fungsi dari setiap organ!

No	Organ Sistem Pencernaan	Fungsi
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
K		
L		

KEGIATAN 2. PERBEDAAN PENCERNAAN MEKANIK DAN KIMIAWI

Organ Tempat Pencernaan	Proses	Organ/Enzim Yang Berperan	Hasil Pencernaan
Mulut	Mekanik		
	Kimiawi		
Lambung	Mekanik		
	Kimiawi		
Usus Halus	Kimiawi		

Figure 4. Student Worksheet

Furthermore, enhancing the learning process using Virtual Reality (VR) technology and edugames provides the opportunity to create immersive learning experiences aligned with the characteristics of 21st-century learning. Chang et al. (2020) stated that the use of VR-based media can increase student engagement and motivation by presenting authentic simulations that are difficult to achieve in conventional learning. These findings are supported by Bower and Jong (2020) in the British Journal of Educational Technology, who emphasized that digital edugames not only increase learning motivation but also contribute significantly to the development of higher-order thinking skills (HOTS).

The integration of VR and edugames with the STEAM and ethnoscience approaches presents a learning innovation relevant to the demands of Sustainable Development Goal (SDG) 4, namely the provision of inclusive, equitable, and quality education. The implementation of this integration is reflected in the development of the Ethno-STEAM module and the development of the assessment rubric, as presented in Figure 5.

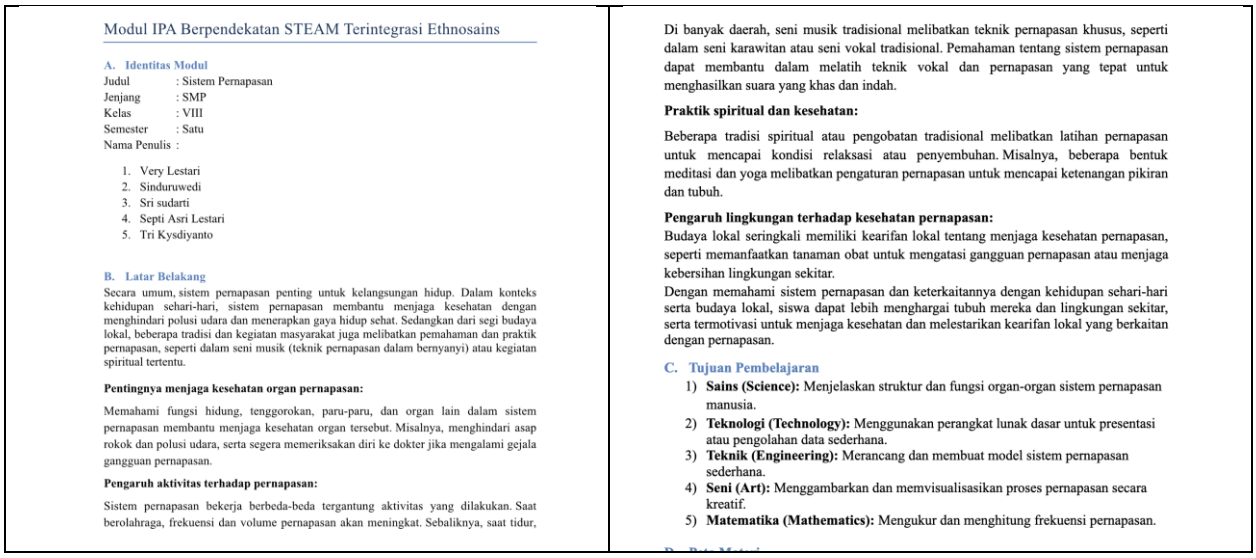


Figure 5. Module

However, limitations were still found in the indicator when participants were asked to provide concrete examples of ethnoscience integration, which showed no improvement (0% in the pretest and posttest). This finding indicates that the application aspect and contextualization skills still require further strengthening. Ramirez and Chen (2021) emphasized that teachers need support in the form of scaffolding, particularly through the sharing of best practices, to be able to connect local knowledge with science content appropriately and meaningfully. Therefore, the sustainability of mentoring programs through communities of practice, such as the Science MGMP, is highly relevant to strengthening these skills. Furthermore, further efforts are needed in the form of ongoing mentoring, exchange of good practices, and the development of an ethnoscience idea bank based on local potential, as recommended by Ismail et al. (2023).

Figure 6a. Participants are trying out virtual reality with Oculus

Figure 6b. Participants are trying out virtual reality with Millea Lab

Figure 6a and Figure 6b show participants' activities while trying out virtual reality technology using Oculus devices and the MilleaLab platform. Going forward, the sustainability of this program can be guided through three main strategies: (1) developing an ethnoscience idea bank based on local potential that can be used as a source of inspiration for teachers; (2) providing intensive mentoring to support teachers in developing and implementing Ethno-STE(A)M-based teaching modules on an ongoing basis; and (3) conducting long-term evaluative research to assess the program's impact on students' scientific literacy, higher-order thinking skills (HOTS), and curiosity.

Through these strategies, teachers are expected to become increasingly capable of acting as innovators in digital science learning that is rooted in local wisdom and has a global orientation. Overall, these findings indicate that the Ethno-STE(A)M workshop-based community service program is effective in strengthening teachers' capacity as agents of science learning innovation. By improving conceptual understanding and application skills, teachers have the opportunity to deliver contextual learning, supported by digital technology, and relevant to global demands and needs.

CONCLUSION

This workshop demonstrated its effectiveness in improving the understanding of STEAM and ethnoscience concepts among Kulon Progo Regency Science Teachers (MGMP) teachers, as demonstrated by a 6 to 18 percentage point increase in the proportion of correct answers across key indicators. Nearly all indicators in the post-test achieved accuracy levels above 90%, indicating the workshop's effectiveness in strengthening teachers' theoretical understanding. Furthermore, more than 75% of participants demonstrated the ability to integrate STEAM and local wisdom (ethnoscience) components into the development of teaching modules and student worksheets (LKPD).

Participants' active participation in learning simulations and product presentations reflected the improvement in application skills acquired through practical activities in offline sessions. The integration of ethnoscience with VR technology and edugames in science learning has proven to be an innovative alternative with the potential to enhance scientific literacy, higher-order thinking skills (HOTS), and students' curiosity. These findings align with Sustainable Development Goal (SDG) 4: Quality Education, which aims to promote inclusive, quality, and culturally relevant education.

However, challenges remain in developing more specific examples of ethnoscience integration. Therefore, follow-up is needed in the form of ongoing mentoring, sharing of good practices, and the development of an ethnoscience idea bank based on local potential. Program sustainability is recommended through strengthening the role of communities of practice, such as the Science MGMP, and conducting long-term evaluative research to

assess the program's impact on student learning outcomes. Overall, the PKM activity of developing Ethno-STE(A)M-based teaching materials in Kulon Progo was effective in improving the conceptual literacy and application skills of science teachers, as well as strengthening their role as innovators of 21st-century learning based on local wisdom and supported by digital technology.

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Enhancing Family Archives Management Awareness Through Community-Based Education

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Abstract. Family archives, including birth certificates, family cards, diplomas, land certificates, and other vital documents, play a crucial role in supporting administrative processes and post-disaster recovery. However, most families in Padukuhan Ngaglik Kidul, a coastal area in Kulon Progo, Indonesia, still store important documents unsystematically. This community service program aimed to enhance awareness and literacy of family archives management through participatory training for the Family Welfare Movement (PKK) women's group. Using a Community-Based Education and Participatory Training approach, this program engaged 30 participants in interactive sessions combining theoretical education, group discussions, and hands-on practice. Results showed significant improvements: 85% of participants understood the importance of family archives, 80% were able to create simple filing systems, and 100% expressed commitment to maintaining organized archives. This program demonstrates that participatory approaches effectively improve family archives literacy in rural communities, contributing to household administrative resilience and disaster preparedness. The model can be replicated in other regions with similar characteristics.

INTRODUCTION

Background and Context

Indonesia's geographical position on the Pacific Ring of Fire places the nation among the most disaster-prone countries globally. The southern coastal region of Java Island, particularly areas in Kulon Progo Regency, faces significant exposure to multiple natural hazards including earthquakes, tsunamis, and volcanic eruptions. Padukuhan Ngaglik Kidul, located approximately two kilometers from the southern coastline, exemplifies communities living with constant disaster risk. This proximity to the coast, combined with the region's seismic activity, necessitates comprehensive disaster preparedness strategies that extend beyond physical infrastructure to include administrative and documentary readiness [1].

In the context of disaster management, family archives comprising birth certificates, family cards, marriage certificates, diplomas, land certificates, health records, and other identity documents constitute critical assets for household resilience. These documents serve multiple crucial functions in post-disaster scenarios: they facilitate access to emergency aid, enable insurance claims, support legal proceedings for property recovery, and provide evidence for administrative processes required during rehabilitation and reconstruction phases. International disaster management literature consistently emphasizes that loss of vital documents significantly impedes recovery processes and can lead to prolonged displacement and economic hardship for affected families [2].

Despite the critical importance of document preservation in disaster-prone regions, preliminary observations in Padukuhan Ngaglik Kidul revealed a concerning reality. Most households maintained no systematic approach to archives management. Documents were typically stored haphazardly, often mixed with everyday household items, without protective measures against physical damage, moisture, or loss. This disorganized storage practice stemmed not from negligence, but from a fundamental lack of awareness regarding the strategic importance of family archives.

Theoretical Framework

Archives, as defined by Indonesian Law No. 43 of 2009, represent recordings of activities or events in various forms and media, created and received by institutions or individuals in the course of social, national, and state life. This legal definition underscores the official recognition of archives as foundational elements of administrative governance and social memory. However, the concept of family archives extends this institutional framework into

the domestic sphere, recognizing that households function as micro-administrative units requiring systematic information management [3].

Family archives encompass comprehensive documentation related to household identity, ownership, education, health, and economic assets. These documents possess multiple value dimensions that justify their careful preservation. Administratively, they enable smooth execution of household transactions and obligations. Legally, they serve as evidentiary instruments in disputes or claims. Financially, they support accountability in economic matters. Historically, they preserve family narratives and generational memory. Understanding these multifaceted values is essential for developing effective archives literacy programs [4].

Contemporary archives literacy exists at the intersection of traditional records management and digital competencies. The digital transformation of government services, banking, education, and healthcare has created a hybrid documentary landscape where families must navigate both physical and electronic records. Archives literacy in the 21st century therefore requires dual capabilities: traditional skills in physical document organization, preservation, and retrieval, alongside digital competencies in electronic file management, cloud storage, data security, and digital backup strategies. This convergence presents unique challenges for rural communities where digital infrastructure may be limited and digital literacy levels vary significantly [5].

Community-Based Education Approach

Community-based education represents a pedagogical paradigm that positions communities as active participants rather than passive recipients in learning processes. This approach recognizes local knowledge, cultural contexts, and existing social structures as valuable resources for educational interventions. In rural Indonesian contexts, the Family Welfare Movement (Pemberdayaan Kesejahteraan Keluarga or PKK) provides an established institutional framework ideally suited for community-based learning initiatives [6].

The selection of PKK as the primary vehicle for archives literacy education reflects strategic considerations grounded in social and cultural dynamics. In Indonesian households, women typically assume primary responsibility for household administration, including document management. PKK groups meet regularly, providing consistent platforms for educational interventions. The social cohesion within these groups facilitates peer learning and mutual support, essential elements for sustaining behavioral change. Moreover, the organizational structure of PKK offers potential for program replication and scaling beyond initial implementation sites [7].

Research Objectives

This community service program pursued five interconnected objectives designed to comprehensively address the archives literacy gap in Padukuhan Ngaglik Kidul. First, the program aimed to fundamentally increase awareness and understanding of family archives management principles among rural community members. Second, it sought to catalyze the creation and adoption of simple, practical filing systems. Third, the program focused on skill development, specifically training PKK members to recognize different categories of important archives. Fourth, it aimed to provide concrete, practical solutions through distribution of basic archives storage media. Finally, recognizing the disaster vulnerability context, the program explicitly targeted enhancement of family preparedness against potential archive loss due to natural disasters [8].

RESEARCH METHOD

Problem-Solving Framework

The main problem faced by the community of Padukuhan Ngaglik Kidul is the low awareness of the importance of family archives management. Vital documents are often stored irregularly, even mixed with other household files. This situation potentially causes administrative difficulties when needed, especially in emergency conditions such as natural disasters or document loss [9].

The problem-solving framework in this community service was structured based on the Participatory Learning and Action (PLA) model, which emphasizes community active participation in the identification, planning, implementation, and evaluation processes. This approach was chosen because it suits the character of rural communities that have a strong culture of mutual cooperation and solidarity.

Table 1 presents the logical relationship between problems, causes, and implemented solutions:

TABLE 1. Problem-Solving Framework

Component	Problem	Solution	Output
Knowledge	Unaware of family archives importance	Basic archives education	Increased awareness
Skills	Unable to categorize archives	Practical training	Improved skills
Attitude	Archives considered unimportant	Reflection and sharing	Positive attitude toward archives
System	No storage system	Family archives template	Simple system established

Target Audience

The target audience for this activity was housewives who are members of the PKK Padukuhan Ngaglik Kidul, Temon District, Kulon Progo Regency. The number of participants was 30 people, with an age range between 25-55 years. Participant characteristics included: (1) high motivation to learn; (2) limited digital literacy; (3) strategic role in families as managers of finances, administration, and household documents; and (4) replication potential through PKK organizational structure.

Activity Methods

The activity methods used in this community service program integrated Community-Based Education and Participatory Training approaches, focusing on enhancing knowledge, skills, and attitudes toward the importance of family archives management [10].

The implementation method used a combination of interactive lectures, demonstrations, and hands-on practice. Table 2 presents the activity structure:

TABLE 2. Activity Structure and Methods

Activity	Method	Output
Basic family archives education	Interactive lecture and Q&A	Participants understand archives concept
Vital family archives identification	Group discussion	Participants recognize important archives
Archives categorization training	Demonstration and practice	Participants able to organize own archives
Reflection and evaluation	Discussion and post-test	Increased participant archives literacy

RESULTS AND DISCUSSION

Implementation Results

The activity was implemented with active participant participation. Most participants were able to create their own family archives storage system at home. The training proceeded interactively with simulation methods and direct practice. Table 3 presents the activity implementation results:

TABLE 3. Activity Implementation Results

Aspect	Result After Activity
Knowledge	85% understand the importance of family archives
Skills	80% able to create simple archives system
Attitude	100% participants stated importance and readiness to organize archives

Effectiveness of Participatory Learning Approach

The significant improvements observed across knowledge, skills, and attitudes dimensions validate the effectiveness of participatory learning methodologies in community education contexts. The 85% comprehension rate regarding family archives importance represents a substantial shift from baseline conditions where most participants possessed minimal awareness of systematic document management principles [11].

The participatory approach succeeded because it honored participants as knowledge holders rather than treating them as empty vessels requiring filling with expert information. The training program provided frameworks and systematic methods that organized scattered experiences into coherent understanding, transforming tacit knowledge into explicit competencies. Furthermore, the use of participants' actual family documents during practice sessions proved instrumental in achieving the 80% skill acquisition rate [12].

Social Dynamics and Knowledge Diffusion

The universal positive attitude change reflects deeper social dynamics beyond individual learning outcomes. PKK groups function as social networks characterized by strong interpersonal relationships, mutual trust, and shared identity around family welfare improvement. When participants publicly declared their intentions to organize family archives during group reflection sessions, they established social accountability mechanisms that strengthened follow-through likelihood [13].

Moreover, the program activated knowledge diffusion processes that extended impact beyond direct participants. The organizational structure of PKK creates formal channels for information cascade. Several participants reported sharing archives management techniques with neighbors who were not PKK members, indicating organic diffusion beyond programmed channels. This multiplier effect amplifies program impact significantly [14].

Andragogical Principles in Practice

The program's pedagogical design deliberately incorporated Knowles' principles of andragogy, recognizing that adult learners possess distinctive characteristics requiring specialized educational approaches. The principle of self-direction manifested through needs assessment processes that invited participants to identify their own document management challenges [15].

Experience-based learning received emphasis through extensive use of participants' prior knowledge and real documents. The training did not treat participants as novices lacking all relevant knowledge, but recognized their substantial experience managing household affairs [16]. The readiness-to-learn principle found expression in the problem-centered rather than content-centered curriculum design [17].

Contextual Adaptations and Local Wisdom

The program's success partly derived from careful contextual adaptation that honored local conditions, resources, and cultural practices. The storage solutions provided represented appropriate technology selections that balanced functionality with affordability and local availability [18]. Cultural adaptation appeared in the program's emphasis on collective rather than purely individual responsibility for archives management [19].

Local wisdom integration manifested in the disaster preparedness dimension. Archives protection strategies incorporated local practices such as storing important items in elevated locations and maintaining duplicate copies with trusted relatives. This integration of formal archives management principles with local adaptive strategies enhanced program legitimacy and practical applicability [20].

Implications for Household Resilience

Enhanced family archives literacy contributes to household resilience conceptualized as the capacity to withstand and recover from various shocks and stresses. Well-organized archives enable households to respond efficiently when situations require documentary evidence [21]. In disaster contexts, administrative resilience becomes acutely critical. Research on post-disaster recovery consistently identifies document loss as a significant impediment [22].

Beyond disaster contexts, improved archives management supports household economic welfare by reducing transaction costs in administrative processes, preventing penalties for missed deadlines or lost documents, and enabling timely access to beneficial programs requiring documentation [23].

Activity Evaluation

Evaluation was conducted using post-test to measure knowledge improvement and participant satisfaction questionnaire to assess training effectiveness. Table 4 presents quantitative evaluation results:

TABLE 4. Quantitative Evaluation Results

Aspect	Excellent	Good	Fair	Poor
Material and relevance	70%	30%	0%	0%
Presenter delivery	65%	35%	0%	0%
Participant engagement	85%	15%	0%	0%
Activity benefits	80%	20%	0%	0%

These results indicate that the activity was highly effective and well-received by the community. Most participants assessed the activity as beneficial and expressed desire for continuation with family archives digitization topics [24].

CONCLUSION

The community service activity successfully enhanced awareness and literacy of family archives management in Padukuhan Ngaglik Kidul. Participants experienced significant increases in understanding, developed practical skills in organizing family documents, and demonstrated positive behavioral changes. The participatory approach proved highly effective, with 85% of participants understanding archives importance, 80% able to create filing systems, and 100% expressing commitment to maintaining organized archives.

This program empowered women as agents of change in family document management and strengthened PKK institutions as partners in non-formal community education. The activity contributed to household administrative resilience and disaster preparedness. The model demonstrates potential for replication in other rural communities facing similar challenges. Future programs should address digital archives management and provide ongoing support for sustained implementation.

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MAPPING TRANSFERABLE SKILLS OF PRE-SERVICE TEACHERS IN INDONESIA: AN EXPLORATORY STUDY TOWARDS 21ST CENTURY EDUCATION READINESS

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Abstract. This study maps the transferable skills of pre-service teachers in Indonesia to support their professional readiness in facing 21st-century education challenges. Using a quantitative descriptive-exploratory approach, data were collected from 780 pre-service teachers across various Indonesian universities through a 32-item Likert-scale instrument covering eight dimensions: communication, teamwork, problem-solving, creativity, leadership, self-management, adaptability, and digital literacy. Results revealed high transferable skills levels (mean = 3.83/5.0) with excellent reliability ($\alpha = 0.97$). No significant gender differences emerged, but variations existed across universities and semesters. Strong inter-dimensional correlations ($r = 0.71–0.83$) indicated integrated skill development. Exploratory Factor Analysis identified two major factors: Integrated Socio-Cognitive Competence and Self-Management and Digital Adaptability. These findings reinforce OECD (2020) and UNESCO (2019) perspectives on flexible, adaptive competencies needed for 21st-century teachers, providing empirical foundation for teacher education curriculum reform in Indonesia.

INTRODUCTION

The 21st-century education paradigm shift demands educators possess not only pedagogical knowledge and skills but also cross-disciplinary abilities or transferable skills supporting adaptability to global changes. The OECD (2020) emphasizes the importance of social, cognitive, and digital competencies for educators in the technology disruption era [1]. These transferable skills, defined as competencies applicable across various contexts and disciplines, have become increasingly critical in preparing teachers who can navigate complex, rapidly changing educational landscapes [2].

In Indonesia, the Merdeka Belajar–Kampus Merdeka (MBKM) policy issued by the Ministry of Education, Culture, Research, and Technology represents a significant reform encouraging pre-service teachers to develop critical thinking, collaboration, and digital literacy skills as foundations of their professionalism [3]. This policy aligns with global trends emphasizing the need for educators to possess not only subject matter expertise but also the capacity to facilitate student-centered learning, foster innovation, and adapt to technological advancement [4]. The World Economic Forum (2020) identifies creativity, critical thinking, and technology use among the top skills needed for future workforce, making their development essential in teacher preparation programs [5].

Research on transferable skills in teacher education has gained momentum internationally. Studies by Fullan (2011) demonstrate that effective 21st-century teachers must be change agents capable of fostering deep learning through collaboration and personalized instruction [6]. Similarly, UNESCO's framework for Education for Sustainable Development emphasizes the importance of competencies such as systems thinking, anticipatory thinking, and collaborative problem-solving in preparing educators for complex global challenges [7]. In the Asian context, research by Kembara and Santoso (2021) found that digital literacy and communication competence significantly predict teaching readiness among Indonesian pre-service teachers [8].

However, preliminary observations of pre-service teachers across various Teacher Training Institutions (LPTK) in Indonesia reveal gaps between academic and transferable skills mastery. While many prospective teachers excel in pedagogical theory and content knowledge, studies suggest deficiencies in leadership, collaborative practice, and creative problem-solving abilities [9]. This gap is particularly concerning given that teachers are expected to model these competencies for their students and create learning environments that foster their development [10]. The traditional teacher preparation model, which emphasizes content delivery and classroom management, may be insufficient for developing the adaptive expertise required in contemporary educational settings [11].

Furthermore, the integration of digital technologies in education, accelerated by the COVID-19 pandemic, has highlighted the urgency of strengthening pre-service teachers' digital literacy and adaptability skills [12]. Research

indicates that teachers with strong transferable skills are better equipped to implement innovative pedagogies, engage diverse learners, and maintain professional growth throughout their careers [13]. Therefore, systematic mapping of these competencies among Indonesian pre-service teachers is essential for informing curriculum reforms and professional development strategies in teacher education institutions.

This study addresses four research questions: (1) What is the proficiency level of transferable skills among Indonesian pre-service teachers? (2) Are there differences in transferable skills mastery based on demographic characteristics such as gender and semester? (3) How do the dimensions of transferable skills correlate? (4) What are the main factors forming the transferable skills structure of pre-service teachers in Indonesia? By answering these questions, this research aims to provide empirical foundation for developing teacher education curricula more relevant to 21st-century needs and contribute to the broader discourse on teacher preparation in developing countries.

METHODOLOGY

Research Design

This study employed a quantitative approach with descriptive-exploratory design. This approach was used to describe transferable skills proficiency levels while exploring the underlying factor structure.

Population and Sample

The research population consisted of pre-service teachers in Indonesia enrolled in 10 universities offering teacher education programs. The sampling technique used proportionate stratified random sampling, with 780 students respondents from various education study programs.

Research Instrument

The research instrument comprised a 1–5 Likert scale questionnaire containing 32 statement items based on eight transferable skills dimensions. The instrument underwent content validity testing using Aiken's V (average 0.93) and Cronbach's Alpha reliability testing (0.97), indicating high consistency and validity.

Data Analysis Techniques

Data were analyzed using: (1) descriptive statistics (mean, standard deviation), (2) reliability testing (Cronbach's Alpha), (3) construct validity testing (EFA, KMO, Bartlett's Test), (4) difference testing (t-test and ANOVA), and (5) inter-dimensional correlation testing (Pearson r). Analysis was conducted using statistical software such as SPSS and JASP, with interpretations based on social quantitative methodology literature [2][3].

RESULTS AND DISCUSSION

Respondent Overview

This study involved 780 pre-service teacher students from 10 universities offering teacher education programs in Indonesia. Respondents represented various education study programs, including economics, language, engineering, and science education. Based on data tabulation, the majority of respondents were female (68%) and male (32%). Most respondents were in semesters 5–7 (71%), while semesters 3–4 comprised 29% of respondents.

Descriptive Analysis of Transferable Skills

Descriptive analysis results showed that pre-service teachers' transferable skills levels were generally in the high category, with an average total score of 3.83 on a 1–5 Likert scale. The highest scores were in communication (3.92) and self-management (3.90) dimensions, while the lowest average was in leadership (3.67). These data indicate that pre-service teachers possess good interpersonal and intrapersonal skills. They can adapt, communicate effectively, and collaborate with peers. However, leadership aspects and innovative creativity remain relatively lower, meaning reinforcement is needed in decision-making and change initiation abilities.

TABLE 1. Average Transferable Skills of Pre-Service Teachers

No	Transferable Skills Dimension	Mean
1	Communication	3.92
2	Teamwork	3.88
3	Problem-Solving	3.75
4	Creativity	3.80
5	Leadership	3.67
6	Self-Management	3.90
7	Adaptability	3.82
8	Digital Literacy	3.85
	Total Average	**3.83**

These findings align with UNESCO (2019) research affirming that teachers in developing countries tend to excel in communication and teamwork but still need improvement in innovation, creativity, and collaborative leadership [4].

Validity and Reliability Testing

Content validity was tested through assessment by three experts (validators) using the Aiken's V index, with an average value of 0.93, indicating each statement item's relevance to the measured construct. Empirical validity testing using Corrected Item–Total Correlation showed all items had values $r \geq 0.50$, making them statistically valid. Additionally, construct validity was tested through Exploratory Factor Analysis (EFA) with results: Kaiser-Meyer-Olkin (KMO) = 0.954 and Bartlett's Test $\chi^2 = 8145.27$; $p < 0.001$. Both results indicate significant inter-item correlations and data structure suitable for factor analysis.

Reliability testing results using Cronbach's Alpha = 0.97 showed very high internal consistency. Alpha values for each dimension ranged from 0.88–0.94, indicating all instrument dimensions are reliable. Thus, this research instrument meets valid and reliable criteria, suitable for measuring pre-service teachers' transferable skills.

Difference Testing

Difference testing was conducted to determine whether significant differences exist in transferable skills levels based on gender and study semester. Results showed no significant differences based on gender ($t = 1.21$, $p = 0.23$), so both male and female students have relatively balanced transferable skills levels. However, significant differences exist based on semester ($F = 3.91$, $p = 0.032$), meaning academic environment factors and learning experience influence cross-disciplinary skill development. These findings are consistent with experiential learning theory (Kolb, 1984) that direct learning experience in collaborative contexts strengthens pre-service teachers' adaptive and communication abilities [5].

Inter-Dimensional Correlation Analysis

Pearson correlation between transferable skills dimensions showed strong and significant relationships (average $r = 0.79$, $p < 0.01$). The highest correlation was between communication and teamwork ($r = 0.83$), while the lowest was between leadership and creativity ($r = 0.69$). These results demonstrate close interconnections among social, cognitive, and digital skills, forming integrated competency patterns.

Exploratory Factor Analysis

Exploratory factor analysis results showed that from 32 statement items, two main factors were formed explaining 71.4% of total variance. Factor 1 comprises Integrated Socio-Cognitive Competence, including communication, teamwork, problem-solving, creativity, and leadership abilities. This factor represents pre-service teachers' abilities in critical thinking, collaboration, and learning leadership. Factor 2 comprises Self-Management and Digital Adaptability, including self-management, adaptability, and digital literacy. This factor shows students' capacity to adapt to changes and utilize technology productively.

Overall, research results show that Indonesian pre-service teachers' transferable skills are categorized as high. The formed factor structure reinforces the concept that transferable skills consist of two major dimensions: socio-cognitive and intrapersonal-digital. These findings are consistent with the OECD Learning Compass 2030 model (OECD, 2020) emphasizing three main pillars of future education: knowledge, skills, and attitudes [6]. Future

teachers are not sufficient with only academic content mastery but must have abilities to adapt, collaborate across fields, and think reflectively.

The high mean scores across all dimensions (3.83/5.0) suggest that Indonesian teacher education programs are making progress in developing comprehensive competencies beyond traditional pedagogical knowledge. However, the relatively lower scores in leadership (3.67) and problem-solving (3.75) dimensions warrant attention. Leadership development is particularly critical as teachers are increasingly expected to lead professional learning communities, mentor colleagues, and drive school improvement initiatives [14]. The gap in leadership skills may reflect limited opportunities for pre-service teachers to engage in authentic leadership experiences during their training, suggesting the need for enhanced practicum designs that include leadership responsibilities [15].

The strong inter-dimensional correlations observed in this study ($r = 0.71–0.83$) support the theoretical premise that transferable skills develop synergistically rather than in isolation. This finding aligns with research by Rahman et al. (2022) demonstrating that creativity and digital literacy jointly predict teaching readiness [16]. The particularly strong correlation between communication and teamwork ($r = 0.83$) reflects the inherently social nature of teaching and underscores the importance of developing these skills through collaborative learning experiences during teacher preparation [17]. This interconnectedness suggests that interventions targeting one skill domain may yield positive spillover effects on other dimensions, supporting integrated rather than compartmentalized approaches to competency development.

The emergence of two distinct factors—Integrated Socio-Cognitive Competence and Self-Management and Digital Adaptability—provides valuable insight into the structure of transferable skills among pre-service teachers. The first factor encompasses outward-facing competencies essential for collaborative professional practice and student engagement. This aligns with sociocultural theories of learning emphasizing teaching as a fundamentally social and dialogic process [18]. The second factor represents inward-facing competencies related to self-regulation, continuous learning, and technological fluency. These capabilities are increasingly recognized as critical for teacher resilience and professional sustainability in rapidly changing educational contexts [19].

The absence of significant gender differences in transferable skills is encouraging from an equity perspective, suggesting that both male and female pre-service teachers in Indonesia are developing these competencies at comparable levels. This finding contrasts with some international research showing gender disparities in specific skill domains and may reflect the relatively balanced gender composition and inclusive culture of Indonesian teacher education programs [20]. However, the significant differences across semesters and universities highlight the importance of programmatic factors in skill development. More experienced students (semesters 5-7) demonstrated higher transferable skills, supporting experiential learning theory's premise that competencies develop through accumulated, reflected-upon experiences [21].

From the national policy perspective, these findings validate the MBKM policy's emphasis on experiential learning, cross-institutional collaboration, and industry partnerships as mechanisms for developing transferable skills [22]. The relatively high digital literacy scores suggest that Indonesian pre-service teachers are responding positively to the increased technology integration in teacher education, though continuous adaptation remains necessary given rapid technological change [23]. The study's results also resonate with UNESCO's Education for Sustainable Development framework, which positions educators as key agents for fostering sustainable development competencies that are fundamentally interdisciplinary and future-oriented [24].

Several implications emerge for teacher education practice. First, curriculum designers should explicitly integrate transferable skills development across all program components, not as separate add-ons but as core competencies woven throughout coursework, practicum experiences, and assessment practices [25]. Second, pedagogical approaches emphasizing authentic project-based learning, collaborative problem-solving, and reflective practice should be prioritized as these methods naturally develop multiple transferable skills simultaneously [26]. Third, universities demonstrating higher student transferable skills should be studied as exemplars to identify specific programmatic features and institutional practices supporting competency development [27].

The study also suggests that leadership and creative problem-solving warrant targeted intervention. This might include structured opportunities for pre-service teachers to lead peer teaching sessions, design innovative learning activities, participate in school improvement projects, or engage in action research addressing real classroom challenges [28]. Additionally, mentoring relationships with experienced teachers who model strong transferable skills could provide valuable developmental experiences [29]. Digital literacy, while relatively strong, requires continuous updating to keep pace with emerging technologies and their pedagogical applications [30].

Theoretical contributions of this study include empirical validation of the two-factor structure of transferable skills in the Indonesian teacher education context, demonstrating both universal patterns consistent with international frameworks and context-specific manifestations. The research extends existing literature by examining transferable skills comprehensively across eight dimensions rather than focusing on isolated competencies. Methodologically, the study demonstrates the utility of combining descriptive, correlational, and factor-analytic approaches to understand both the levels and structure of complex competency constructs [31].

Looking forward, the development of transferable skills among pre-service teachers should be understood as an ongoing process extending into early career teaching. While this study captures competency levels at a single point in time, longitudinal research tracking skill development from pre-service through early career stages would provide valuable insights into how these competencies evolve with professional experience and which aspects of teacher preparation programs have lasting impact [32]. Furthermore, research examining the relationship between pre-service teachers' transferable skills and their subsequent effectiveness in supporting student learning would strengthen the case for prioritizing these competencies in teacher education [33].

CONCLUSIONS

This study successfully mapped transferable skills of pre-service teachers in Indonesia, revealing several important findings. First, pre-service teachers demonstrate high transferable skills levels (mean = 3.83/5.0) with communication and self-management as the strongest dimensions. Second, while no significant gender differences emerged, variations exist across universities and semesters, indicating the influence of institutional learning environments and student experience levels. Third, strong inter-dimensional correlations (r = 0.71–0.83) suggest integrated development across all transferable skills aspects. Fourth, factor analysis identified two major components: Integrated Socio-Cognitive Competence and Self-Management and Digital Adaptability, aligning with international frameworks from OECD and UNESCO on 21st-century competencies.

These findings have important implications for teacher education in Indonesia. Teacher Training Institutions should integrate transferable skills into curricula through project-based learning and self-reflection. Educators need to facilitate collaborative learning and digital technology use to develop 21st-century skills. Government should develop national policies that measure and strengthen transferable skills in teacher education. Future research should employ mixed methods approaches and expand to regions outside Java Island for more representative findings.

This research provides empirical foundation for developing 21st-century teacher learning models oriented toward balance between social and digital skills. Findings can be used for improving teacher education curricula and evaluating competency-based learning achievement across disciplines.

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Best Practices in Measuring Learning Outcomes Achievement (CPL) through Outcome-Based Education: A Community Engagement Program at Instituto Profissional de Canossa, Timor Leste

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Abstract. The measurement of Graduate Learning Outcomes (CPL) is a critical component of quality assurance in higher education, particularly within an Outcome-Based Education (OBE) framework. However, many vocational higher education institutions face challenges in implementing systematic and data-driven CPL measurement practices. This study reports the implementation and outcomes of a community engagement program aimed at disseminating best practices in CPL measurement at Instituto Profissional de Canossa (IPDC), Timor Leste. The program was conducted through online training and simulation activities involving academic staff and focused on strengthening conceptual understanding, practical application, and initial development of CPL measurement instruments. The results indicate improved participant understanding of OBE principles, enhanced ability to map and simulate CPL measurement, and increased readiness to develop contextualized assessment instruments. Despite technical constraints related to internet connectivity and limited follow-up mentoring, the program contributed positively to institutional capacity building in quality assurance practices. This study highlights the potential of structured training and simulation-based approaches as effective strategies for supporting the adoption of outcome-based assessment in vocational higher education institutions.

INTRODUCTION

Outcome-Based Education (OBE) has become a central paradigm in higher education quality assurance, emphasizing the alignment between curriculum design, learning processes, and measurable learning outcomes. In recent higher education reforms, OBE is increasingly positioned as a strategic framework to ensure that graduates possess competencies relevant to labor market demands and societal expectations1,2. Within this framework, the systematic measurement of Graduate Learning Outcomes (CPL) plays a crucial role as an indicator of graduates' knowledge, skills, and professional attitudes. Robust learning outcome assessment enables higher education institutions to evaluate curriculum effectiveness, improve teaching and learning strategies, and support evidence-based quality assurance practices1,3.

In practice, however, many higher education institutions continue to face substantial challenges in implementing CPL measurement in a structured and data-driven manner. Recent studies indicate that limited institutional understanding of OBE, the absence of standardized outcome measurement instruments, and constraints in assessment-related human resources remain persistent barriers, particularly in developing and transitional education systems4,5. Consequently, CPL measurement is often reduced to a formal compliance activity rather than being utilized as a meaningful mechanism for continuous curriculum improvement and graduate competency development6.

These challenges are also experienced by Instituto Profissional de Canossa (IPDC), Timor Leste, a higher education institution focused on vocational and professional education. Vocational higher education institutions are expected to play a strategic role in producing work-ready graduates and supporting local economic development, making outcome-based assessment particularly critical4. However, prior to this program, IPDC had not yet developed a comprehensive and systematic approach to measuring graduate learning outcomes. CPL assessment had not been fully integrated into curriculum evaluation, alumni tracking, or continuous quality improvement processes.

The absence of a structured CPL measurement system limits IPDC's capacity to generate reliable data on graduate competencies and weakens evidence-based decision-making for curriculum development. Moreover, limited exposure to contemporary best practices in CPL measurement and OBE implementation has constrained

the institution's ability to align educational outcomes with evolving industry and societal needs. This condition reflects a broader pattern identified in recent studies on vocational higher education in emerging economies, where quality assurance systems are still transitioning toward outcome-oriented and data-informed models5.

Responding to these challenges, this community engagement program aimed to disseminate best practices in CPL measurement through an Outcome-Based Education approach, focusing on conceptual understanding, practical simulation, and institutional capacity building. The program was implemented through online workshops and simulations involving academic staff at IPDC, with an emphasis on developing contextualized CPL measurement instruments suitable for vocational education settings. Recent evidence suggests that structured training and simulation-based approaches are effective in strengthening institutional capacity for outcome-based assessment and quality assurance implementation1.

This article aims to document and analyze the implementation of the community engagement program, highlighting its methods, outcomes, and contributions to strengthening quality assurance practices at IPDC. By sharing practical insights and lessons learned, this study contributes to the growing body of post-2020 literature on CPL measurement and OBE implementation in higher education, particularly within cross-country and international community engagement contexts.

RESEARCH METHOD

This community engagement program employed a training-based and participatory approach designed to strengthen institutional capacity in measuring graduate learning outcomes (CPL) using an Outcome-Based Education (OBE) framework. The program targeted academic staff at Instituto Profissional de Canossa (IPDC), Timor Leste, who are directly involved in curriculum implementation, assessment, and quality assurance processes.

The activities were conducted online over two consecutive days, on 3–4 July 2025, utilizing synchronous virtual meetings. The methodological design combined conceptual delivery, simulation, and guided practice, allowing participants to not only understand the theoretical foundations of CPL measurement but also apply them in a contextualized institutional setting. This approach was selected to address both conceptual gaps and practical limitations previously identified at the partner institution.

The first stage focused on conceptual reinforcement, where participants were introduced to the principles of Outcome-Based Education, the role of CPL in higher education quality assurance, and the alignment between learning outcomes, curriculum design, and assessment strategies. This session emphasized the importance of CPL as a data-driven instrument for evaluating graduate competencies and supporting continuous curriculum improvement.

The second stage involved simulation of CPL measurement, where participants were guided through practical examples of mapping learning outcomes, determining assessment indicators, and interpreting CPL achievement results. The simulation aimed to translate abstract OBE concepts into operational assessment practices that could be adapted to IPDC's vocational education context.

The third stage was designed as guided instrument development, in which participants worked collaboratively to draft CPL measurement instruments tailored to their respective study programs. The instruments were expected to reflect program-specific competencies while remaining aligned with institutional quality assurance objectives. Although full mentoring was planned as a follow-up activity, its implementation was partially constrained by technical limitations, particularly unstable internet connectivity and time zone differences between Indonesia and Timor Leste.

Program evaluation was conducted using a process-oriented evaluation approach, focusing on participants' engagement, understanding, and perceived benefits of the activities. Feedback was collected through online forms distributed at the end of the program to capture participants' reflections on content relevance, clarity of delivery, and applicability of the materials. The evaluation results were used to assess the effectiveness of the activities in enhancing participants' understanding of CPL measurement and to identify areas requiring further institutional support.

Despite technical constraints, the methodological approach enabled participants to gain practical exposure to CPL measurement practices and provided IPDC with an initial framework for integrating outcome-based assessment into its quality assurance system.

RESULTS AND DISCUSSION

The implementation of the community engagement program at Instituto Profissional de Canossa (IPDC), Timor Leste, produced several notable outcomes related to participants' understanding and initial capacity to implement CPL measurement within an OBE framework. Overall, the program succeeded in achieving its primary objective of disseminating best practices in CPL measurement, despite several technical and contextual constraints.

The first key outcome was the successful dissemination of CPL and OBE concepts to academic staff at IPDC. Based on participant feedback and engagement during the sessions, there was a clear improvement in participants' conceptual understanding of CPL as an integral component of quality assurance rather than merely an administrative requirement. Prior to the program, CPL measurement at IPDC had not been systematically linked to curriculum evaluation or graduate competency mapping. After the training sessions, participants demonstrated improved awareness of how learning outcomes should be formulated, measured, and utilized for curriculum improvement.

The second outcome related to the simulation of CPL measurement, which enabled participants to translate theoretical concepts into practical assessment activities. Through guided simulations, participants were introduced to the process of mapping learning outcomes, identifying relevant indicators, and interpreting CPL achievement results. This activity addressed one of the main challenges faced by IPDC, namely the absence of practical experience in implementing outcome-based assessment. The simulation approach proved effective in bridging the gap between conceptual understanding and operational practice, consistent with previous studies emphasizing experiential learning in OBE implementation[7].

Another important result was the initial development of CPL measurement instruments tailored to the needs of different study programs at IPDC. Although the instruments produced during the program were still in draft form, they reflected participants' growing ability to contextualize CPL indicators according to vocational education objectives. This finding supports the argument that capacity-building initiatives focusing on collaborative instrument development can enhance institutional readiness for outcome-based assessment systems[8].

However, the results also revealed several implementation challenges that need to be critically discussed. Technical issues, particularly unstable internet connectivity and differences in time zones between Indonesia and Timor Leste, limited the effectiveness of the planned mentoring phase. As a result, in-depth follow-up assistance and instrument refinement could not be fully implemented. This constraint highlights the importance of considering infrastructural readiness when designing international online community engagement programs, especially in developing country contexts.

Despite these limitations, the evaluation results indicated a positive perceived impact of the program on participants' understanding and readiness to implement CPL measurement practices. Participants reported that the materials and simulations provided practical insights that could be adapted to their institutional context. This aligns with findings from previous research emphasizing that effective CPL measurement requires not only regulatory compliance but also institutional learning and continuous professional development[4].

From a broader perspective, the results of this program demonstrate that best-practice dissemination through structured training and simulation can serve as an effective entry point for strengthening quality assurance systems in vocational higher education institutions. The experience at IPDC suggests that even short-term interventions, when well-designed, can initiate meaningful changes in how institutions perceive and implement CPL measurement. Nevertheless, long-term sustainability will depend on continued mentoring, institutional commitment, and the integration of CPL data into curriculum review and decision-making processes.

CONCLUSION

This community engagement program demonstrated that structured training combined with simulation-based learning can effectively enhance institutional understanding and initial capacity in measuring CPL within an OBE framework. The activities conducted at Instituto Profissional de Canossa (IPDC), Timor Leste, successfully increased participants' awareness of CPL as a strategic instrument for quality assurance rather than a mere administrative requirement.

The program outcomes indicate that conceptual reinforcement, practical simulation, and collaborative instrument development are essential components in supporting higher education institutions in adopting outcome-based assessment practices. Despite technical constraints related to internet connectivity and time zone differences, participants showed improved readiness to develop and apply CPL measurement instruments aligned with institutional and program-level objectives.

These findings suggest that best-practice dissemination through community engagement initiatives can serve as an effective entry point for strengthening quality assurance systems in international and cross-institutional contexts. For sustainable impact, future programs should emphasize continuous mentoring, stronger integration of CPL data into curriculum evaluation, and the use of digital systems to support long-term monitoring of graduate competencies.

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Evaluation Model of the School Operational Curriculum (KOSP) in Vocational High Schools in the Special Region of Yogyakarta

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Abstract. This study evaluates the implementation of the School Operational Curriculum (KOSP) in vocational high schools and develops an implementative evaluation model to support continuous curriculum improvement. Employing an evaluative–descriptive design integrated with a research and development approach, the study applies the Context–Input–Process–Product (CIPP) framework. Data were collected from eleven vocational high schools in the Special Region of Yogyakarta through questionnaires and semi-structured interviews involving teachers, heads of competency programs, vice principals for curriculum, and school principals. The findings indicate that KOSP implementation is generally effective, with very good performance in the context, input, and process dimensions, reflecting strong curriculum alignment, adequate resources, and effective instructional practices. However, the product dimension demonstrates comparatively lower performance, revealing limitations in systematic outcome evaluation, particularly in tracer studies, industry recognition, and documentation of graduate competencies. These results suggest that while curriculum planning and instructional processes are well established, outcome monitoring and impact evaluation remain underdeveloped. This study concludes that KOSP evaluation should adopt a comprehensive and outcome-oriented approach by integrating the CIPP framework with continuous quality assurance mechanisms and structured outcome monitoring to enhance curriculum relevance, accountability, and alignment with labor market needs.

INTRODUCTION

The implementation of the Merdeka Curriculum marks a significant shift in Indonesia's education policy toward a more flexible, learner-centered, and competency-based approach. This curriculum reform emphasizes school autonomy in designing learning processes that are responsive to students' characteristics and local contexts. In this framework, schools are required to develop a School Operational Curriculum (Kurikulum Operasional Satuan Pendidikan – KOSP) as a formal document guiding instructional planning, implementation, and assessment at the school level 1,2.

KOSP is defined as a curriculum developed independently by educational units to translate national curriculum standards into operational learning plans that reflect local needs and institutional characteristics1. The policy explicitly states that curriculum development at the school level must be adaptive, contextual, and oriented toward continuous improvement, rather than merely fulfilling administrative requirements2. This policy direction places evaluation as a central mechanism for ensuring that curriculum design and implementation remain aligned with educational objectives and learner needs.

In the context of Vocational High Schools (Sekolah Menengah Kejuruan – SMK), curriculum relevance becomes particularly critical. Vocational education is expected to prepare students for direct entry into the labor market by equipping them with job-specific skills, industry-oriented competencies, and adaptable work attitudes2. Scholars argue that vocational curricula must continuously evolve in response to technological change, labor market dynamics, and industry standards, making systematic curriculum evaluation indispensable3.

However, empirical studies indicate that the implementation of KOSP in SMKs is often constrained by limited teacher readiness, insufficient resources, and challenges in interpreting frequent policy changes. These issues reduce the effectiveness of curriculum implementation and hinder the achievement of intended learning outcomes. Without a structured evaluation framework, schools may struggle to identify weaknesses in curriculum planning, instructional processes, and learning outcomes.

Previous research on curriculum evaluation in vocational schools demonstrates the importance of longitudinal and comprehensive evaluation practices. A study conducted at SMK Dharma Bahari Surabaya found that curriculum evaluation carried out over at least one academic year provided essential feedback for school development planning, including student assessment results, graduate tracking, teacher reflections, and school quality reports4. Similarly, research on the implementation of the Merdeka Curriculum at SMKN 2 Bandar

Lampung shows that evaluation practices tend to focus on cognitive, psychomotor, and affective assessments at the classroom level, while broader curriculum effectiveness remains underexplored5.

From a theoretical perspective, curriculum evaluation has long been recognized as a systematic process for determining the extent to which educational objectives are achieved. Tyler's Objective Model emphasizes that evaluation should be directly linked to clearly defined educational goals and learning experiences6. Meanwhile, the CIPP model proposed by Stufflebeam conceptualizes evaluation as an ongoing process encompassing context, input, process, and product, allowing evaluators to support decision-making and continuous improvement rather than merely judging outcomes7. These models underline the importance of comprehensive and formative evaluation approaches in curriculum implementation.

Despite the availability of these theoretical frameworks, there is limited empirical research that adapts established evaluation models specifically for KOSP implementation in vocational education. Most existing studies focus on partial aspects of curriculum implementation rather than providing an integrative evaluation model tailored to the unique characteristics of SMKs. Therefore, this study aims to develop and validate a comprehensive evaluation model for KOSP implementation in vocational high schools in the Special Region of Yogyakarta. By adopting a research and development approach, this study seeks to contribute to both curriculum evaluation theory and educational practice by offering an evidence-based, practical model that supports continuous improvement and strengthens the quality of vocational education.

LITERATURE REVIEW

Curriculum evaluation is widely understood as a systematic and evidence-based process for assessing the effectiveness of a curriculum in achieving its intended objectives. Rather than serving solely as a summative judgment, curriculum evaluation functions as a formative mechanism that provides feedback for curriculum improvement and informed decision-making3. Effective curriculum evaluation requires alignment between curriculum objectives, instructional processes, and learning outcomes, supported by reliable data and systematic analysis.

Theoretical foundations of curriculum evaluation have been shaped by several influential models. Tyler's Objective Model emphasizes that evaluation should be grounded in clearly defined educational objectives and should examine the extent to which learning experiences enable students to achieve those objectives6. This model highlights goal clarity and outcome measurement as core principles of curriculum effectiveness. While widely adopted, the model has been critiqued for its limited attention to contextual and process-related factors in curriculum implementation.

To address these limitations, Stufflebeam introduced the CIPP model, which conceptualizes evaluation as a continuous and decision-oriented process encompassing four dimensions: context, input, process, and product7. Context evaluation identifies needs and priorities, input evaluation examines strategies and resources, process evaluation monitors implementation fidelity, and product evaluation assesses outcomes and impacts. The CIPP model is particularly relevant for complex educational programs, as it supports continuous improvement rather than retrospective judgment.

Empirical studies on curriculum evaluation in vocational education demonstrate the importance of comprehensive and longitudinal evaluation approaches. Research conducted at SMK Dharma Bahari Surabaya showed that curriculum evaluation implemented over at least one academic year provided meaningful feedback for school development planning, including insights from student assessments, graduate surveys, teacher reflections, and school quality reports. These findings indicate that multi-source evaluation data enhance the validity of curriculum assessment in vocational contexts.

Similarly, Ependi5 found that evaluation practices in the implementation of the Merdeka Curriculum at SMKN 2 Bandar Lampung predominantly focused on assessing students' knowledge, skills, and attitudes through tests, performance tasks, and observational instruments. While such assessments are essential for measuring learning outcomes, the study revealed limited attention to evaluating curriculum design coherence and implementation processes, suggesting a gap in holistic curriculum evaluation practices.

Overall, existing literature indicates that although established evaluation models and empirical studies provide valuable insights, there remains a lack of integrative evaluation frameworks specifically adapted to the implementation of school-level operational curricula in vocational education. This gap underscores the need for developing a comprehensive evaluation model that systematically incorporates objectives, context, implementation processes, and outcomes to support continuous curriculum improvement.

RESEARCH METHOD

This study employed an evaluative–descriptive survey design combined with a research and development (R&D) approach to formulate an implementative evaluation model for the School Operational Curriculum (KOSP) in vocational high schools. The evaluation process was grounded in the Context–Input–Process–Product

(CIPP) framework, which was used to systematically examine curriculum implementation, institutional readiness, instructional processes, and learning outcomes. The R&D component enabled the refinement of the evaluation model based on empirical findings from the field, ensuring its relevance and applicability in real school contexts.

The research was conducted in vocational high schools (SMKs) located in the Special Region of Yogyakarta, particularly those offering the Office Management and Business Services (MPLB) program. A total of eleven SMKs that had implemented KOSP and involved industry partners (Dunia Usaha dan Dunia Industri/DUDI) were included in the study. Participants were selected using purposive sampling, focusing on individuals who possessed comprehensive knowledge of KOSP documentation and implementation, including teachers, heads of competency programs, vice principals for curriculum, and school principals.

Data were collected through questionnaires and semi-structured interviews. The questionnaire employed a four-point Likert scale ranging from strongly disagree to strongly agree and was developed based on indicators derived from the CIPP framework to capture variations in KOSP implementation across schools. Semi-structured interviews were conducted to obtain deeper insights into institutional experiences, challenges, and needs related to curriculum evaluation. The instruments were subjected to content validation through expert judgment by curriculum specialists and vice principals for curriculum to ensure the relevance and representativeness of the evaluation indicators prior to data collection.

Quantitative data obtained from the questionnaires were analyzed using descriptive statistical techniques to generate mean scores for each CIPP dimension, allowing comparison of implementation quality across evaluation aspects. Qualitative interview data were analyzed using an interactive analysis approach involving data reduction, data display, and conclusion drawing to strengthen the interpretation of quantitative findings. The results of both analyses served as the empirical basis for developing an integrated KOSP evaluation model that combines the CIPP framework, continuous quality assurance principles, and digital dashboard integration for monitoring assessment outcomes, internships, competency tests, tracer studies, and industry feedback. The proposed model was further reviewed for feasibility and acceptability, taking into account school capacity, resource availability, and the dynamic nature of curriculum policy implementation.

RESULTS AND DISCUSSION

The findings of this study reveal that the implementation of the School Operational Curriculum (KOSP) in vocational high schools in the Special Region of Yogyakarta demonstrates a generally high level of effectiveness across the four dimensions of the CIPP evaluation model. The overall mean score of 3.43 indicates that KOSP implementation is perceived as very good, reflecting strong institutional commitment to curriculum reform and continuous quality improvement.

The context dimension achieved the highest mean score (3.52), suggesting that KOSP development in the participating schools is strongly aligned with institutional vision and mission, national Merdeka Curriculum policies, and the Profile of Pancasila Students. Schools have been able to contextualize curriculum planning by incorporating local potential, student characteristics, and regional needs. This finding confirms that the planning stage of KOSP implementation has successfully established a clear strategic direction, which is a critical prerequisite for effective curriculum execution. The strong context alignment also reflects an outcome-oriented curriculum mindset, where schools intentionally design learning experiences to support vocational relevance and adaptability to Industry 4.0 demands, including digital-based learning and project-based approaches.

The input dimension also demonstrated a very good level of readiness, with a mean score of 3.48. This indicates that most schools possess adequate human resources, curriculum documentation, learning facilities, and stakeholder involvement to support KOSP implementation. Teachers' participation in curriculum training and the availability of complete and accessible KOSP documents suggest that institutional capacity building has been prioritized. Furthermore, the involvement of industry partners (DUDI) in curriculum development and teacher training highlights the application of the link and match principle, strengthening the relevance of vocational education to labor market needs. Nevertheless, qualitative insights indicate that resource availability may not be evenly distributed across all competency programs, implying the need for more equitable resource allocation to prevent disparities in curriculum quality.

The process dimension, with a mean score of 3.44, reflects the effective translation of curriculum plans into instructional practice. Teachers consistently implemented learning activities based on learning outcomes (Capaian Pembelajaran), integrated Pancasila Student Profile projects (P5), and applied both formative and summative assessments. The adoption of differentiated and inclusive instructional strategies demonstrates a shift toward student-centered learning, which is a core principle of the Merdeka Curriculum. Regular supervision and reflective practices further support instructional quality improvement. However, the findings also reveal that cross-subject reflection and systematic documentation of project outcomes remain areas for enhancement, particularly to ensure sustainability and institutional learning.

In contrast, the product dimension recorded the lowest mean score (3.26), placing it in the "good" category rather than "very good." This gap indicates that while curriculum planning and implementation are strong, the

monitoring and documentation of learning outcomes require further strengthening. Although graduates are perceived to have achieved competencies aligned with curriculum standards and industry expectations, tracer studies and formal industry recognition are not yet systematically implemented across all competency programs. This finding suggests that outcome measurement mechanisms, such as alumni tracking, industry satisfaction surveys, and digital portfolios, have not been fully integrated into the evaluation cycle. As a result, evidence of graduate quality and long-term curriculum impact remains fragmented.

The comparative analysis across CIPP dimensions highlights a common pattern in curriculum reform implementation: strengths in planning and instructional processes are not always matched by robust outcome evaluation systems. This reinforces the importance of strengthening the product component within the internal quality assurance cycle (PPEPP). Without systematic outcome evaluation, schools risk underutilizing valuable feedback needed to refine curriculum design and implementation.

Overall, the findings suggest that KOSP implementation in the participating SMKs has reached a mature stage in terms of strategic alignment and instructional execution. However, the sustainability and scalability of curriculum improvement depend on the development of an integrated evaluation system that systematically links context, input, process, and product data. These results empirically support the need for an implementative KOSP evaluation model that integrates CIPP principles with continuous quality assurance and structured outcome monitoring to enhance the quality of vocational education.

The consistently high performance observed in the context, input, and process dimensions indicates that KOSP implementation in the participating vocational schools has reached a relatively institutionalized stage. From a curriculum evaluation standpoint, this pattern reflects strong alignment between curriculum intentions and instructional practices, which is consistent with Tyler's Objective Model. Tyler (1949) emphasized that curriculum effectiveness depends on the clarity of educational objectives and the coherence between objectives, learning experiences, and evaluation6. The strong contextual alignment found in this study suggests that schools have successfully internalized curriculum goals and embedded them into operational planning.

Nevertheless, the comparatively lower score in the product dimension reveals a structural weakness that has been widely documented in curriculum evaluation literature. Stufflebeam and Shinkfield (2007) argue that educational institutions often emphasize planning and implementation while underutilizing outcome data for decision-making and improvement7. This imbalance was also evident in the present findings, where learning outcomes were generally perceived as positive, yet systematic mechanisms such as tracer studies and industry validation were inconsistently applied. As a result, evidence of long-term curriculum impact remains limited.

In the context of vocational education, outcome evaluation carries particular significance. Studies on Technical and Vocational Education and Training (TVET) consistently highlight that curriculum relevance should be assessed not only through internal academic achievement but also through graduate employability, industry satisfaction, and alignment with labor market demands. The absence of standardized tracer studies across programs, as identified in this study, suggests that schools may lack integrated data systems capable of consolidating assessment results, workplace learning outcomes, and post-graduation trajectories. This limitation reduces the strategic value of curriculum evaluation for continuous improvement.

The strong results in the process dimension, particularly in differentiated instruction, formative assessment, and the integration of Projek Penguatan Profil Pelajar Pancasila (P5), indicate a meaningful shift toward student-centered and competency-based learning. This finding aligns with contemporary curriculum research emphasizing that authentic assessment and reflective instructional practices are essential for developing transferable skills required in modern workplaces. However, the limited documentation of project outcomes and cross-subject reflection identified in this study suggests that instructional innovation has not yet been fully institutionalized at the organizational level. Without systematic documentation, innovative practices risk remaining fragmented and dependent on individual teacher initiatives.

From a quality assurance perspective, the findings reinforce the importance of embedding curriculum evaluation within a continuous improvement framework. Quality in education should be understood as a dynamic process of transformation rather than static compliance. In this regard, the uneven performance in the product dimension indicates that the evaluation stage within the internal quality assurance cycle (PPEPP) requires strengthening. KOSP evaluation should therefore function not as a periodic administrative task, but as an integral component of institutional learning and curriculum renewal.

Overall, the extended discussion underscores that effective KOSP implementation requires a balanced evaluation approach that gives equal weight to planning, implementation, and outcomes. The empirical findings of this study support the argument that integrating the CIPP framework with outcome-oriented indicators and continuous quality assurance mechanisms can enhance the strategic function of curriculum evaluation in vocational education. Such an approach is critical to ensuring that school-based curricula remain relevant, accountable, and responsive to evolving labor market and societal demands.

CONCLUSION

This study aimed to evaluate the implementation of the School Operational Curriculum (KOSP) in vocational high schools using the CIPP evaluation framework and to provide an empirically grounded basis for developing an implementative evaluation model. The findings demonstrate that KOSP implementation in the participating vocational schools has generally been effective, with strong performance in the context, input, and process dimensions. These results indicate that schools have successfully aligned curriculum planning with institutional vision, national curriculum policies, and vocational education objectives, supported by adequate resources and sound instructional practices.

However, the product dimension emerged as the weakest aspect of KOSP implementation. Although graduates were perceived to have achieved the intended competencies, outcome evaluation mechanisms were not consistently implemented across programs. This imbalance suggests that curriculum evaluation practices remain more focused on planning and implementation than on long-term outcomes and impact.

The study highlights the importance of strengthening outcome-oriented evaluation within the internal quality assurance cycle. Without systematic monitoring of graduate trajectories and industry recognition, schools risk losing critical feedback needed to refine curriculum design and enhance its relevance to labor market demands. Therefore, effective KOSP evaluation should move beyond administrative compliance and function as a strategic tool for continuous curriculum improvement.

Overall, this study contributes to curriculum evaluation practice in vocational education by providing empirical evidence that supports the integration of the CIPP framework with continuous quality assurance principles. The proposed evaluation model offers a structured and implementative approach to linking curriculum planning, instructional processes, and learning outcomes. Strengthening the product dimension through integrated data systems, industry collaboration, and tracer studies is essential to ensure that KOSP implementation not only meets policy expectations but also produces measurable and sustainable outcomes for vocational graduates.

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DEVELOPMENT OF CASE STUDY ASSESSMENT INSTRUMENTS IN THE ENGINEERING PROFESSIONAL PROGRAM

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Abstrak. Mata kuliah Studi kasus adalah mata kuliah yang harus ditempuh oleh mahasiswa Program Studi Program Profesi Insinyur (PSPPI) baik regular maupun RPL. Tujuan penelitian ini adalah ingin mengembangkan instrument penilaian studi kasus pada Program Studi Program Profesi Insinyur yang valid dan reliabel. Metode penelitian yang digunakan dalam penelitian ini adalah Reasearch and Development (R&D). Desain penelitian meliputi tiga tahapan yang mengadopsi model 4-D mengacu langkah-langkah model procedural yang dikembangkan oleh Thiagarajan[1] meliputi Difine, Desain, Development dan Desimination yang hanya sampai Validitas Isi. Teknik Pengumpulan data dilakukan melalui uji ahli dengan menggunakan Teknik Delphi, melibatkan para pakar pendidikan profesi dan praktisi keinsinyuran. Instrumen penelitian berupa lembar validasi dengan skala Likert 1–4, yang digunakan untuk menilai aspek kesesuaian konten, konstruksi, dan bahasa instrumen. Analisis data validitas isi dilakukan dengan formula Aiken's V [2], sedangkan reliabilitas diuji melalui konsistensi antar penilai. Hasil penelitian menunjukkan bahwa instrumen penilaian studi kasus yang dikembangkan memenuhi kriteria validitas isi masuk kategori tinggi 0,904 (Aiken's V = 0,82–0,94), dengan tingkat kesepakatan ahli yang konsisten pada setiap putaran Delphi. Instrumen ini juga dinilai praktis digunakan oleh dosen dalam mengevaluasi capaian pembelajaran berbasis studi kasus pada Program Profesi Insinyur. Dengan demikian, instrumen yang dihasilkan layak digunakan sebagai perangkat penilaian yang objektif, terstandar, dan sesuai dengan kebutuhan penilaian studi kasus dalam Program Studi Program Profesi Insinyur (PSPPI).

Kata kunci: Pengembangan, instrumen penilaian, Studi Kasus, PSPPI

Abstract. The Case Study course is a mandatory course for both regular and RPL students of the Professional Engineering Program (PSPPI). The purpose of this study is to develop a valid and reliable case study assessment instrument for the Professional Engineering Program. The research method used in this study is Research and Development (R&D). The research design includes three stages that adopt the 4-D model referring to the steps of the procedural model developed by Thiagarajan [1] including Define, Design, Development and Dissemination which only reaches Content Validity. Data collection techniques were carried out through expert testing using the Delphi Technique, involving professional education experts and engineering practitioners. The research instrument was a validation sheet with a Likert scale of 1–4, which was used to assess aspects of the suitability of the content, construction, and language of the instrument. Content validity data analysis was carried out using the Aiken's V formula [2], while reliability was tested through consistency between assessors. The results of the study indicate that the developed case study assessment instrument meets the high content validity criteria of 0.904 (Aiken's V = 0.82–0.94), with consistent expert agreement across each Delphi round. This instrument was also deemed practical for use by lecturers in evaluating case study-based learning outcomes in the Professional Engineering Program. Therefore, the resulting instrument is suitable for use as an objective, standardized assessment tool, and meets the needs of case study assessment in the Professional Engineering Program (PSPPI).

Keywords: Development, assessment instrument, Case Study, PSPPI

INTRODUCTION

Professional engineer education is one of the strategic efforts in preparing human resources who have technical competence, professionalism, and engineering ethics in accordance with the needs of industry and society. Graduates of the Professional Engineer Program (PPI) are expected not only to master theoretical knowledge, but also to be able to solve real problems in the field with scientific and professional approaches (Law No. 11 of 2014

concerning Engineering) [3]. Therefore, an assessment system is needed that is able to measure students' critical thinking skills, analytical skills, and problem-solving abilities more comprehensively [4].

One relevant form of assessment is case study-based assessment [5]. This method requires students to identify real problems, analyze various alternative solutions, and provide appropriate recommendations in accordance with professional standards. According to Brookhart (2013), a good assessment instrument must be able to measure student competencies validly, reliably, and in accordance with the expected learning outcomes. However, case study assessment instruments in the Professional Engineer Study Program are still limited, so that the evaluation of student competencies has not been fully measured objectively.

The development of a case study assessment instrument becomes important because it can provide a more accurate evaluation tool in measuring problem-solving abilities, critical thinking, and the application of engineering knowledge in real situations. In line with the opinion of Nitko & Brookhart (2011), systematically developed assessment instruments will improve the quality of assessment and produce more accurate data in making learning decisions. Thus, this research seeks to present a case study assessment instrument that is in accordance with the characteristics of learning in the Professional Engineer Program.

In addition, the developed assessment instrument is also expected to become a standard reference for lecturers in conducting student performance assessments. This is important considering that professional education does not only emphasize cognitive aspects, but also affective and psychomotor aspects that reflect the professionalism of engineers with higher-order thinking skills [6]. Therefore, the development of this case study assessment instrument functions not only as an evaluation tool, but also as a learning medium for students in training critical thinking skills, decision making, and responsibility for engineering practices.

Based on this description, this research is very relevant to be conducted. By developing a case study assessment instrument in the Professional Engineer Study Program, it is expected that a more objective, measurable, and profession-based assessment system can be created. This research uses an instrument development approach with the 4-D model so as to produce an instrument product that is valid, reliable, and feasible to be used in the context of professional engineer education.

LITERATURE REVIEW

Assessment in professional education has a very important role to measure student competencies comprehensively, especially in the domain of critical thinking skills and problem solving [4]. The case study-based assessment model is considered relevant for professional engineer programs because it can represent real situations that will be faced in the field [7]. Case studies are able to train students in identifying problems, analyzing alternative solutions, and making appropriate decisions in the context of the engineering profession. Thus, the development of case study-based instruments can increase the validity of assessment of learning outcomes.

In addition, assessment instruments need to meet aspects of validity, reliability, and practicality. Valid instruments will truly measure the intended competencies, while reliability ensures consistency of assessment results, and practicality ensures that the instrument can be easily used by lecturers and students. In the context of professional programs, case study-based assessment instruments [7] must be systematically designed to be able to measure analytical abilities, application of theory, and students' technical skills in accordance with workplace needs.

Furthermore, the development of assessment instruments often uses a Research and Development (R&D) approach [8]. One model that is widely used is the 4-D model (Define, Design, Develop, and Disseminate) proposed by Thiagarajan [1]. This model allows the instrument development process to be carried out in stages, starting from needs analysis, product design, testing, to dissemination. This model has been proven effective in producing instrument products whose validity and reliability have been tested [9].

In this research, especially in professional programs, it is also important to consider input from experts. The Delphi Technique [10] can be used to obtain consensus from experts regarding the feasibility of instrument items before being tested more widely, so it is an effective method to achieve agreement in research instrument development. Therefore, the combination of the 4-D approach with expert validation through the Delphi Technique will strengthen the quality of the case study assessment instrument in the professional engineer study program.

METHOD

This research is included as development research (Research and Development). The research design uses a 3-D model, a modification of the 4-D [1][11]. The 3-D model includes three stages, namely definition (Define), design (Design), and development (Develop).

Define

The first step is a preliminary study using document analysis techniques with a literature review technique [12], [13] for conceptual definitions and operational definitions related to case study assessment in the Professional Engineer Program Study Program.

Desain

The second step is formulating objectives, designing tasks, and compiling assessment rubrics using literature review techniques [12][13]. In compiling the assessment rubric, it refers to three aspects, namely case analysis reports, presentations, and discussion participation.

Develope

The third step is requesting expert opinions and assessments related to definitions, objectives, tasks, and assessment rubrics using the Delphi method [10] involving nine experts [14]. The aspects for which expert opinions were requested include the weight of each aspect, the suitability between assessed aspects and indicators, and the presented rubric. The assessment rubric for case analysis reports includes case mastery, problem analysis, solutions and recommendations, writing quality, and accuracy of problem-solving methods. The assessment rubric for presentation aspects includes presentation structure, mastery of material, and media and communication. The assessment rubric for discussion participation aspects includes activeness and relevance of opinions.

Research Subjects

The research subjects involved 9 expert judgments, consisting of eight experts in the field of Engineering from the Faculty of Engineering, and one evaluation expert. The experts are lecturers of the Case Study course in the Professional Engineer Program Study Program (PSPPI).

Data Collection Instrument

This research instrument used a questionnaire with a rating scale of 1 to 4.

Data Analysis

The initial stage of content validity used qualitative analysis, namely input from expert judgment, then the analysis results were revised for improvement, and then returned again to expert judgment until they were completely accepted without further revisions [15]. Data from expert judgment assessments were analyzed using the Aiken's formula [2] to obtain content validity [9], [16], [17] of the developed instrument.

RESULTS AND DISCUSSION

Results

In this study, the researcher involved nine experts, including eight experts in the field of engineering from the lecturers in charge of the Case Study course in the Professional Engineering Program and one expert in the field of evaluation. After going through a long process of conducting several FGDs to conduct small and large scale trials with several revisions, it was finally agreed that the case study assessment instrument in the Professional Engineering Program was declared worthy to proceed to the next stage. The results of the assessment of the nine experts obtained data as shown in Table 1.

Table 1: Expert Assessment Results Data

No	Aspect	EXPERT ASSESSMENT								
		A	B	C	D	E	F	G	H	I
1	Case Mastery	4	3	4	4	3	4	4	4	4
2	Problem Solving Approach	4	4	4	3	3	4	3	4	4
3	Solutions and Recommendations	4	3	4	4	3	4	3	4	3
4	Writing Quality	4	4	4	3	3	4	3	4	4
5	Accuracy of Problem Solving Methods	4	3	4	4	3	4	4	4	4
6	Presentation Capabilities	4	3	4	4	4	4	4	4	4
7	Material Mastery	4	3	4	4	3	4	4	4	3
8	Utilization of Media and Communication	4	3	4	4	3	4	4	4	4
9	Liveliness	4	3	4	4	4	4	4	4	4
10	Relevance of Opinion	4	3	3	4	3	4	3	4	3

Next, the assessment data was analyzed using Aikens' formula to obtain the results as in Table 2.

Table 2: Aikens V Analysis Results

Aspect	Expert									S1	S2	S3	S4	S5	S6	S7	S8	S9	∑ S	n(c-1)	V
	1	2	3	4	5	6	7	8	9												
Case Mastery	4	3	4	4	3	4	4	4	4	3	2	3	3	2	3	3	3	3	25	27	0,9259
Problem Solving Approach	4	4	4	3	3	4	3	4	4	3	3	3	2	2	3	2	3	3	24	27	0,8889
Solutions and Recommendations	4	3	4	4	3	4	3	4	3	3	2	3	3	2	3	2	3	2	23	27	0,8519
Writing Quality	4	4	4	3	3	4	3	4	4	3	3	3	2	2	3	2	3	3	24	27	0,8889
Accuracy of Problem Solving Methods	4	3	4	4	3	4	4	4	4	3	2	3	3	2	3	3	3	3	25	27	0,9259
Presentation Capabilities	4	3	4	4	4	4	4	4	4	3	2	3	3	3	3	3	3	3	26	27	0,963
Material Mastery	4	3	4	4	3	4	4	4	3	3	2	3	3	2	3	3	3	2	24	27	0,8889
Utilization of Media and Communication	4	3	4	4	3	4	4	4	4	3	2	3	3	2	3	3	3	3	25	27	0,9259
Liveliness	4	3	4	4	4	4	4	4	4	3	2	3	3	3	3	3	3	3	26	27	0,963
Relevance of Opinion	4	3	3	4	3	4	3	4	3	3	2	2	3	2	3	2	3	2	22	27	0,8148
																					0,9037

The results of the study showed that the assessment instrument developed through the Delphi method with the participation of nine experts had a high level of content validity [18] [17], with an Aiken validity coefficient of 0.904. This indicates that the questions in the instrument have a high level of suitability with the aspects to be measured or assessed [9], and the instrument can be considered a valid tool in measuring the intended concept. Therefore, this instrument has the potential to provide accurate and relevant assessment results.

DISCUSSION

The Delphi method is a research approach that involves a series of iterative discussions among a group of experts with the aim of reaching agreement regarding the suitability of the aspects to be assessed with the assessment rubric. The participation of nine experts [14] in the Delphi method provides an opportunity to build consensus and a shared perspective on the instrument being developed. The Delphi process, which involves a series of question-and-answer sessions, allows for careful formulation of questions based on the views of diverse experts. Data from the expert assessments are analyzed using Aiken's V [19] to obtain a content validity coefficient [20]. Aiken's V is a statistical measure used to measure the content validity [21] of an assessment instrument. The Aiken's V ranges from 0 to 1, with higher values indicating a higher level of content validity.

Based on the analysis, the Aiken's V value of 0.904 indicates that the assessment instrument developed using the Delphi method has a high level of content validity [17] [2]. This indicates that the questions in the instrument are highly appropriate and relevant to the established criteria for measuring the intended concept [22] [23]. The V coefficient value indicates that experts tend to agree on the relevance and suitability of the questions to the intended concept.

The results of the Aiken's V analysis of 0.904 provide confidence that the assessment instrument developed through the Delphi method truly measures what it is supposed to measure [24]. This also indicates that the questions in the instrument have undergone in-depth evaluation by experts and have been declared as an important part in measuring relevant variables according to the established criteria.

CONCLUSION

The results of the study indicate that the assessment instrument developed using the Delphi method, involving the participation of nine experts, has a high level of content validity, with an Aiken validity coefficient of 0.904. This indicates that the questions in the instrument have a high degree of correspondence with the aspects intended to be measured or assessed, and the instrument can be considered a valid tool for measuring the intended concept. Therefore, this instrument has the potential to provide accurate and relevant assessment results. These results indicate that the criteria specified in the assessment rubric align with the aspects specified in the Case Study course for PSPPI UNY students. The high validity coefficient value (0.904) provides confidence that this instrument substantially measures the desired variables. Therefore, this assessment instrument provides strong confidence and is suitable for use in assessing the Case Study course in the Engineering Professional Program at Yogyakarta State University.

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School Community Perceptions of Multiculturalism and Religious Tolerance in the Digital Era

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Abstract. Indonesia is a socio-culturally diverse nation in terms of ethnicity, race, and religion. Maintaining national integration has consistently been a central concern throughout Indonesia's history. In this context, education plays a strategic role in nurturing diversity as a source of social harmony through the implementation of multicultural education. This study aims to analyze school community perceptions of religious tolerance in schools in the digital era. The research employed a qualitative approach using focus group discussions (FGDs) and in-depth interviews involving 15 students and 5 teachers. Data were analyzed descriptively to identify key patterns and themes. The findings reveal several important issues related to interreligious intolerance in the digital era, including teachers' social constructions of intolerance, the practice of multicultural education as a preventive strategy against intolerance, and the selection of practical models of multicultural education implemented in Indonesian schools. These findings highlight the importance of strengthening multicultural education practices to promote religious tolerance amid the challenges posed by digital transformation.

INTRODUCTION

Indonesia is a nation characterized by profound socio-cultural diversity, encompassing differences in ethnicity, race, and religion. While such diversity constitutes a fundamental asset for social cohesion, it simultaneously presents persistent challenges, particularly when primordial identities are mobilized in ways that generate social tension and conflict. Historical evidence indicates that socio-religious conflicts in Indonesia have frequently been triggered by critical moments such as political elections, regime transitions, and structural economic inequalities. These dynamics demonstrate that diversity, although inherent to Indonesian society, is not inherently harmonious but requires continuous social and institutional management.

Diversity continues to shape social relations across multiple spheres of everyday life, including education. Consequently, the question of how to maintain national integration has remained a central concern throughout Indonesia's history. In this context, education occupies a strategic position in cultivating diversity as a source of social harmony through the implementation of multicultural education. Multicultural education is not merely an instructional approach but a normative framework aimed at fostering mutual respect, inclusivity, and social justice within pluralistic societies. However, its implementation faces substantial challenges, stemming not only from persistent structural inequalities but also from evolving social characteristics influenced by rapid advances in science and technology.

Contemporary Indonesian society is increasingly embedded within what is commonly referred to as the digital era, online society, or cyber society. Social interactions are now intensively and extensively mediated by digital networks, particularly social media platforms, which profoundly influence political, economic, and socio-cultural activities. Within this digitally mediated social environment, interreligious relations have become more vulnerable to tension, especially due to the emergence of echo chambers. These algorithm-driven spaces tend to reinforce homogeneous viewpoints while marginalizing alternative perspectives, thereby intensifying religious identity boundaries and reducing opportunities for meaningful interfaith dialogue.

The situation is further exacerbated by the dynamics of the post-truth era, in which emotional resonance often outweighs rational deliberation in the production and consumption of information. In social media interactions, religious identities are increasingly amplified through affective narratives, misinformation, and ideological polarization. This process contributes to the solidification, intensification, and even "freezing" of interreligious relations, where difference is emphasized over shared social values.

These broader socio-digital transformations inevitably extend into educational settings. Schools are not isolated from digital influences; rather, they function as microcosms of wider societal dynamics. Based on systematic data collection, this study identifies three key findings related to interreligious intolerance in

educational contexts in the digital era: teachers' social constructions of digital-era intolerance, the role of multicultural education practices as anticipatory and preventive strategies, and the selection of instructional models applied in multicultural education praxis within schools in the Special Region of Yogyakarta, Indonesia. These findings underscore the urgent need for context-sensitive and digitally responsive multicultural education to sustain religious tolerance in contemporary schooling.

LITERATURE REVIEW

This study is grounded in three key theoretical pillars to construct a holistic solution framework. First, social contact theory (1), which is adapted to digital contexts as digital contact theory (2), posits that structured interactions within virtual environments can reduce prejudice when specific conditions are met: (1) equal status among participants, (2) shared goals, and (3) institutional support. Second, social constructivist theory as articulated by (3) provides a foundational perspective. In its digital adaptation, (4) emphasizes the role of mediated learning through technological scaffolding, wherein multicultural content must be designed within learners' Zone of Proximal Development. Third, the critical digital literacy framework (5) conceptualizes tolerance literacy as a competency enabling learners to deconstruct dominant narratives and algorithmic biases.

Recent findings on information disorder (6) advocate a prebunking approach—countering misinformation before exposure—through gamified learning interventions. Theoretically, this model addresses the challenges of echo chambers (7) and algorithmic bias (8) while aligning with Freire's principles of critical pedagogy in digital contexts. This integrated theoretical framework provides a foundation for transforming tolerance education in alignment with the realities of digital society, while simultaneously anticipating the psychosocial risks associated with online interactions.

Previous research on technology-based tolerance education can be categorized into three generations: Generation 1 (2010–2017), which focused on static digital content such as e-books and videos using one-way communication approaches (9); Generation 2 (2018–2021), which emphasized the development of gamification and basic virtual reality for tolerance simulations (10), (11); and Generation 3 (2022–present), which prioritizes adaptive, participatory, and algorithm-aware digital learning ecosystems.

METHODE

This study employed a qualitative research design using focus group discussions (FGDs) and in-depth interviews. The participants consisted of 15 students and 5 teachers who served as key informants. The primary research instrument was the researcher as a human instrument, responsible for designing the study, collecting and analyzing data, interpreting findings, and reporting results. The researcher determined the research focus, selected participants, conducted observations and interviews, assessed data credibility, and drew conclusions. Data were analyzed using descriptive qualitative analysis.

RESULTS AND DISCUSSION

The dynamics of interreligious social relations in the era of digital transformation are also deeply reflected in educational settings. Following an extensive process of data collection, this study reveals several significant findings related to interreligious relations within educational environments in the digital era. Three major findings emerge concerning interreligious intolerance: 1) teachers' constructions of intolerance in the digital era, 2) multicultural education practices as anticipatory strategies against intolerance, and 3) the selection of praxis models for multicultural education in Indonesia.

1. Teachers' Constructions of Intolerance in the Digital Era

Based on a series of in-depth interviews with key informants, this study finds that religious intolerance, according to teachers' social constructions, has intensified in the digital era. One of the most salient experiences reported by teachers is the increasing prevalence of hate speech, hoaxes, and religiously charged content circulating across various social media platforms. A particularly prominent phenomenon is the growing incidence of interreligious bullying in digital spaces, as expressed by the following informant:

"…in terms of interreligious intolerance within the school environment, it can be said to be relatively absent. However, on social media, it is clearly present. I often see people attacking one another in the name of religious differences, each claiming their own truth. Then they bully each other and even compare the characters of their respective prophets."

This testimony indicates that overt manifestations of interreligious intolerance are not strongly perceived in offline school environments. However, the same informant acknowledges that hate speech and religious bullying on social media have become increasingly pervasive and deeply concerning. Consequently, while interreligious

relations in offline contexts such as schools remain relatively manageable, in virtual spaces or online societies teachers and educational institutions have very limited capacity to exert control.

Nevertheless, although often perceived as sporadic or situational, practices of interreligious intolerance have indeed occurred within educational institutions. One notable example is the case involving a public senior high school in Yogyakarta, SMAN 8 Yogyakarta, which in 2018 required all tenth-grade students to participate in a compulsory scouting camp during a major religious holiday period from March 30 to April 1. This policy went viral on social media for several days because non-Muslim students were required to attend the camp despite the fact that the same period coincided with the observance of the Christian Holy Week and Easter Triduum (12). This case illustrates how educational policies that disregard religious diversity may inadvertently generate intolerance and public controversy.

At the national level, data from Setara Institute further contextualize this issue. In 2023, the institute recorded a total of 217 incidents involving 329 acts of violations of freedom of religion or belief in Indonesia. Among these, Central Java and the Special Region of Yogyakarta ranked within the top five regions, each with 14 recorded incidents of intolerance. The most frequent victims of intolerance were members of the Ahmadiyah community, followers of local or indigenous belief systems, Christians, and Shi'a adherents. Meanwhile, places of worship most frequently targeted included churches, Shi'a and Ahmadiyah mosques, vihara, temples, and synagogues (13,14). These data demonstrate that schools operate within a broader socio-political ecosystem in which intolerance remains structurally embedded.

In response to such conditions, a teacher from SMAN 8 Yogyakarta explained that efforts to strengthen faith within the school environment are continuously pursued. Teachers regularly participate in religious study sessions (pengajian), while students are encouraged to perform dhuha prayers every morning to enhance religious devotion. On certain occasions, the school organizes religious quiz competitions facilitated by the student council, sometimes involving students from junior high schools. However, when asked whether the school had ever conducted religious education sessions attended by students of different faiths in a single class, the informant stated that this had never been done and expressed strong opposition to such an idea:

"…if religious lessons were conducted in a single session attended by teachers and students of different religions, it would definitely be tense and could lead to conflict."

This response reflects a prevailing assumption among teachers that interreligious encounters within formal religious instruction are inherently risky and conflict-prone. As a result, there is no institutionalized forum for interfaith dialogue or moral education derived from shared ethical teachings across religions. Religion is conceptualized primarily as an individual matter of faith enhancement rooted in one's own religious tradition, which in turn fosters exclusivist orientations.

Based on this informant's account, it becomes evident that students' religious identities are increasingly reinforced in isolation from one another. Instead of facilitating shared ethical reflection, schools prioritize activities that strengthen individual religious identities, such as religious competitions. As a public school, this situation is particularly striking, as civic-oriented activities—such as competitions on Pancasila or national values—are less emphasized. Consequently, incidents of religious intolerance, such as the 2018 case at SMAN 8 Yogyakarta, can be understood as a logical outcome of religious education practices shaped by teachers' exclusivist constructions of religion. In such contexts, religious symbols tend to overshadow national civic symbols, even within state schools.

2. Multicultural Education Practices in the Digital Era

Several informants acknowledged that practices of religious intolerance increasingly occur on social media platforms. Given that learning processes have already integrated e-learning systems, all informants agreed that preventive measures are necessary to anticipate interreligious bullying in digital spaces.

One manifestation of online bullying often stems from comparative and superiority-based perspectives. Social media platforms are saturated with content that emphasizes hierarchical comparisons, particularly highlighting numerical superiority based on the size of religious adherents. This quantitative logic fosters a sense of dominance and majority consciousness, while neglecting the substantive moral teachings that intersect across religions. Such content exploits emotional dimensions, making it more likely to go viral and gain higher engagement.

These dynamics motivated SMA Negeri Playen Gunungkidul to implement multicultural education initiatives, including the dissemination of digital flyers promoting media literacy and religious tolerance. According to informants, multicultural education is integrated into sociology classes, emphasizing inclusive attitudes and religious tolerance. Additionally, the school mandates daily reading activities every Wednesday and Thursday, including novels and literary works. This initiative aims to cultivate a strong reading culture, which is believed to enhance students' critical filtering skills when engaging with social media content. Students become less susceptible to disinformation, hate speech, hoaxes, and online bullying.

Most informants reported that multicultural education is primarily delivered through civic education (Pendidikan Kewarganegaraan) and sociology as part of the formal curriculum. However, not all schools implement multicultural education through extracurricular activities. Teachers generally argue that civic education

includes Pancasila values that promote unity and democracy as foundational elements for tolerance, while sociology covers Indonesia's cultural diversity and encourages mutual appreciation. Notably, none of the senior high schools or vocational schools in this study integrated multicultural education into religious education subjects.

When asked about the possibility of conducting religious education classes attended by students of different faiths, nearly all informants considered it highly unlikely. The primary reason cited was the perceived sensitivity of religious behavior. There is a prevailing assumption that dialogical discussions of religion across faiths pose a high risk of conflict and unproductive debate. This perception indicates that teachers tend to understand religion in normative, formal, and exoteric terms. As one informant stated, "If students of different religions were placed in one religious education class, it would become chaotic."

These accounts suggest that religious education in schools is still largely understood as religiousness rather than religiosity. Religiousness refers to formal, ritualistic, and scriptural practices strictly adhering to canonical doctrines, whereas religiosity emphasizes substantive understanding, contextual interpretation, and ethical processes. Consequently, multicultural education in schools encounters structural constraints. Effective multicultural education, particularly in fostering religious tolerance, requires a foundational shift toward understanding religion as religiosity rather than mere religiousness. It must prioritize substance over form, process over outcomes, and dialogue and encounter as necessities (15).

If religious education remains confined to rigid religiousness, interreligious encounters in schools and broader society become nearly impossible. This presents a significant challenge to the implementation of multicultural education aimed at cultivating religious tolerance. Exclusivist, universalistic, and homogenizing religious interpretations undermine the fundamental premise of multicultural education, which celebrates diversity as a source of social cohesion.

Multicultural education requires open, inclusive perspectives that actively embrace diversity. Schools thus function as arenas for cultivating democratic values, with teachers playing a critical role as agents of change toward democratic thinking. As Levinson and Banks argue, if the core aim of multiculturalism is to celebrate difference, then multicultural education must embody the same spirit. Levinson (16) notes that educational philosophers emphasize preserving minority cultures by fostering autonomy and exposure to diverse ideas, enabling critical thinking and open-mindedness. In contrast, Banks highlights the role of multicultural education in promoting social action, equipping students with the knowledge, values, and skills necessary to challenge injustice and advocate for marginalized groups. Under this model, teachers act as agents of change, promoting democratic values and empowering students to engage in transformative action (17).

Following Banks' perspective, teachers must develop awareness and capacity to integrate multicultural education across all subjects. Students should be actively involved in the production of knowledge that embodies values of diversity and tolerance. Epistemologically, this participatory process reduces racial prejudice, ethnocentrism, and religious intolerance through collaborative learning. Such an environment dismantles stereotypes, fosters cooperative and collaborative dispositions, and cultivates equality and solidarity, ultimately strengthening democratic social structures.

3. Models of Multicultural Education Praxis in Indonesia

Dialogue and encounter constitute the core principles of multicultural education in schools. Without these, the substantial intersections among religious teachings risk becoming rigid and frozen. Teachers play a crucial role in fostering new awareness of dialogue, as canonical religious sources across traditions provide ample foundations for mutual engagement. Opportunities for dialogue expand when religion engages with socio-cultural realities rather than focusing exclusively on ascetic or eschatological concerns.

Drawing on Max Weber's notion of world rejection, religious orientations that prioritize otherworldly salvation over worldly engagement limit the potential for interreligious dialogue. All religions contain principles that balance worldly and otherworldly salvation, and this equilibrium provides a critical foundation for multicultural education. The central thesis advanced here is that the more religion prioritizes eschatological concerns exclusively, the narrower the space for dialogue and encounter. Conversely, balanced orientations open pathways for interreligious collaboration in addressing socio-cultural challenges.

However, conservative perspectives often interpret worldly engagement as secularization that threatens religious purity. This dichotomous and binary mode of thinking poses a significant obstacle to multicultural education. Teachers' exoteric, eschatological, and scripturalist understandings of religion require transformation toward more esoteric, inclusive, contextual, and balanced interpretations.

The persistence of formalistic and binary religious interpretations among teachers presents a major challenge to multicultural education. From a Derridean perspective, such thinking reflects logocentrism. If the state engages through social institutions such as schools, families, and mass media, it must go beyond mere socialization of national values. A more fundamental intervention is required: transforming citizens' modes of thinking through critical approaches, including poststructuralist perspectives that deconstruct intolerance.

Jacques Derrida's concept of deconstruction (18) aims to subvert logocentric thinking, which he viewed as the source of philosophical stagnation. Logocentrism relies on dichotomous and hierarchical oppositions—presence/absence, identity/difference, speech/writing—where one term is privileged over the other. Derrida argues that such hierarchies must be deconstructed through inversion and displacement. Inversion reverses hierarchies, while displacement moves beyond binary systems altogether.

In the context of anti-intolerance efforts, many initiatives stop at inversion without displacement, merely reversing positions while remaining within the same hierarchical framework. As a result, intolerance is reproduced rather than dismantled. Genuine deconstruction requires abandoning the original system of thought. Exemplary figures such as Nelson Mandela and Abdurrahman Wahid (Gus Dur) exemplify this approach by transcending binary oppositions and disrupting cycles of intolerance.

Unfortunately, educational institutions in Indonesia continue to reproduce intolerance through logocentric knowledge production. Since the post-authoritarian reform era, schools have increasingly become arenas for religious identity consolidation, facilitated by rising religious political influence. Teachers and lecturers have often served as agents of religious movements, reinforcing exclusivist identities—even under the banner of the state.

It is therefore unsurprising that studies over the past decade have reported increasing intolerance among teachers and students. Research by the Center for the Study of Islam and Society found that 63% of teachers in Indonesia exhibit intolerant attitudes in religious life. Logocentric thinking dominates educational processes, embedding intolerance within students' cognitive frameworks. Consequently, despite claims of promoting tolerance, educational institutions often reproduce intolerance through their epistemological foundations.

Thus, the state has not yet fully addressed religious radicalism and intolerance through education. Meaningful intervention requires deconstructive reforms within educational institutions to dismantle logocentric thinking and foster genuinely inclusive multicultural education.

CONCLUSION

This study reveals that interreligious intolerance in the digital era is shaped not only by online dynamics but also by teachers' constructions of religion and tolerance within school settings. The findings highlight three interconnected aspects: teachers' perceptions of digital-era intolerance, multicultural education practices as preventive strategies, and the selection of multicultural praxis models in Indonesian schools. While offline school interactions tend to remain relatively harmonious, digital spaces intensify intolerance through hate speech, misinformation, and identity polarization, exposing the limitations of conventional religious education that emphasizes formal religiosity over dialogical engagement.

Building on previous studies, this research affirms that multicultural education grounded in cultural inclusivity and critical digital literacy is a strategic pathway to fostering interreligious tolerance. However, its effectiveness depends on transforming normative and exclusivist religious understandings into contextual and dialogical approaches. By positioning teachers as agents of democratic change and students as active co-constructors of knowledge, multicultural education can contribute to sustainable social cohesion and democratic resilience in increasingly digital and plural educational environments.

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JOGOTIRTO VILLAGE'S PIONEER EFFORT SLEMAN REGENCY AS A CHILD-FRIENDLY REGION THROUGH "NGELMU" DANCE TRAINING

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INTRODUCTION

Childhood is a period of growth, both physical and spiritual. Children's growth requires special attention, especially in terms of moral and character education. Moral and character education should be a strong foundation for children to navigate a broader life. In this regard, education within the family environment plays a crucial role in a child's development. As Ki Hajar Dewantara stated, the family environment is the first and most important center of education, and the character of every human being is always influenced by family life (Dewantara, 1977). Moral education is crucial for children as they navigate the broader period of adolescence.

Every child has the right to survive, grow, and develop, and to be protected from violence and discrimination. However, this hope has not been fully realized, as some children still experience various forms of physical and mental violence, both from their environment and from those closest to them. The prevalence of violence against children is due to various factors, one of which is the belief that violence is acceptable and normal in child-rearing and in the application of discipline (Sholikah: 2022, 16).

Adolescence is a vulnerable period for bad behavior due to their tendency to experiment with new things. Physical development in adolescents begins to appear, especially in their sexual organs. During adolescence, sexual hormones also begin to form, so that their behavior is greatly influenced by these hormones (Suhesty, et al., 2019, 72). However, what concerns us is the social life of adolescents today, which has reached an alarming level (Gunarsa, 2017). Education in the world of adolescents and young people requires proper supervision. Ki Hajar Dewantara further stated that:

Young people tend to imitate Western culture, and individualism is prevalent among them. They appear to be separating themselves from their families, resulting in disharmony. Parents have a role to play in monitoring the behavior of young men and women. They need to be given guidance and advice in cultivating morals that shape the nation's character. Youth movements are a crucial support for education, both in terms of intellectual and moral intelligence, as well as social behavior. Therefore, youth movements need to be central to education and incorporated into educational plans (Dewantara, 1977).

Teenagers nowadays are often faced with problems both within themselves and those around them. They tend to be influenced by negative influences, both verbally and in behavior that deviates and even disturbs those around them. Teenagers often think less about the future, even about their goals after completing school. Generally, teenagers who have thought about their future tend to have a clear vision of their dreams (Kartono, 2014).

Juvenile delinquency is a complex phenomenon that has become a serious concern in various societies worldwide. It not only affects individual adolescents individually but also impacts families, schools, and the wider community. Juvenile delinquency encompasses a wide range of behaviors, including drug use, violence, criminal activity, risky sexual behavior, and rejection of established social norms. Factors influencing juvenile delinquency are diverse, including peer pressure, family disruption, lack of parental supervision, and the influence of media and technology (Bobyanti, 2023, 476).

Juvenile delinquency reflects flaws in educational patterns, including those at home, in the community, and at school. Assessment of this issue cannot be simplified to a single aspect but involves many aspects, including the child and adolescent themselves. Essentially, juvenile delinquency demonstrates a lack of discipline in following applicable rules and norms, both within the family, school, community, and within the individual's own norms (Putri, et al., 2023, 218b).

Speaking of juvenile delinquency, a village called Jogotirto frequently experiences juvenile delinquency. Danang, a resident of the village, explained that in the hamlet, children and adolescents frequently engage in behavior inappropriate for their age. They are often seen gathering together drinking alcohol, committing acts of violence against residents they encounter, and even engaging in pornographic acts. This naturally causes concern for parents and other residents.

The behavior of these children and adolescents had become a daily habit and had been going on for quite some time. What was concerning, according to Danang, was that they always invited friends or other residents, sometimes younger than them, so the behavior seemed to be passed down to their younger siblings. The delinquency of these children and adolescents had become individual behavior. So, even when they weren't together, they continued to drink alcohol. This concern sparked heated discussion in the village, leading to a joint effort to address the problems of children and adolescents in the hamlet through child-friendly programs.

Child-Friendly Villages are defined as programs that encourage human resource development through the development of positive values, skills, and habits. Meanwhile, child-friendly villages are also used to develop aspects of territorial commitment, civil rights and children's freedoms, environment, family and alternative care, basic rights and welfare, education, special protection rights, culture, and facilities and infrastructure from an institutional perspective. Every aspect of the child-friendly village program ensures the fulfillment of children's rights to life, growth, and development, as well as protection and participation (Suharta, 2018).

Developing positive values, skills, and habits can be achieved through arts-based activities. Our arts contain profound values, so by practicing arts skills (dance, gamelan, or other arts), it is hoped that the noble values contained within the arts will be absorbed by the practitioner. Practicing the arts will encourage positive and refined activities, especially dance.

Children's dance is an art form that can be used to foster character. Therefore, it's important to ensure that the dance themes taught to children are age-appropriate. Furthermore, the dances chosen should provide motivation and encouragement for learning and social interaction. In this regard, "Ngilmu" dance training can be an alternative to support efforts to reduce or eliminate negative behaviors among children and adolescents that have been complained about for some time. It also helps promote the development of Jogotirto Village, Berbah, Sleman, as a Child-Friendly Area.

LITERATURE REVIEW

The purpose and benefits of training according to De Cenzo, (1999), "training is a learning experience in seeking relatively permanent changes in an individual that will improve the ability to carry out his work". Roger Cartwright (2003) Training is very specific and related to mastering certain tasks or duties. Dessler, G, (1977) stated that "training is a process of teaching skills. The purpose of holding this training is to provide experience in dance skills to participants so that they are able to present themselves in front of others about the values that develop in society, and provide experience in expressing art (dance) and developing attitudes and behavior, instilling cultural values and personality.

The "Ngelmu" dance is a children's choreography created out of the choreographer's concern over the rise in stunting and delinquency among children and adolescents. The dance was created by Thoyib, a student at the UNY Dance Department, and was performed in the 2024 Choreography Test. According to the choreography, the "Ngelmu" dance is contemporary, yet thematically conveys positive meaning and values for children.

Child-Friendly Villages (CVs) is a concept for village development. The primary goal of Child-Friendly Village Development is to create a safe, comfortable, and supportive environment for children's growth and development. Children are provided with adequate protection and opportunities to participate in village community life, and support is provided for them in developing their potential and quality of life. Child-Friendly Villages are an ideal platform to ensure that children can grow and develop optimally in a safe, dignified, and loving environment.

METHOD

Problem Solving Framework

The descriptive relationship between the problem and the solution in this activity is as follows. Jogotirto Village is located near tourist attractions, but ironically, many children and adolescents still engage in inappropriate behavior. Furthermore, children in the village need activities that can reduce, or even eliminate, inappropriate behavior. Dance training is one such activity that is expected to reduce, divert, or eliminate other less beneficial activities.

The "Ngilmu" dance is a new creation suitable for training, and is expected to provide solutions to the village's problems. The Ngilmu dance is seen as adapting to the times, while still prioritizing the positive values implicit in it.

Target Audience

The target audience for this activity is elementary school children from Jogotirto Village, Berbah District, Sleman.

PkM Activity Method

The training method used is Drill and Practice, a teaching approach that involves systematic repetition of exercises to improve students' skills and understanding. This method aims to help students master the subject

matter. According to Nasution & Prastowo, 2021 in (Abubakar, et al., 2025), p. 64), the drill and practice model is a learning method carried out through a practice process to acquire skills or abilities from the ongoing learning process. Thus, the drill and practice method is a learning approach that teaches skills through repeated practice activities. This method can be applied in dance learning because repeated practice can improve students' skills, dexterity, and motor or movement abilities better through repeated practice.

The PkM team designed this activity in three ways, namely: 1) The PkM team prepared by practicing the Ngilmu dance and designing community service activities; 2) conducting community service activities by conducting Ngilmu dance training for children in Jogotirto Village and taking videos at the end; 3) conducting interviews with parents of training participants regarding children's behavior after participating in the dance training.

RESULTS AND DISCUSSION

The first thing the PkM Team did was communicate with a practitioner in Jogotirto village named Ratih Dwi Anjani. The communication was carried out by the Head of the PkM Team, the PkM Team received information about children who were already behaving like adults. With this information, the PkM Team wanted to carry out dance training activities for children in Jogotirto village, namely dance training. Following up on the communication, the PkM Team conveyed the plan to the Head of Jogotirto and was very well received, and suggested using the Jogotirto Village Hall.

The Community Service Team then communicated with Ratih Dwi Anjani, a practitioner from Jogotirto village who was tasked with mobilizing the training participants. The discussion focused on scheduling, which involved three components: the Community Service Team, Jogotirto village, and the training participants. The schedule must take into account the use of the village hall, the Community Service Team's activities, and the children's school activities.

Activity Preparation

Before carrying out the activities, the Community Service Team first conducted preparations to facilitate the implementation of the community service. These preparations included discussions, creating a plan and assigning tasks, and practicing the Ngilmu dance for the Community Service Team before presenting it to participants.

"Ngelmu" Dance as Training Material

The Ngelmu Dance was created by Yahya Thoyib Marsido during the Choreography Test at the FBSB UNY Dance Arts Education Study Program in the Odd semester of 2024. The Ngilmu Dance was created to be given to students at the final elementary school level (grade 6). In the Choreography Test, the Ngilmu dance was danced directly by elementary school students according to the purpose for which the dance was created. The theme raised in the Ngilmu dance is about children who are studying or going to school. Some parts of this dance convey appropriate educational value and are suitable for elementary school children. As depicted in the synopsis below.

"Ngelmu" comes from the Javanese language and means "to seek knowledge." It's normal to feel happy, joyful, sad, tired, and bored while learning, but that doesn't stop children from striving for success. This dance piece depicts a child's journey in seeking knowledge, drawing on a developed Badui folk dance (Marsido, 2024).

Based on the results of the PkM Team's FGD, which attempted to revive student-created dances so that they would not stop at the Choreography Test alone, but could be optimized for purposes beyond campus. After several considerations, the Ngilmu dance was finally chosen as the material to be presented at the 2025 PkM activity. Another consideration was the intention of Jogotirto village to free its area from juvenile delinquency and the pioneering of Jogotirto village as a child-friendly area could be realized. One of the efforts made was by carrying out beneficial activities.

Workshop Implementation

First Day Training Activities (July 14, 2025)

The community service activity, which included Ngilmu dance training, was held at the Jogotirto Village Hall from 3:30 PM to 6:00 PM WIB. The training began with an introduction from the Community Service Team to the participants and their accompanying parents. The participants were positioned in a circle with the Community Service Team to help them focus and build camaraderie. On this occasion, the Community Service Team also presented the community service program in Jogotirto Village. The presentation lasted approximately 30 minutes, followed by practice.

Practice or training begins with a warm-up involving stretching the body. Warming up is crucial in dance training because it reduces the risk of injury and also helps participants become more technically prepared for the dance movements.

The goal of the first Ngilmu dance training activity was for participants to master the movements up to the second minute of the 6-minute Ngilmu dance. The instructor for the Ngilmu dance training was Muhammad Alfian. During the training, Muhammad Alfian presented the movement material along with the correct rhythm

and count. The exercises were repeated until the participants mastered the movements and rhythm. There were difficulties initiating the movements because the accompaniment lacked a clear code for starting. These difficulties were overcome through drills or repeated practice.

Figure 1. Ngilmu dance movement practice
(Photo: PkM Team, 2025)

Second Day Training Activities (July 18, 2025)

The second day of practice began later in the afternoon because the participants had activities at school until 3:30 PM. This second practice session ran from 4:00 PM to 7:00 PM, with a half-hour break from 6:00 PM to 6:30 PM for Maghrib prayers.

After warming up, the second day of the Ngilmu dance movement practice involves reviewing the material presented on the first day. The practice focuses first on changing the rhythm or count of the movements to match the accompaniment. This step requires careful practice and requires considerable time to find the right rhythm. Once the repetition and rhythm changes have been mastered, the instructor adds new movement material as a continuation of the previous movement. As in the first practice, the drill method is also applied in delivering new material, with the target audience reaching the 3-minute mark.

In the next exercise, the instructor divided the participants into two groups. One group practiced the Ngilmu dance from beginning to end, while the other participants sat and observed and provided feedback on the other group's performance. This method in dance learning or training is crucial for monitoring participants' mastery of the material.

Figure 2. Movement training with participants divided into two groups.
(Photo: PkM Team, 2025)

Third Day Training Activities (July 25, 2025)

Like the previous two training sessions, the third training session followed a relatively similar flow. The session began with a group prayer and motivational speeches to the participants. The goal of this step was to ensure the children were enthusiastic about participating in the training until the final day.

The third training session was held at the Jogotirto Village Hall from 3:30 PM to 5:30 PM. As usual, the training began with a shorter warm-up to give participants more energy for the movement material. This was the result of an evaluation of the previous meeting, where the warm-up was quite long, which affected the participants' stamina. The warm-up was led by Ngilmu dance choreographer Yahya Thoyib. A light warm-up was provided to loosen up the leg and body muscles.

The movement practice in this third session began with a review of the movements taught in the previous session. However, in this session, participants were encouraged to memorize them on their own without the assistance of the Coaching Team. Without any prompting, the participants spontaneously formed their own groups. They discussed the movements while moving their hands while sitting, recalling the movements from the beginning to the end.

The spontaneously formed groups demonstrated different ways of memorizing the movements. The coaching team didn't provide any instructions, allowing the participants to memorize independently, even in groups. Some groups simply sat and moved their hands, while others attempted to move according to the material provided.

One group was more active in memorizing the movements. This group attempted to move in a standing position, performing the actual movements. The group sitting at the top tended to be static in memorizing the

movements. After sufficient time had passed to memorize the material, the movements they had learned and memorized were then practiced with accompaniment. Once the participants were deemed to have mastered the material.

Figure 3. The group sitting at the bottom was more active.
(Photo: PkM Team, 2025)

Fourth Day Training Activities (July 28, 2025)

The fourth day of training was held at the home of practitioner Ratih Dwi Anjani. The training began with a light warm-up led by Yahya Thoyib. During the warm-up, a power outage occurred, so emergency lighting was used. When the lights went out, it was very dark, so a man took an emergency light to replace the one that had gone out. This demonstrated the support of the local residents. They always came to watch the training, including the mothers of the participants. Core exercises, focused on completing movement material.

Fifth Day of Training Activities (July 29, 2025)

The fifth Ngilmu dance practice focused on mastering the material and dividing the groups. Before moving on to the main part of the practice, a warm-up was conducted.

Mastery training is conducted using the drill method. This method involves continuous practice, repeating several times, to ensure participants quickly master the material. Training with this method lasts approximately one hour. The trainer tries out repetitions of any movements that are still incorrect.

In the second half, which lasted approximately one and a half hours, the 20 participants were divided into four groups. Each group was then tasked with cooperating with one another.

Each participant was given the task of creating a cheer to build enthusiasm. After performing the cheer, each group worked on memorizing movements, creating formations, and presenting.

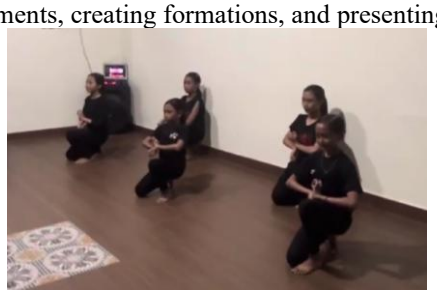

Figure 4. Formation made by group 1.
(Photo: PkM Team, 2025)

Sixth Day Training Activities (August 4, 2025)

During the sixth and final day of training, the PkM Team focused on the use of props, while still practicing the material from beginning to end to monitor participants' retention of the movement material. The props used were imitation books made of liver sponge. The prop training was quite challenging, requiring repetition of the props several times for movements that were technically challenging. Some participants expressed difficulty with certain movements. The trainer attempted to provide movement techniques with simpler props that were easier for the participants to understand.

This training still uses the drill method, reinforcing several movements with props that are difficult for participants. This method is quite effective because repeated practice makes it easier for participants to master the material, considering that using props is one of the more challenging dance exercises.

Figure 5. Movement exercises using props while jengkeng.
(Photo: PkM Team, 2025)

After the participants had mastered the movements using props, the PkM Team gathered the participants for a briefing. First, the PkM Team Leader thanked the participants for their enthusiasm in participating in the activity. The PkM Team felt a growing sense of camaraderie, both with the participants, with the parents who accompanied them, and with the local community. It was also explained that this activity wasn't over; the culmination of the activity would be a video shoot in an open space.

The plan was welcomed with joy by the participants, even though the shooting was without dance costumes with a flashmob concept or creating a group formation with 20 dancers. Ultimately, the concept of a group formation with 20 dancers was chosen, because flashmobs require longer preparation. It was decided to shoot the video on August 18th at Lava Bantal, coinciding with the activities of the Anjani studio led by Ratih Dwi Anjani, as a practitioner in this PkM activity.

Video Shooting Activity (August 18, 2025)

The Ngilmu dance video recording, the result of the training conducted by the UNY Dance Arts PkM Team, was held at Lava Bantal on August 18, 2025, starting at 09.00 to 11.30. The shooting was repeated several times, which was caused by several things, such as: The dancers were out of frame, there was visual leakage, the floor design formed by the dancer formation tended to be less neat.

The repetition was also done because the background view changed. In the first video take, the camera was positioned between two large trees, but the space used by the dancers was much smaller. This was a point of review, as the dancers' movement seemed very limited and significantly disrupted their performance.

The next take was conducted in a larger, but somewhat warmer, space. In this shot, the dancers had more freedom of movement, making the floor design more visible.

Figure 6. The camera is positioned without any obstruction from the tree.
(Photo: PkM Team, 2025)

3. Development of Participant Behavior During Training

The 2025 Dance Arts Assignment Community Service Team (PKM) not only provided dance training to participants but also observed their behavior at each meeting. To obtain more comprehensive data, the PkM Team also involved parents, providing both moral support and interviews with them.

The results of the PkM Team's observations and interviews regarding changes in participant behavior are as follows:

First Day of Training

At first, the participants seemed awkward, this was because they were not yet familiar with the PkM Team. Collaboratively, the PkM Team tried to convince and motivate the participants to do the exercises with a happy feeling without any coercion. The Pkm Team always praised the participants and applauded them when they performed the Ngilmu dance movements. This made the participants feel appreciated, until when the practice was about to close, a participant dared to ask if the accompanying music could be shared with the participants? This question surprised the PkM Team. They were elementary school age asking such an important thing, so Yahya Thoyib provided the link to the accompaniment. This question was a sign that the participants were very serious about participating in this training.

Second Day of Training

The use of the method of dividing participants into two groups encouraged them to take responsibility for their learning. Furthermore, this method encouraged some participants to express their opinions on their peers' actions,

such as whether a movement performed by another group was incorrect. This development is crucial to continuously monitor until participants gain confidence. The methods implemented by the PkM Team in the two training sessions significantly impacted participants' courage in expressing their opinions, growing their self-confidence, and fostering camaraderie.

Third Day of Training

Observations made by the Community Service Team showed that the participants demonstrated a sense of responsibility for their work, albeit in their own ways. Another development was that the participants had begun to learn to collaborate with their peers.

Fourth Day of Training

The participants were very diligent and diligent in participating in the training, eager to master the movement material presented by the trainer. Each participant felt a sense of responsibility for what they learned.

Fifth Day of Training

By working in groups, each participant assumed responsibility for their group. Some group members tried to express their ideas and opinions, while others tried to respect the opinions of others.

Sixth Day of Training

The participants demonstrated enthusiasm and a sense of accomplishment. They followed every instruction with great enthusiasm, ensuring a thorough grasp of the material. They also demonstrated a strong sense of responsibility, as evidenced by their nearly 100% attendance.

Parents' comments on this activity were gathered through interviews when they accompanied their children to the Ngilmu dance training. One parent commented that the participants showed a high level of enthusiasm and responsibility. They explained that before the Ngilmu dance training, they did their homework beforehand to avoid distractions during the practice. In the days leading up to the training, the participants had not done this; they usually did their homework at night.

Seventh Day of Training

On the final day of the training, the video shoot took place in an open location. Based on the considerations and input from practitioners, the shoot was conducted in the Lava Bantal Parking Lot. This activity was the most demanding. The video shoot took a considerable amount of time, as there were repeated takes to achieve the best possible video. Furthermore, the hot weather was quite physically demanding for the participants.

Despite this, the participants showed no signs of fatigue or irritation with the cameraman or stage manager. This was because they still displayed the same high level of enthusiasm as in previous training sessions. Furthermore, the public was watching, which further motivated them. The participants demonstrated dedication and a strong sense of responsibility. They did not want to disappoint in their video shoot, so the hard work they put in over the six training sessions yielded satisfactory results.

CONCLUSION

The 2025 Dance Arts Assignment Community Service (PKM) activity in Jogotirto Village, Berbah, Sleman, was successfully completed, from preparation to implementation. This was the result of the solid and optimal work of the PkM Team by designing and implementing planned and measurable activities. Furthermore, the success of this PkM implementation was also the result of the collaborative work built between the PkM Team, the Head of Jogotirto Village and her staff, Practitioners, participants, and parents who faithfully accompanied and waited for their daughters to practice the Ngelmu dance.

The Ngelmu dance training consisted of six rehearsals and one video shoot. Three rehearsals took place in the afternoon at the Jogotirto Village Hall and three evenings at the Anjani Studio. During the training, the participants mastered the Ngelmu dance, including memorization, movement techniques, rhythm, use of book props, and the application of floor patterns for video recording.

The PkM Team's observations revealed encouraging changes in participants' behavior. These began with a fundamental fear of unfamiliar people, which was evident in the children's learning. Through the team's approach and familiarity, participants began to demonstrate behavioral changes in subsequent training sessions. They actively asked questions, enjoyed the activities, were able to collaborate with others, respected others' opinions, and exhibited high levels of enthusiasm and responsibility, both inside and outside the training (based on interviews with parents).

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DEVELOPMENT OF A WEB-BASED ONLINE NEWS INFORMATION SYSTEM TO ENHANCE INFORMATION DISSEMINATION AT THE FACULTY OF SPORTS SCIENCE AND HEALTH, UNIVERSITAS NEGERI YOGYAKARTA

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Abstract. The rapid advancement of information and communication technology has significantly transformed how higher education institutions disseminate information. Universities are required to adopt reliable and accessible digital platforms to support transparency, efficiency, and institutional visibility. This study aims to design and develop a web-based online news information system at the Faculty of Sports Science and Health (FIKK), Yogyakarta State University (UNY), to enhance information dissemination for academic communities and the public. The research employed a Research and Development (R&D) approach using the ADDIE model, consisting of Analysis, Design, Development, Implementation, and Evaluation stages. The system was developed using PHP, JavaScript, HTML, CSS, and MySQL, and integrated with UNY's Single Sign-On (SSO) authentication. System validation involved three information technology experts and four public relations experts, followed by limited user testing with administrators, lecturers, and students. The results indicate that the developed system is valid, user-friendly, secure, and effective in improving the speed, accuracy, and accessibility of information dissemination. The system contributes to institutional digital governance and supports the university's strategic goal toward becoming a World Class University.

Keywords: information system, online news, website development, ADDIE model, higher education

INTRODUCTION

The advancement of information technology has significantly transformed the way information is produced, distributed, and accessed. In higher education institutions, information dissemination is a crucial aspect of academic governance, institutional transparency, and public communication. Universities are expected to provide accurate, timely, and easily accessible information to support academic activities and institutional reputation.

Universitas Negeri Yogyakarta (UNY), particularly the Faculty of Sports Science and Health (FIKK), requires an integrated information system to manage and disseminate news related to academic and non-academic activities. Although FIKK UNY already operates a faculty website, the existing news management system has not been fully optimized in terms of structured content management, ease of use, and integration with institutional authentication systems.

The development of a web-based online news information system offers a strategic solution to these challenges. Such a system enables real-time publication, structured data management, and broader access without limitations of time and place. In addition, a well-managed news portal contributes to accreditation processes, internal quality assurance, and institutional branding.

Therefore, this study focuses on developing a web-based online news information system at FIKK UNY to improve the effectiveness of information dissemination and support the university's digital transformation agenda.

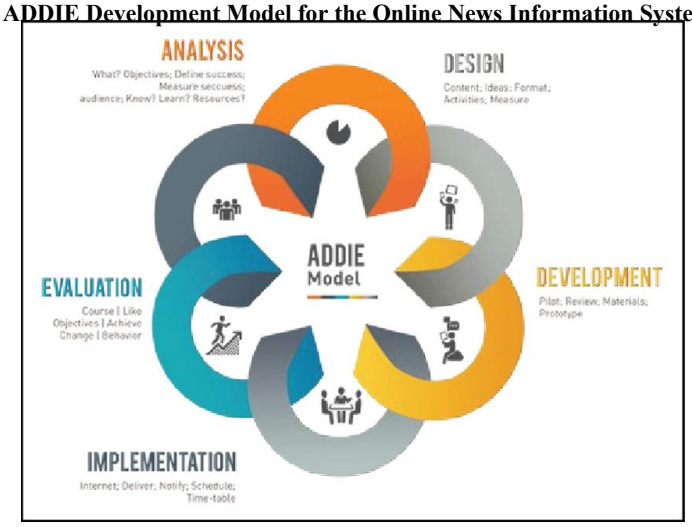
METHOD

This study employed a Research and Development (R&D) approach using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The research was conducted at the Faculty of Sports Science and Health (FIKK), Universitas Negeri Yogyakarta, from March to October 2025.

Research Development Model

The ADDIE model was selected due to its systematic structure and suitability for developing web-based information systems. Each phase allows iterative evaluation to ensure the system meets user needs and institutional objectives. Figure 1 illustrates the ADDIE development model applied in this study.

Figure 1. ADDIE Development Model for the Online News Information System



System Development Procedure

The system development process consisted of the following stages. Table 1 presents the stages and activities in the ADDIE model.

Table 1. Stages of System Development Using the ADDIE Model

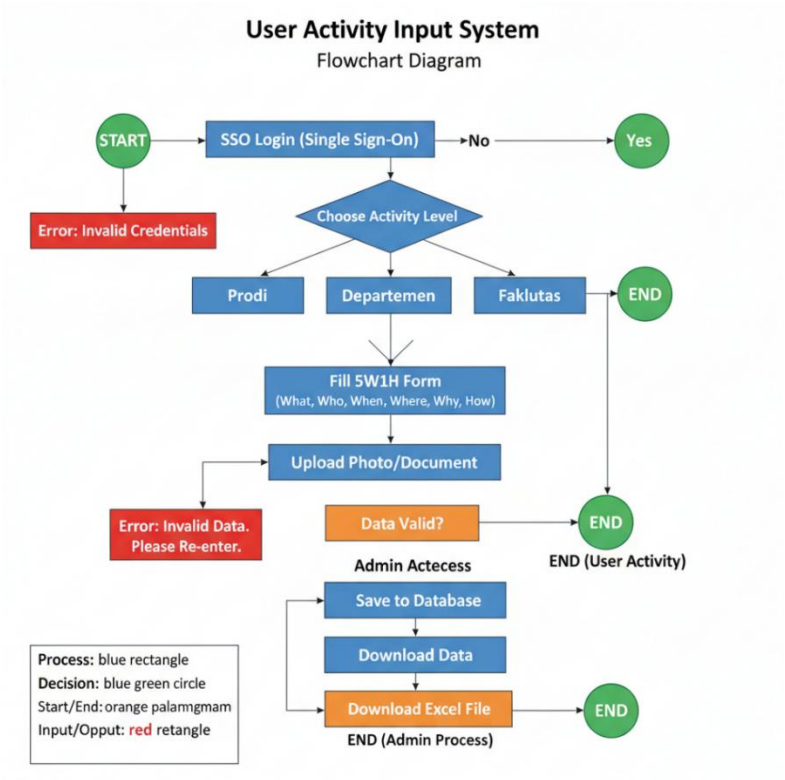
Stage	Activities
Analysis	User needs analysis, identification of dissemination problems, infrastructure analysis
Design	UML modeling, database design, user interface prototyping
Development	System coding, database implementation, interface-backend integration
Implementation	System deployment, administrator training, black-box testing
Evaluation	Expert validation, limited user testing, system refinement

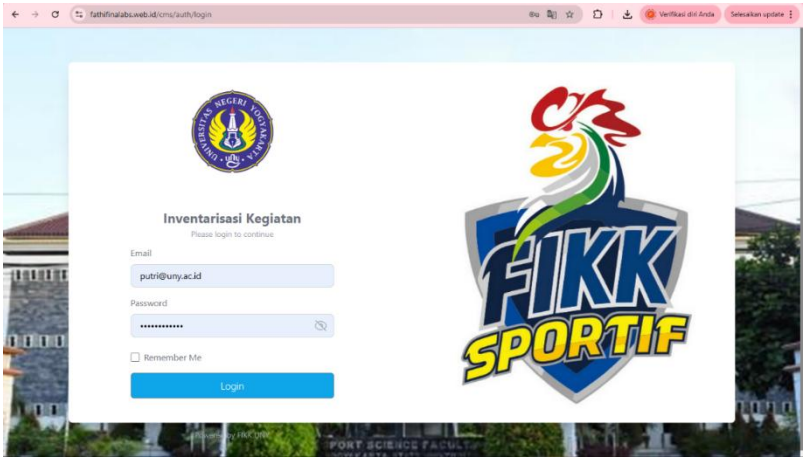
RESULT

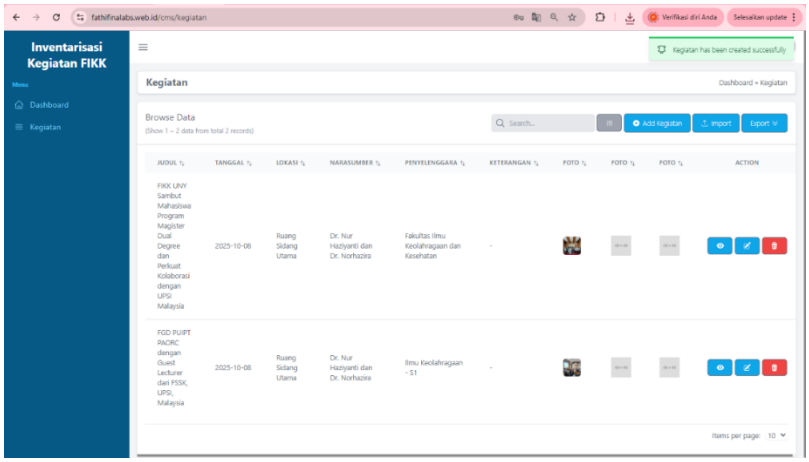
System Design and Architecture

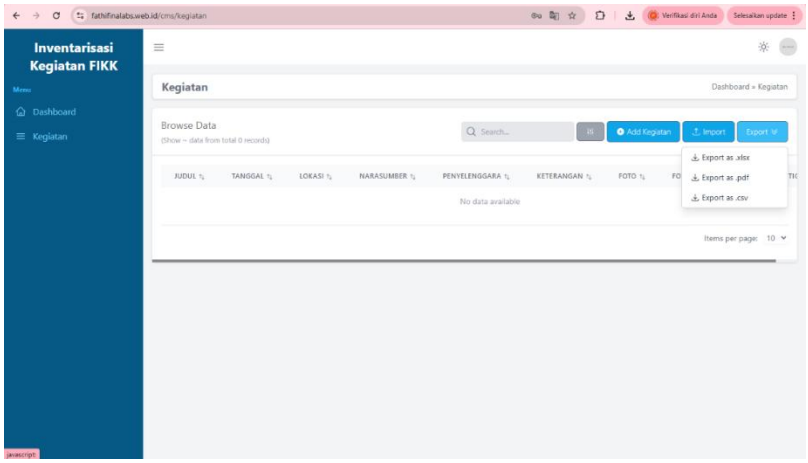
The developed system consists of a frontend interface for users and a backend system for administrators. The system integrates Single Sign-On (SSO) authentication to ensure data security and user accountability. Figure 2 shows the system flowchart of the online news information system.

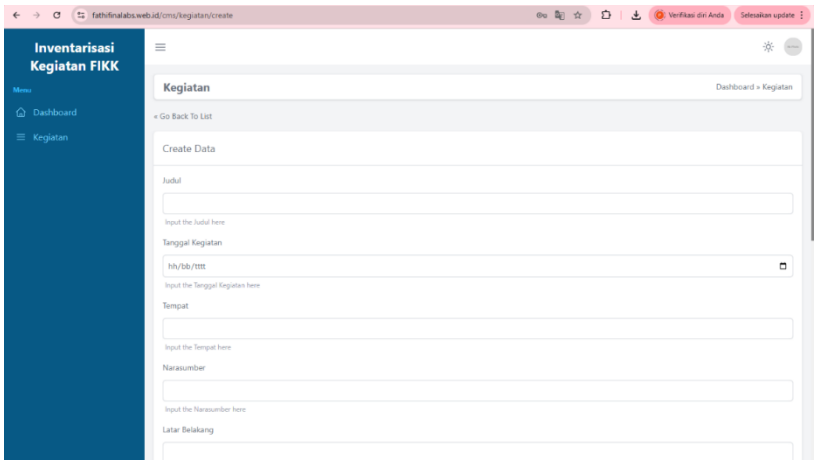
Figure 2. System Flowchart of the Web-Based Online News Information System











Expert Validation Results

System validation was conducted by three information technology experts and four public relations experts. The evaluation covered technological suitability, security, usability, UI/UX design, information dissemination effectiveness, and system scalability. Table 2 summarizes the expert validation results.

Table 2. Expert Validation Results

Evaluation Aspect	IT Experts	PR Experts	Category
Technology suitability	4–5	4	Agree–Strongly Agree
System security (SSO)	4–5	4	Agree–Strongly Agree

Evaluation Aspect	IT Experts	PR Experts	Category
Usability	4–5	5	Strongly Agree
UI/UX design	4–5	4	Agree
Information dissemination effectiveness	4	5	Strongly Agree
System scalability	4	4	Agree

The validation results indicate that the system is feasible and suitable for implementation.

Limited User Testing

Limited trials were conducted with 15 respondents consisting of administrators, lecturers, and students. The testing focused on usability, system responsiveness, authentication process, and user satisfaction. Table 3 presents the results of limited user testing.

Table 3. Limited User Testing Results

Aspect Evaluated	Average Score	Category
Ease of use	4.4	Agree
SSO authentication	4.6	Agree
System responsiveness	4.0	Agree
User interface design	4.4	Agree
Overall user satisfaction	4.2	Agree

The results demonstrate positive user acceptance, although minor improvements were suggested, such as optimizing photo upload speed and enhancing search and filtering features.

DISCUSSION

The results indicate that the developed web-based online news information system effectively improves information dissemination at the faculty level. The structured 5W1H-based news input ensures content quality, while SSO integration enhances system security and accountability.

The ADDIE model facilitated a systematic development process, ensuring alignment between user needs, system design, and implementation outcomes. Similar to previous studies, the use of structured development models contributes to system reliability and user satisfaction.

Furthermore, the system supports digital governance by improving transparency, accessibility, and efficiency in managing institutional information. These outcomes are particularly relevant for higher education institutions pursuing digital transformation and global visibility.

CONCLUSION

The web-based online news information system for FIKK UNY was successfully developed using the ADDIE model. The system is feasible, secure, user-friendly, and effective in enhancing information dissemination for academic communities and the public. The inclusion of structured workflows, expert validation, and user testing confirms its readiness for broader implementation.

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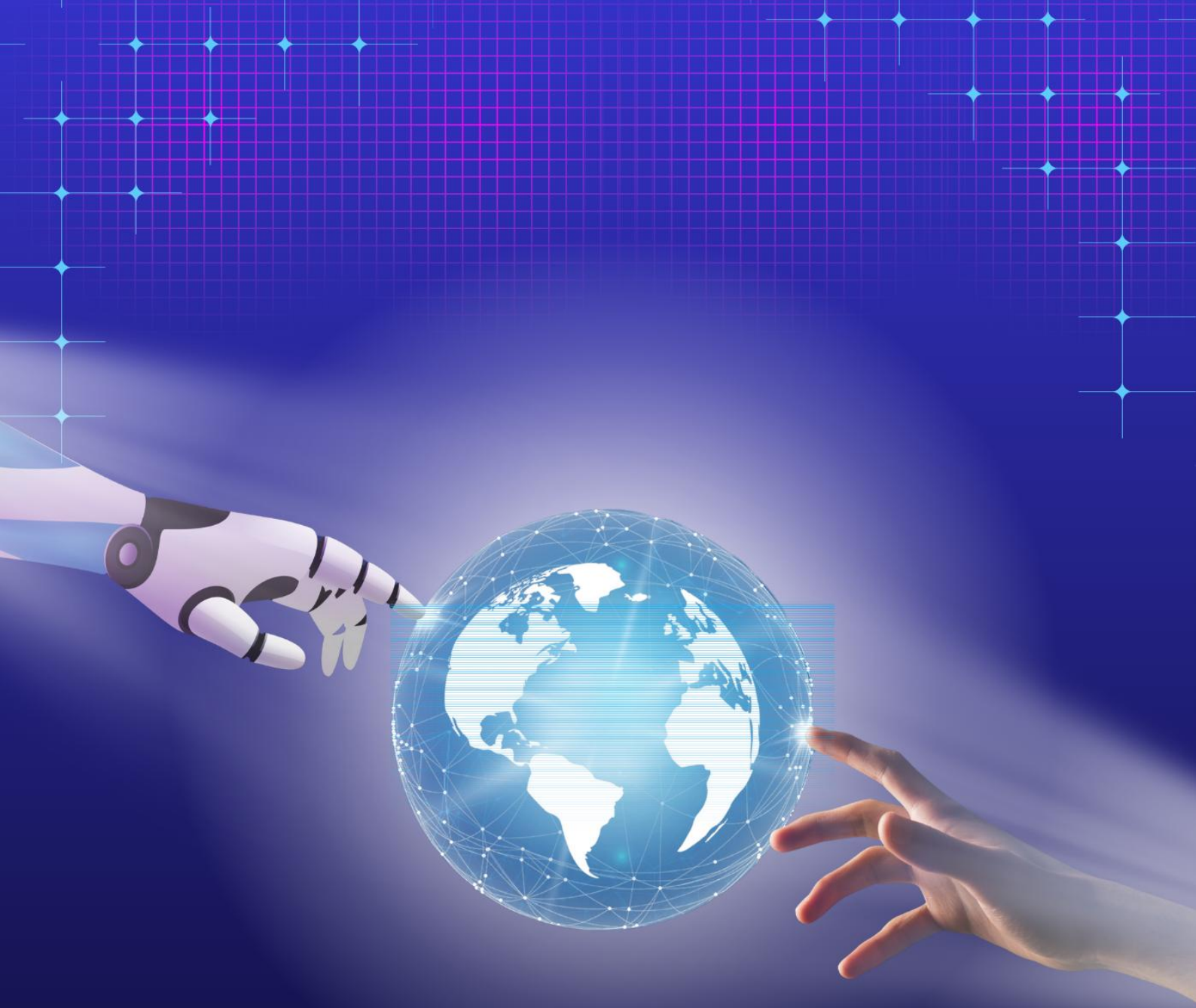

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