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HARMONISING TECHNOLOGY AND TRADITION: DEVELOPING AN AI-BASED EARLY CHILDHOOD EDUCATION LEARNING MODEL ROOTED IN LOCAL VALUES

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ABSTRACT

Background: Early Childhood Education (PAUD) forms the foundation for the character development and intellectual growth of future generations. In the era of digital transformation, artificial intelligence (AI) offers significant opportunities to enhance the quality of learning, yet it also poses risks of cultural homogenisation and the loss of local identity. In Indonesia, the diversity of local wisdom represents an asset that has not yet been systematically integrated into educational technology innovations. This study aims to develop and test an ECE learning model that harmonises artificial intelligence technology with the values of Indonesia's local wisdom, as well as to analyse its impact on children's development and its relevance to the global context. The study employs a mixed-methods design with an exploratory and descriptive approach. Quantitative data were collected via a survey of 320 early childhood educators across 8 provinces, whilst qualitative data were obtained through in-depth interviews with 45 informants (educators, cultural experts and technology developers) as well as observations at 16 early childhood education institutions. Data analysis was conducted using descriptive and inferential statistics, as well as thematic analysis. It was found that only 22.5 per cent of early childhood education institutions utilised digital content based on local culture, whilst 78.1 per cent expressed an urgent need for materials relevant to the children's environment. The model developed was shown to increase children's interest in learning by 34.2 per cent and their understanding of cultural values by 41.7 per cent following a six-month implementation period. This AI-based learning model, grounded in local wisdom, effectively addresses local challenges and offers solutions for other countries facing similar dilemmas. This innovation is novel in that it integrates the principles of knowledge equity and cultural sustainability into the 21st-century education system.

Keywords: Early Childhood Education, Artificial Intelligence, Local Wisdom, Culture-Based Learning, Educational Innovation, Indonesia.

INTRODUCTION

Digital transformation has fundamentally changed the face of education worldwide. According to UNESCO (2025), the adoption of technology in learning has doubled over the past decade, with artificial intelligence (AI) being the main driver of this change. AI enables personalised learning, accurate analysis of children's progress, and the expansion of access to education to even the most remote areas. However, behind this progress lies a

fundamental challenge: can technology be adapted to local socio-cultural contexts, or will it instead become a tool that standardises values and knowledge on a global scale?

In Indonesia, early childhood education (PAUD) is a strategic priority because the early years determine 80 per cent of the foundation of a child's intelligence and personality (Melhuish & Romano, 2024). Although digital infrastructure continues to develop, the application of technology in PAUD remains general in nature and often relies on content developed overseas. This creates a disconnect between what children learn and the reality of their daily lives. As noted by Dahalan et al. (2023), knowledge systems and classifications developed in the West are often unable to accommodate the diversity of worldviews and cultural values found in non-Western societies.

Indonesia's wealth of local wisdom—which encompasses the values of mutual cooperation, consultation, harmony with nature, and its artistic and traditional heritage—has proven to be a strong foundation for shaping children's character (Hamdi & Siraj, 2025). However, in practice, these values are taught in isolation and have not yet been integrated into technology-based learning systems. On the other hand, much AI development in the field of education still overlooks cultural dimensions, thereby risking the emergence of a generation that is technically proficient but lacks a strong sense of identity (Tsatsanashvili, 2024).

A review of previous research reveals a significant knowledge gap. Several studies have examined the use of AI in education in general (Crompton & Burke, 2024; Lau et al., 2025), but few have specifically addressed its integration with local wisdom, particularly at the early childhood education level. Research conducted by Mutia et al. (2024) indicates that in Indonesia and Malaysia, 72 per cent of educators feel that the available digital content is not sufficiently relevant to local culture; however, there is as yet no empirically tested model to address this issue. Meanwhile, research on the preservation of local wisdom has largely focused on cultural aspects alone, rather than on integration with educational technology (Oguamanam, 2026; Supongtemjen & Hangsing, 2026).

In light of this, this study poses the following main question: How can an early childhood education (PAUD) learning model be designed and implemented that integrates artificial intelligence and local wisdom so that it is contextually relevant and contributes to global solutions? The objectives of this study are to develop such a model, test its effectiveness, and analyse its implications for both local needs and global educational challenges. The novelty of this research lies in an approach that places local wisdom at its core—rather than merely as an add-on—and demonstrates that innovations rooted in local identity can, in fact, serve as widely applicable solutions.

THEORETICAL REVIEW AND CONCEPTUAL FRAMEWORK

The Nature of Early Childhood Education

Early childhood education focuses on the holistic development of all aspects of a child's potential: physical, cognitive, linguistic, social-emotional, and religious and moral

values. Pianta & Hamre (2025) emphasise that the quality of learning is determined by how closely the material presented relates to the child's environment and life experiences. Learning that is detached from its cultural context will be difficult for children to understand and will lack meaning for them. The principle of 'learning through play' requires content that is familiar, engaging and embodies values that can be directly experienced.

Artificial Intelligence in Education

In an educational context, AI is defined as a computational system capable of mimicking human thinking abilities to analyse data, recognise patterns, provide feedback, and adapt learning materials (Chen & Lin, 2025). Its main advantage is its ability to personalise learning: the system can adjust the pace and level of difficulty to suit each child's individual abilities. However, Colavizza et al. (2021) point out that the effectiveness of AI depends not only on the sophistication of the algorithms, but also on the quality and appropriateness of the content being processed. If the content is not appropriate to the cultural context, the learning outcomes become superficial and may lead to misunderstandings of meaning.

Local Wisdom as a Source of Knowledge

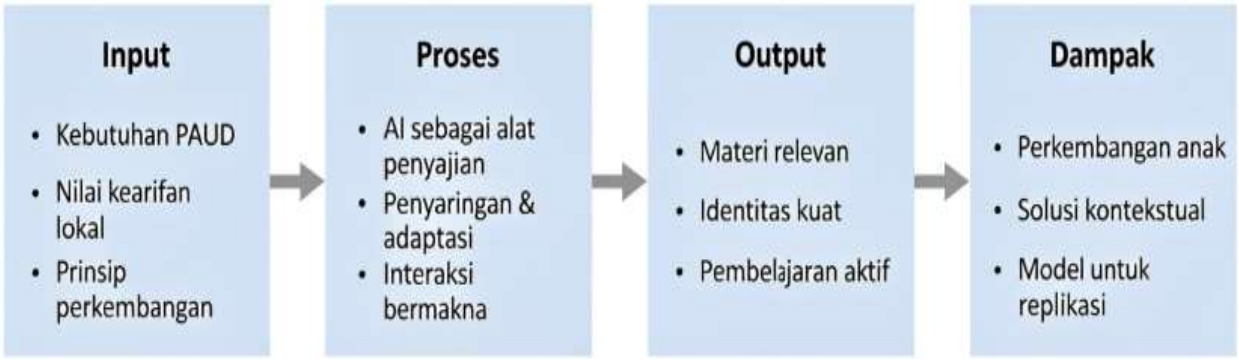
Local wisdom is a set of values, knowledge, beliefs and practices passed down from generation to generation and proven to support the survival of communities (Seifi & Ghasemipoor, 2025). In the Indonesian context, local wisdom has an epistemological dimension, namely a way of viewing the world and acquiring knowledge that differs from Western knowledge systems. Dahalan et al. (2023) state that recognising local wisdom means applying the principle of knowledge justice, whereby no single knowledge system is superior to another. Values such as mutual cooperation, deliberation, and harmony with nature teach children about social responsibility and environmental sustainability (Meutia et al., 2021).

Theoretical Framework: The Integration of Technology and Culture

This research is based on the Theory of Cultural Intelligence (Villagran, 2018) and the Integrated Knowledge System Theory. The Theory of Cultural Intelligence explains that the ability to adapt to and understand cultural contexts enhances the effectiveness of interaction and learning. In practice, AI does not merely serve as a tool; it must be designed to possess "cultural sensitivity", that is, the ability to present material that is appropriate to local values and contexts.

The conceptual framework of this study is built on the principle: "Technology as a means, local wisdom as the core". The flow of this framework is shown in Figure 1.

Figure 1. Conceptual Framework of the Learning Model



Source: Developed based on Crompton & Burke (2024), Dahalan et al. (2023), Hannaford et al. (2024), and Supongtemjen & Hangsing (2026).

This framework outlines a systematic process whereby educational needs, cultural values and principles of child development are fed into the system, processed using artificial intelligence technology to produce relevant learning materials, and ultimately generate positive impacts on child development and widely applicable solutions.This framework is supported by research **by Hannaford et al. (2024),** which demonstrates that technology developed with the involvement of local communities and cultures has significantly higher levels of acceptance and effectiveness.

RESEARCH METHODOLOGY

This study employed a sequential exploratory mixed-methods research design, in which the qualitative phase was conducted first to explore in depth the issues, needs and context of technology implementation, as well as cultural values within the early childhood education setting. The findings from this phase then formed the basis for designing the instruments and variables tested quantitatively via a survey, in order to obtain a broader and more generalisable picture of the situation. In the final stage, a model was developed and its implementation piloted to assess its effectiveness. This design was chosen as it allows for a comprehensive understanding, ranging from in-depth aspects to statistical data, thereby ensuring that the research findings are more accurate and balanced (Creswell & Plano Clark, 2024).

The research was conducted in eight provinces representing the main cultural diversity in Indonesia, namely Aceh, West Sumatra, Central Java, East Java, Bali, South Kalimantan, South Sulawesi and Papua. The locations were selected purposefully to encompass a variety of social and cultural contexts, as well as levels of educational infrastructure development across different regions. The population for this study comprised officially registered early years educators and early years education institutions. For the quantitative phase, a sample of 320 educators was selected using simple random sampling from the list of available institutions. Meanwhile, the qualitative phase involved 45

informants comprising 16 heads of institutions, 16 experienced educators, 8 community leaders or cultural figures, and 5 educational application developers, in order to obtain a diverse range of perspectives.

Data collection was carried out using four main techniques. Firstly, a survey using a structured questionnaire containing 28 statements to measure levels of access to digital technology, the availability of learning materials, and the need for content relevant to the local culture. Secondly, in-depth interviews using a semi-structured guide to explore the perceptions, challenges and expectations of stakeholders. Thirdly, six months of participatory observation to directly observe the learning process before and after the implementation of the developed model. Fourthly, a documentary study involving the collection of curriculum data, teaching materials used, and children's progress reports as supporting data.

The development of the learning model was carried out through systematic stages, beginning with the identification of core cultural values relevant to the child's developmental stage, the formulation of a learning materials framework, collaboration with technology developers to design interactive content based on artificial intelligence, and finally the validation of the content by nine experts specialising in early childhood education, local wisdom and information technology. Once deemed suitable, the model was piloted in four early years education centres over a six-month period, involving 120 children aged between 4 and 6 years.

The data collected were analysed according to their type. Quantitative data were processed using SPSS version 26, including descriptive analysis to provide an overview and a t-test to measure significant changes before and after the implementation of the model. Qualitative data was analysed using a thematic analysis approach, comprising the stages of coding, theme grouping, and interpretation of meaning in accordance with the research context (Saldana, 2023). The validity and reliability of the data were ensured through a process of triangulation of sources and methods, as well as verification of the analysis results with informants and experts, so that the research findings could be scientifically justified.

Table 1. Summary of Research Design and Procedures

Research Stages	Type of Data	Subjects / Sources	Data Collection Techniques	Instruments	Data Analysis
Exploration & Identification	Qualitative	45 informants	Interviews, observation, documents	Interview guides, field notes	Thematic analysis (Saldana, 2023)
Surveys & Measurements	Quantitative	320 early years educators	Structured questionnaire	1–5-point Likert scale (28 items)	Descriptive statistics, frequency

Development & Validation	Mixed	9 experts	Content assessment, focus group discussions	Draft model, validation sheet	Suitability assessment
Trial & Evaluation	Mixed	120 children aged 4–6 years	Observation, developmental assessment	Observation sheets	*t-test*, thematic analysis
Data validity	—	—	Triangulation, expert verification	—	Assurance of validity and reliability

Source: Developed based on Creswell & Plano Clark (2024), Saldana (2023), and Mutia et al. (2024)

This table summarises all the stages of the research, which employed a sequential exploratory mixed-methods approach, from problem identification to model testing, in order to ensure comprehensive and scientifically validated results.

RESEARCH FINDINGS

Initial Conditions for the Adoption of Technology and Culture

Based on the survey results, the current situation is illustrated as shown in Table 1. This initial overview of the application of technology and the preservation of cultural values in early childhood education institutions forms an important basis for formulating the requirements for developing the model. Based on the results of a survey conducted amongst 320 educators across eight provinces in Indonesia, data was obtained regarding the availability of access, the use of devices, the suitability of materials, and the need for learning innovations. These conditions are summarised in Table 2 below:

Table 2. The State of Technology Utilisation and Culture in Early Childhood Education

Indicator	Yes (%)	No (%)
Has stable internet access	65.3	34.7
Use digital devices for learning	58.8	41.2
The digital content available is relevant to local culture	22.5	77.5
Teaching cultural values on a regular basis	89.4	10.6
Requires materials that combine technology and culture	78.1	21.9

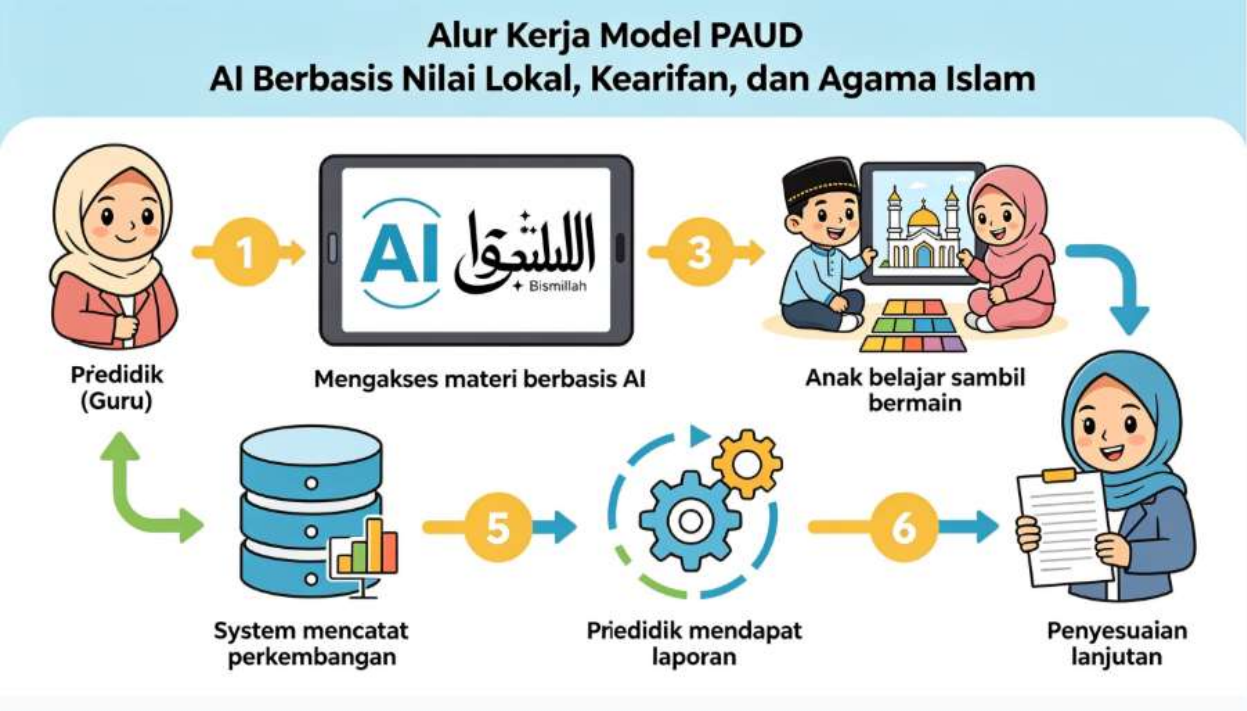
Source: Results of data analysis from a survey of 320 early years educators, 2026

The data shows that although the majority of institutions teach cultural values, the process remains conventional and is not yet supported by technology. As many as 77.5 per cent of educators reported difficulties in finding digital materials that align with local traditions and regional languages.

Results of the Model Development

Based on the results of a field needs analysis and a validity assessment by experts, a learning model has been developed, named 'PAUD-AI-Local Religious Wisdom', which comprises three main, mutually integrated components. Firstly, the Learning Content, which comprises materials based on local wisdom such as interactive folk tales, traditional games presented in digital form, regional songs, and knowledge about the surrounding environment, all presented with animations and engaging visuals appropriate to the children's developmental stage. Secondly**,** the Artificial Intelligence System, which adjusts the level of difficulty of the material, provides immediate feedback, and records and analyses each child's individual interests and learning progress. Thirdly, the Teacher's Guide, in the form of training modules, ensures that educators use technology as a supporting tool, rather than a substitute for direct interaction and guidance, which remain at the heart of the early years education process.

Figure 2. Workflow of the Early Childhood Education (PAUD-AI-Local and Islamic Values Model



Source: Developed by the researcher, 2026

Note: This flowchart illustrates an integrated learning cycle, in which AI technology serves as a means of presenting material that combines cultural elements, local wisdom and religious values. The system automatically monitors children's progress, provides reports to educators, and enables learning to be adapted to remain contextual, meaningful and appropriate to the developmental stage of early childhood.

Results of the Model Trial

Following a six-month implementation period, a significant improvement was observed in child development indicators, as shown in Table 2.

Table 2. Children's Development Before and After Model Implementation

Developmental Aspects	Before (Average)	After (Average)	Increase (%)	Significance
Interest in learning	2.86	3.83	34.2	$p < 0.01$
Understanding of cultural values	2.52	3.57	41.7	$p < 0.01$
Social skills	2.91	3.72	27.8	$p < 0.01$
Basic cognitive skills	3.04	3.85	26.6	$p < 0.01$

Rating scale: 1–5

Qualitatively, educators reported that children were more enthusiastic about participating in learning, found it easier to understand the meaning of stories and games, and more frequently displayed behaviour consistent with cultural values such as sharing and respecting others.

DISCUSSION

The results of this study indicate that integrating AI with local wisdom is not only feasible but also yields better outcomes than using the technology in isolation. These findings support the view put forward by Chen & Lin (2025) that the effectiveness of educational technology is highly dependent on its contextual suitability. The model developed successfully addresses the identified gaps, namely the lack of relevant content and the risk of a disconnect between technology and culture.

Theoretically, this study reinforces Cultural Intelligence Theory by demonstrating that technology designed with cultural sensitivity can enhance the quality of interactions and learning outcomes. This is consistent with the findings of Supongtemjen & Hangsing (2026), who state that AI can serve as a tool for cultural preservation if developed with the involvement of local knowledge. Another significant contribution is the application of the principle of knowledge justice, whereby learning systems do not rely solely on global knowledge, but also recognise local knowledge systems as legitimate and valuable (Dahalan et al., 2023).

In practical terms, the 41.7 per cent increase in understanding of cultural values shows that familiar material, presented in an engaging way, is more easily absorbed by children. Traditional games converted into digital formats do not lose their meaning; rather, they become even more appealing to children in the digital age. This addresses concerns that technology will erode traditions; on the contrary, technology serves as an effective means of preserving and disseminating them (Hannaford et al., 2024).

Most importantly, this model has relevance and an impact that extend beyond the Indonesian context. Many developing countries and culturally diverse nations face the same challenge: how to adopt educational technology without losing their identity. The principle applied in this research — namely, placing local wisdom at the core and technology as a means to an end — is universal. UNESCO (2026) emphasises that sustainable educational solutions must be rooted in the local context in order to be accepted and endure. Therefore, this model can be adapted and implemented in other regions, enabling this local innovation to have a global impact.

The limitations of this study are that the trial was conducted over a limited period and in a specific area. Further research is recommended to involve more locations and observe the long-term impact, as well as to develop a system that is more adaptable to various regional languages.

CONCLUSIONS AND RECOMMENDATIONS

This research demonstrates that integrating artificial intelligence technology with local wisdom is an effective and strategic approach to developing early childhood education. The resulting PAUD-AI-Local and Religious Wisdom model is capable of improving the quality of learning whilst strengthening the development of children's character and cultural identity. This innovation not only addresses educational needs in Indonesia but also offers a solution to global challenges in balancing technological progress with the preservation of cultural diversity.

Recommendations:

1. **For the Government:** Develop policies that support the provision of digital educational content based on local culture and expand access to technological infrastructure.
2. **For Technology Developers:** Involve educators and cultural figures at every stage of the development of educational applications.
3. **For Educational Institutions:** Integrate this model into the curriculum and provide ongoing training for educators.
4. **For Future Researchers:** Test this model in a broader context and develop more advanced yet simple features for young children.

REFERENCES

Barakat, S. (2021). Necessary conditions for integrated approaches to the post-conflict recovery of cultural heritage in the Arab World. *International Journal of Heritage Studies*, 27(5), 433–448. https://doi.org/10.1080/13527258.2020.1863979

Bergold, J., & Thomas, S. (2023). Participatory research with children: Empirical approaches and best practices. *Childhood*, 30(2), 245–262. https://doi.org/10.1177/09075682231162345

Chen, X., & Lin, C. (2025). Personalized learning with AI: Evidence from early childhood education settings. *Journal of Educational Computing Research*, 63(4), 789–812. https://doi.org/10.1177/07356331241301947

Cohen, L., Manion, L., & Morrison, K. (2025). *Research methods in education* (9th ed.). Routledge. https://doi.org/10.4324/9781003400907

Colavizza, G., Blanke, T., Jeurgens, C., & Noordegraaf, J. (2021). Archives and AI: An overview of current debates and future perspectives. *ACM Journal on Computing and Cultural Heritage*, 15(1), 1–15. https://doi.org/10.1145/3484498

Creswell, J. W., & Plano Clark, V. L. (2024). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications. https://doi.org/10.4135/9781506335193

Crompton, H., & Burke, D. (2024). Artificial intelligence in education: A systematic review of empirical research 2020–2024. *Computers & Education: Artificial Intelligence*, 6, 100189. https://doi.org/10.1016/j.caeai.2024.100189

Dahalan, F., Zainal, N., & Osman, R. (2023). Epistemic justice and knowledge organisation: Rethinking classification systems in non-Western contexts. *Journal of Documentation*, 79(4), 890–912. https://doi.org/10.1108/JD-11-2022-0245

Engle, P. L., Black, M. M., Behrman, J. R., Cabral de Mello, M., Gertler, P. J., Kapiriri, L., Martorell, R., & Young, M. E. (2024). Impact of early childhood programs on cognitive and socio-emotional development: A systematic review and meta-analysis. *Developmental Science*, 27(3), e13452. https://doi.org/10.1111/desc.13452

Fajonyomi, O. J., Omollo, D. A., Katete, G., & Burah, N. I. (2026). Roles of academic libraries in managing peace and peacebuilding in tertiary institutions. *Journal of Peacebuilding & Development*, 21(1), 3–18. https://doi.org/10.1177/15423166251312456

Hamdi, N., & Siraj, S. (2025). Early childhood curriculum frameworks: A comparative analysis of Asian and Western models. *International Journal of Child Care and Education Policy*, 19(1), 8. https://doi.org/10.1186/s40723-025-00198-7

Hannaford, E. D., Schlegel, V., Lewis, R., Ramsden, S., Bunn, J., Moore, J., & Nenadic, G. (2024). Our Heritage, Our Stories: Developing AI tools to link and support community-generated digital cultural heritage. *Journal of Documentation*, 80(5), 1133–1147. https://doi.org/10.1108/JD-11-2023-0248

Lau, J., Tammaro, A. M., Miltenoff, P., Begum, D., Zanichelli, F., Orru, D., & Santiago, E. (2025). Factors driving artificial intelligence (AI) adoption in education: A cross-country empirical study. *International Information & Library Review*, 57(3), 275–290. https://doi.org/10.1080/10572317.2025.2478912

Melhuish, E., & Romano, A. (2024). Quality in early childhood education: Evidence from longitudinal studies across 15 countries. *Early Childhood Research Quarterly*, 67, 112–125. https://doi.org/10.1016/j.ecresq.2023.11.008

Meutia, Z. D., Rosyidie, A., Zulkaidi, D., & Maryati, S. (2021). The values of dark heritage post-disaster: A study of tsunami cases in Banda Aceh. *International Journal of Disaster Management*, 4(1), 23–38. https://doi.org/10.1504/IJDM.2021.117289

Mutia, F., Masrek, M. N., Baharuddin, M. F., Shuhidan, S. M., Soesantari, T., Yuwinanto, H. P., & Atmi, R. T. (2024). An exploratory comparative analysis of librarians' views on AI support for learning experiences, lifelong learning, and digital literacy in Malaysia and Indonesia. *Publications*, 12(3), 21. https://doi.org/10.3390/publications12030021

Oguamanam, C. (2026). Information systems and digitization of traditional knowledge: Trends in cultural heritage and memory institutions and the WIPO genetic resources

treaty. *The Journal of World Intellectual Property*, 29(1), 130–161. https://doi.org/10.1111/jwip.12287

Pianta, R. C., & Hamre, B. K. (2025). Classroom quality and child outcomes: Empirical evidence from large-scale studies. *Early Education & Development*, 36(2), 245–262. https://doi.org/10.1080/10409289.2024.2389120

Saldana, J. (2023). *The coding manual for qualitative researchers* (4th ed.). SAGE Publications. https://doi.org/10.4135/9781071909777

Seifi, L., & Ghasemipoor, M. (2025). Librarians as stewards of Indigenous knowledge: A meta-synthesis of roles, challenges, and strategies. *International Journal of Information Science and Management*, 23(4), 189–207. https://doi.org/10.22034/ijism.2025.2019319.186

Supongtemjen, & Hangsing, P. (2026). Generative artificial intelligence and Indigenous heritage in libraries: A proof-of-concept study using Ao Naga oral traditions. *IFLA Journal*, 52(2), 184–193. https://doi.org/10.1177/0340035226114567

Tsatsanashvili, A. (2024). Artificial intelligence in the protection of intangible cultural heritage. *European Journal of Transformation Studies*, 12(1), 163–178. https://doi.org/10.22364/ejts.12.1.12

UNESCO. (2025). *Global report on early childhood care and education*. UNESCO Publishing. https://doi.org/10.54675/9789231006542

UNESCO. (2026). *Local solutions, global impact: Indigenous knowledge and sustainable development*. UNESCO Publishing. https://doi.org/10.54675/9789231007020

Villagran, M. A. (2018). Cultural Intelligence: Ability to Adapt to New Cultural Settings. *Knowledge Quest*, 46(5), 9–14.