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Early childhood literacy skills: Implementation of the local genius-based steam learning model

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Abstract. Literacy skills are a key focus in the Merdeka Curriculum, with the development of children's literacy being fostered through engaging activities. Innovative learning models that allow children to explore their potential freely play a crucial role in this process. One such model is the Science, Technology, Engineering, Art, and Mathematics (STEAM) Learning Model, which can serve as both an approach and the core of early childhood education. Research on this topic is increasingly diverse and complementary. This study focuses on the implementation of the STEAM learning model, using Local Genius as the learning theme. The aim of this research was to evaluate the effect of the STEAM model based on Local Genius on early childhood literacy skills. Using a post-test only control group design with a quasi-experimental approach, data were collected through observation and analyzed using one-way analysis of variance (ANOVA). The results revealed an F value of 5.612 with a significance of 0.025 (sig < 0.05), indicating that the STEAM Learning Model based on Local Genius significantly influences early childhood literacy skills. Based on these findings, it is recommended that educators implement the STEAM Learning Model, incorporating local cultural elements, to enhance literacy skills in early childhood education.

Introduction

In early childhood education (ECE), the development of foundational skills is crucial in preparing children for the next stage of their educational journey. In this context, the training provided in ECE not only covers aspects of literacy and academic ability, but also emphasizes the importance of character development and discipline. Through this education, children are encouraged to understand moral and religious values, build a positive self-identity, and develop disciplinary attitudes that will serve as essential capital for their future educational endeavors. The transition from early childhood education to primary school is carried out through enjoyable activities, in line with the guidance of Mr. Nadiem Anwar Makarim, Minister of Education, Culture, Research, and Technology of Indonesia, during the launch of episode 24 of the Merdeka curriculum (Kemdikbudristek, 2023). The enjoyable transition process plays a significant role in creating a pleasant learning atmosphere and fostering a good relationship between educators and students,

facilitating children's adaptation to a new environment, such as primary school (Layyinah, 2017). The importance of enjoyable learning during the foundational phase can yield positive results for the growth and development of children's abilities.

Enjoyable learning aims to maintain children's interest in learning. When children engage in enjoyable learning activities, they not only gain knowledge but also experience happiness and satisfaction, which in turn supports the development of their foundational skills. The enjoyable learning methods also help children achieve broader learning goals, such as character development and social skills. The foundational abilities instilled include learning outcomes in ECE that cover three interconnected stimulation elements, including learning outcomes (1) religious values and moral character, (2) identity; and (3) literacy and the basics of STEAM (Rahardjo M. & Maryati, 2021).

Amidst the Merdeka curriculum, which emphasizes the importance of literacy, the application of attractive and enjoyable learning becomes highly relevant, especially with the challenges posed by the post-COVID-19 pandemic, which resulted in learning loss for many children. Literacy here is not only limited to reading and writing abilities but also encompasses broader language skills development, such as listening, speaking, and understanding information. In this context, early literacy accompanied by enjoyable and innovative activities will be more effective in stimulating children's language abilities and encouraging their intellectual development (Suryawati & Akkas, 2021). Therefore, it is essential to integrate creative approaches in learning that can optimally enhance children's literacy skills.

Ideally, ECE in Indonesia should adhere to the principles of the Merdeka Curriculum, which emphasizes learning based on children's interests and integrates local values, as well as the comprehensive development of literacy skills. This curriculum requires teaching that supports creativity and innovation, focusing not only on academic aspects but also on children's character and social development. However, in practice, many educators still face difficulties in implementing enjoyable and innovative learning approaches. Limited understanding of effective learning models, lack of resources, and challenges in adapting teaching methods suitable for the post-pandemic situation present significant obstacles. Additionally, some regions still lack adequate facilities and training to support the effective development of literacy skills among young children.

However, based on initial observations conducted at a partner early childhood education institution, PAUD Pelita Kasih, it was found that most students still experienced difficulties in recognizing letters, distinguishing the initial sounds of words, and understanding the content of simple stories read aloud by the teacher. Formative assessment data collected from 30 children aged 5–6 years indicated that only 30% of the children were able to consistently recognize vowel and consonant letters, while the remaining 70% demonstrated a low understanding of basic literacy concepts. Furthermore, interviews with classroom teachers revealed that the learning approaches used so far have not been fully contextual and have lacked real-life learning experiences for the children, resulting in low interest and engagement in literacy activities. This condition highlights an urgent need to develop a more enjoyable, meaningful, and developmentally appropriate learning model to optimally enhance children's literacy skills.

The implementation of the STEAM Learning Model for students can provide possibilities and opportunities for students to expand their knowledge, foster positive attitudes, and build self-confidence, with the goal of developing abilities, particularly the 21st-century skills needed today, namely critical thinking, creativity, collaboration, and communication skills (Indrayana et al., 2022; Widana et al., 2021). It is also noted that if the STEAM approach is used in learning, its principle aligns with the process an engineer goes through, known as the Engineering Design Process (EDP).

In the STEAM approach, activities develop children's ideas based on science and technology, engaging in problem-solving using the disciplines of science, technology, engineering, art, and mathematics (Motimona & Maryatun, 2023).

STEAM implementation has a greater integral impact on the development of 3-6-year-old children's competencies through teacher professional development. Effective STEAM implementation requires extensive teacher professional development to create an integrative and holistic learning experience for children. Well-trained teachers in this approach will be better able to manage activities that stimulate children's creativity, improve critical thinking skills, and design learning that is based not only on science but also on art and culture relevant to their lives (Monkeviciene et al., 2020). Thus, STEAM-based education at an early age is expected to enhance children's academic abilities and enrich their personal and social aspects (Sukendra et al., 2023).

Several previous studies have found that STEAM can enhance children's creativity, particularly in thinking and problem-solving (Wahyuningsih et al., 2019). This is due to the hands-on and interdisciplinary nature of the STEAM approach, which encourages children to engage in collaborative activities, explore diverse solutions, and think critically. Other research on the development of STEAM learning with traditional games (Sit & Rakhmawati, 2022) showed the development of feasibility and effectiveness in enhancing children's creativity, critical thinking, early science, and early math. The integration of traditional games into STEAM learning not only helps foster cognitive skills but also allows children to connect with their cultural heritage, making the learning process more meaningful and engaging. Another study by (Rini et al., 2022) found that STEAM is also an effective practice in promoting gender equality in early childhood. This approach encourages all children, regardless of gender, to participate equally in science, technology, engineering, art, and mathematics activities, helping to break down traditional gender stereotypes and promote inclusivity. These studies collectively highlight the broad and significant benefits of STEAM education, particularly in fostering creativity, critical thinking, and social equality in early childhood.

Additionally, integrating local wisdom or local genius in early childhood education, particularly with the STEAM approach, greatly contributes to introducing children to their culture and traditions. Local Genius or Local Wisdom is an inherent part of a community's culture. Local Genius is also interpreted as thinking about life values (Abubakar & Anwar, 2021). Local wisdom is steady and sustainable, passed down through stories for generations. Local wisdom is viewed as knowledge gained by the community through a series of experiences in trying and integrating with the culture and natural conditions of a region (Siahaan, 2018). Local wisdom is passed down in the form of folklore, proverbs, songs, and folk games. It contains knowledge and wisdom that encapsulates theological, cosmological, and sociological perspectives (Pingge, 2017). And it is preserved as wise thinking that reflects how knowledge is generated, stored, applied, maintained, and passed on (Toharudin & Kurniawan, 2017).

This practice of knowledge, passed down through generations, has a positive impact on various community conditions, whether in agriculture, health, education, or other sectors. The use of local wisdom in education, particularly in the learning process, has proven effective through various studies. Research on local wisdom-oriented learning is effective in improving the mathematics achievement of eighth-grade junior high school students (Ernawati et al., 2023), ethnoscience or science learning approaches that implement local wisdom (Wardani, 2021), and can be used as a source of social studies learning (Widyanti, 2016).

In this study, the types of local wisdom used include various cultural elements that reflect the way of life of the community, such as folklore, traditional games, and cultural values from Bali. For

example, traditional games that teach basic engineering concepts, teamwork, as well as patience and problem-solving, or folklore that contains moral and ethical values. This local wisdom, when integrated with the STEAM approach, can create a learning environment that not only enhances children's literacy skills but also introduces them to culture and traditions that involve aspects of science, technology, art, and mathematics in daily life.

The STEAM approach allows for the harmonious integration of various disciplines, while local wisdom enriches learning by providing relevant and meaningful cultural context (Widana & Septiari, 2021). For instance, children can learn basic concepts in science and technology through folklore that explains natural phenomena or use traditional games to teach basic engineering and problem-solving techniques. In this way, the integration of local wisdom and STEAM not only supports the development of children's literacy skills but also enhances their creativity and social abilities, which in turn can improve overall learning outcomes.

This research is important to address the challenges of literacy learning in ECE post-pandemic by exploring the implementation of a Local Genius-based STEAM learning model. Combining STEAM with local wisdom in early childhood education can create an enjoyable, contextual, and meaningful learning environment that strengthens literacy skills while shaping children's character and cultural identity. Specifically, this study aims to examine how the integration of cultural elements, such as traditional games, folklore, and local values, with the STEAM approach can enhance children's ability to recognize letters, understand sounds, and comprehend simple texts. Packaged in activities inspired by local wisdom, such as Balinese culture and folklore, the STEAM model has the potential to capture children's attention, increase their focus, and spark their enthusiasm for learning. With a comprehensive approach that is relevant to their daily lives, this research is expected to provide practical and innovative solutions for educators to overcome literacy learning challenges in early childhood education, particularly in the post-pandemic context.

Method

This study uses a quasi-experimental design with a control group to examine the cause-and-effect relationship between the application of the Local Genius-based STEAM learning model and its impact on early childhood literacy skills. The research was conducted at PAUD Pelita Kasih, located in Padang Permai, Br. Padang Bali, Dalung, Kuta Utara District, Bali, during the odd semester of the 2023-2024 academic year. An overview of this research design can be noted as follows.

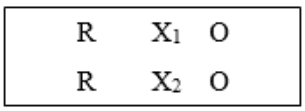

Image 1. Research design

Description:
X1 = Local Genius-based STEAM learning model
X2 = Conventional learning model
O = Early childhood literacy skills

The design compares two learning models to evaluate the impact of the Local Genius-based STEAM model on early childhood literacy skills. X1 represents the experimental treatment, integrating STEAM elements and local wisdom, while X2 represents the conventional learning model using traditional teaching methods. O is the dependent variable, early childhood literacy skills. The study aims to determine which model is more effective in improving literacy outcomes,

providing insights into the effectiveness of combining local wisdom with the STEAM approach in early childhood education.

The population for this study consisted of all children aged 5-6 years at Pelita Kasih PAUD. The sample consisted of 30 children divided into two groups: the control group (X2) and the experimental group (X1), each containing 15 children. Group selection was carried out using random sampling to ensure comparability between groups in terms of age and developmental stage.

The instruments used to collect data in this study were developed based on the Ministry of Education and Culture Regulation (Permendikbudristek, 2022) No. 5 of 2022, which governs the curriculum for early childhood education. These instruments aim to measure early childhood literacy skills, including the ability to express feelings, recognize letter symbols, repeat simple sentences, and recognize and understand various information. The indicators used in this instrument are as follows: 1) Expressing Feelings with Adjectives. Children are assessed based on their ability to express feelings using adjectives such as happy, sad, angry, afraid, etc. 2) Naming Known Letter Symbols. Children are asked to name letter symbols that they recognize. 3) Repeating Simple Sentences. Children are asked to repeat simple sentences provided by the observer. And 4) Recognizing and Understanding Various Information. Children are tested on their ability to recognize and understand various information presented orally.

To test the validity and reliability of the research instruments, two main approaches were used. The instrument's validity was tested through content validity and construct validity. Content validity was assessed by consulting experts on the appropriateness and completeness of the instrument items related to the research objectives, while construct validity was tested using factor analysis to ensure that the instrument measures aspects relevant to the concepts in the STEAM approach and local wisdom. Based on the results of the validity test, it can be concluded that all instruments used to measure literacy skills are valid, as evidenced by all calculated r values being greater than the r table value of 0.514. Additionally, the reliability of the instrument was tested using the test-retest method to measure the consistency of the instrument's measurements. The reliability coefficient was calculated using the Cronbach's alpha formula, with an accepted reliability coefficient $\geqslant 0.70$, indicating that the instrument has good internal consistency. The reliability test results for the literacy skills measurement instrument showed that the Cronbach's alpha value was greater than the r table value, i.e., $0.724 > 0.70$, indicating that the instrument is reliable. With the appropriate testing methods and validity and reliability coefficients that meet the standards, it is expected that the instruments used in this study will generate valid and reliable data to support the successful implementation of the Local Genius-based STEAM learning model in improving early childhood literacy skills.

Data collection was carried out using the observation method for both the experimental and control groups, which were given different treatments. The experimental group received the Local Genius-based STEAM learning model, while the control group used the conventional learning model. Observations were conducted within the same period to minimize external factors that might influence the results.

To test the research hypothesis, a one-way analysis of variance (ANOVA) technique was used. Before hypothesis testing, the literacy data collected were analyzed descriptively and tested with prerequisite tests (normality test and homogeneity test) to ensure the data met the necessary assumptions for performing ANOVA. This technique is suitable for analyzing data with one dependent variable and one independent variable, as it enables comparison across different groups or conditions (Sugiyono, 2022). The hypothesis testing criterion involves comparing the significance value (p-value) with the predetermined significance level of 0.05. If the p-value < 0.05,

the alternative hypothesis is accepted, indicating a significant effect of the Local Genius-based STEAM learning model on children's literacy skills.

Results and Discussion

Results

The research implementation of the control class (B1) used a conventional learning model, while the experimental class (B2) employed a Local Genius-based STEAM learning model. The application of STEAM learning based on Local Genius is carried out using Balinese folklore (*satua*) and Balinese folk songs (*Gending*). Satua entitled *I Belog* and *Pedanda Baka* (*kedis Cangak lan I Yuyu*), along with the gending *Dadong Dauh*, are integrated into the curriculum to support the implementation of the STEAM learning model. These cultural elements were carefully selected as they reflect the local wisdom, traditions, and values of Bali, providing a contextually relevant and meaningful learning experience for the children.

The integration of Balinese folklore and folk songs is grounded in the recognition that learning is most effective when it is rooted in the cultural and social contexts familiar to the learners. According to Vygotsky's sociocultural theory, learning is enhanced when it is situated in the social and cultural environment of the learners, allowing them to make connections between new knowledge and their lived experiences. By incorporating these traditional stories and songs, the STEAM model not only fosters cognitive and creative skills but also promotes the development of cultural identity and appreciation among the young learners.

Furthermore, this approach provides a holistic learning experience, as it combines multiple domains of knowledge, such as science, technology, engineering, arts, and mathematics (STEAM), with the rich cultural heritage of Bali. This fusion encourages the development of critical thinking and problem-solving abilities while simultaneously cultivating an understanding of local traditions, values, and narratives that are integral to the learners' community.

The learning process in the research classes can be seen in image 2 below, which illustrates the specific steps and activities carried out in both the control and experimental classes during the study. By comparing the two learning models, the study aims to measure the effectiveness of the Local Genius-based STEAM model in enhancing literacy and cognitive development while reinforcing cultural values. This research underscores the importance of culturally responsive teaching strategies in early childhood education, as they can contribute to more engaging and meaningful learning experiences that respect and celebrate local traditions.

a. Control class (B1)

b. Experimental class (B2)

Image 2. Research implementation

The learning process shown in Figure 2a uses a conventional learning model, where the teacher plays a central role and primarily implements the lecture method along with assigning tasks to students. This traditional approach limits the children's opportunities to actively explore their potential and develop their abilities, as the focus is mostly on passive learning, with minimal engagement from the students themselves. Consequently, children are less likely to develop critical thinking, creativity, and problem-solving skills that are essential for their future learning and growth.

In contrast, the learning process in the experimental group, shown in Figure 2b, employs the Local Genius-based STEAM learning model. This model shifts the focus of the learning process to the students, making them the center of attention. In this approach, the teacher's role is more of a facilitator, guiding and supporting the children's exploration and discovery. Children are encouraged to actively participate in their learning, express their ideas, and explore knowledge through hands-on activities. This model provides equal opportunities for all students to engage with various learning media, helping them to enhance their cognitive, social, and creative skills in a more dynamic and interactive learning environment. By fostering an environment where students are the active participants, the Local Genius-based STEAM model allows children to develop not only academic knowledge but also critical life skills.

During the learning process in both treatment classes, observations were made to assess the children's literacy skills. These observations were conducted systematically to ensure accurate and consistent data collection. The literacy skills of the children in both the control and experimental groups were carefully monitored and recorded throughout the study. Based on the results of the data tabulation, the descriptive statistics were calculated to provide a clear overview of the literacy skill levels in both groups. The findings of these calculations, which summarize the central tendencies and variability of the literacy skills data, are presented in Table 1. This table offers a detailed snapshot of the performance of each group, which forms the basis for further statistical analysis and comparison.

Table 1 shows that the average literacy skill in the control class was 39.47, while in the experimental class it was 55.4. This indicates a noticeable difference in literacy skills between the two groups, suggesting that the Local Genius-based STEAM learning model may have a positive impact on children's literacy development. The standard deviation in the control class was 17.54, while in the experimental class it was 19.26, reflecting a higher level of variability in the experimental class. This could indicate that while the experimental group showed greater improvement on average, the results varied more widely among the children in that group.

Table 1. Descriptive Test Data of Early Childhood Literacy Skills

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Control class	15	39.4667	17.54124	4.52913	29.7526	49.1807	18.00	75.00
Exsperimental class	15	55.4000	19.25691	4.97211	44.7359	66.0641	26.00	80.00
Total	30	47.4333	19.82976	3.62040	40.0288	54.8379	18.00	80.00

The next step in this research is to pass the prerequisite test (normality test and homogeneity of variance test), which ensures that the data meets the assumptions required for reliable hypothesis testing. After these tests, the hypothesis testing will proceed using the one-way ANOVA formula. The normality test results, which assess whether the data distribution approximates a normal distribution, are presented in Table 2. Meanwhile, the homogeneity of variance test, which examines whether the variance between the groups is equal, is shown in Table 3. These tests are crucial in ensuring the validity of the subsequent statistical analysis and will provide further

evidence to support or refute the impact of the Local Genius-based STEAM learning model on literacy skills.

In Table 2, it can be said that the data is normally distributed for all treatment classes. This conclusion is based on the results of the Shapiro-Wilk test, where the Sig value for the control group is 0.250 and for the experimental group is 0.149. Since both values are greater than the critical threshold of 0.05, we can accept the null hypothesis that the data follows a normal distribution. This is an important prerequisite for proceeding with further statistical analysis.

Table 2. Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Literasi	Control Class	.156	15	.200*	.927	15	.250
	Exsperimental Class	.179	15	.200*	.913	15	.149

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 3. Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
.397	1	28	.534

In Table 3, the data shows homogeneous variance, as indicated by the significance value of 0.534 for the child literacy data, which is greater than 0.05. This result suggests that the variances between the control and experimental groups are equal, meaning that the assumption of homogeneity of variance is satisfied. Homogeneity of variance is essential for the validity of the one-way ANOVA test, as unequal variances could skew the results.

The next testing stage will involve examining the effect of the Local Genius-based STEAM learning model on early childhood literacy. The one-way ANOVA test results, which will determine if there is a statistically significant difference between the groups, are presented in Table 4. This analysis will help assess whether the observed differences in literacy skills between the control and experimental groups can be attributed to the teaching model used, providing further insights into the effectiveness of the Local Genius-based STEAM approach.

Table 4 below, shows the F value of 5.612 with a significance of 0.025. Since the significance value (sig) is less than 0.05, it indicates that the result is statistically significant. In other words, the observed differences in literacy outcomes between the experimental group and the control group are unlikely to have occurred by chance. The ANOVA results with sig <0.05 lead to the acceptance of the alternative hypothesis, which suggests that the Local Genius-based STEAM learning model has a significant effect on early childhood literacy learning outcomes. This finding supports the hypothesis that integrating the Local Genius-based STEAM approach into early childhood education can enhance literacy skills, providing a strong argument for the effectiveness of this innovative teaching model. Thus, the results imply that the use of this model can lead to improvements in children's literacy development compared to traditional learning methods.

Table 4. ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1904.033	1	1904.033	5.612	.025
Within Groups	9499.333	28	339.262		
Total	11403.367	29			

Discussion

The implementation of a STEAM-based learning model integrated with local wisdom to enhance early childhood literacy skills requires an approach that combines elements of Science, Technology, Engineering, Arts, and Mathematics within the context of local wisdom. Research indicates that STEAM-based learning can improve children's critical thinking skills by providing relevant contexts and facilitating active learning methods (Gencer & Doğan, 2020). Gencer and Doğan emphasize the importance of an infusion approach in learning, which aligns with the need to integrate local wisdom into the education curriculum to enhance the relevance and effectiveness of the learning process for children (Gencer & Doğan, 2020).

Local wisdom, as outlined by Alifiyah (2023), can serve as a framework for designing learning experiences that are relevant for children, especially in this digital age. By linking STEAM content with local culture and environment, children can more easily grasp the concepts being taught and improve their literacy skills. This is further supported by research that finds using appropriate media, such as storybooks or educational games, to be effective in enhancing early childhood literacy (Umiarso et al., 2022; Rahman & Nurani, 2024). For example, interventions through literacy dice games can develop children's literacy skills in a fun and engaging way (Hewi, 2020).

Furthermore, the development of literacy involving technological elements, such as augmented reality (AR), has been proven to enhance children's understanding and engagement in the learning process (Sari, 2022; Suzanti et al., 2023). This indicates that the use of cutting-edge technology in learning can be integrated with teaching based on local wisdom, creating a holistic and engaging learning experience for early childhood. Sari et al., (2022) highlight that learning models that incorporate technologies such as AR can build children's executive functions and improve their understanding of concepts related to financial literacy, which is also critical in early childhood education (Sari et al., 2022).

Learning in the experimental class (B2) showed higher literacy skills than the control class (B1). The application of STEAM to students is able to provide possibilities and opportunities for students to expand knowledge, and a positive attitude, confident in their ability as learners with the aim of developing their potential, welcoming competition in the 21st century (Indrayana et al., 2022). STEAM provides opportunities for children to get to know themselves and the environment, explore and construct abilities, and apply their understanding to real contexts. After listening to *satua* and *gending* that contain Local genius content, children can explore their world, through the media that has been provided. So that all foundation abilities can be well stimulated. Including literacy skills, which are developed through design activities, brainstorming and working together in completing tasks. These results are also supported by the findings of Atiaturrahmaniah et al. (2022) who studied the critical thinking and literacy skills of elementary school students using the STEAM learning model.

Learning outcomes are also strengthened by the use of Balinese *satua* and *gending* (Local genius) which are full of character values and the development of children's new vocabulary, and by using the stages of the STEAM learning process, resulting in a new and fun learning experience for early childhood. The fun learning process optimises all aspects of child development, especially literacy skills. This is supported by Mustika (2019) who states that the reading text of Satua Bali plays a role in fostering a Literacy Culture and character building in elementary school students. In addition, local wisdom can have a good impact when students apply their knowledge and practice in solving problems or difficulties faced in a good and correct way (Naryatmojo, 2019).

The integration of STEAM education with local genius concepts presents a unique opportunity to enhance literacy skills among early childhood learners. Local genius, which refers to the wisdom

and cultural practices inherent in a community, can be effectively utilized to create a culturally responsive learning environment that promotes literacy development. This approach aligns with the findings of Hidayati et al., who emphasize the importance of integrating local wisdom into educational practices to improve learning outcomes and attitudes among students (Hidayati et al., 2020). By embedding local cultural elements into the STEAM framework, educators can foster a more engaging and relevant learning experience for children.

Research indicates that utilizing local wisdom in early childhood education not only enhances literacy skills but also strengthens children's understanding of their cultural identity. For instance, Musi et al. highlight the significance of incorporating local wisdom values in multicultural learning, which can enrich children's literacy experiences and promote a sense of belonging (Musi et al., 2022). Similarly, Amalia et al. found that a literacy culture based on local wisdom effectively enhances children's knowledge of their local culture, particularly in rural settings (Amalia et al., 2022). This cultural grounding is crucial for developing literacy skills, as it provides children with relatable contexts for learning.

Moreover, the application of innovative teaching methods, such as augmented reality (AR), can further enhance literacy development in early childhood settings. Sari et al. demonstrated that AR technology significantly improves children's financial literacy, suggesting that interactive and engaging tools can positively influence cognitive and behavioral outcomes in young learners (Sari et al., 2022). This aligns with the findings of Umiarso et al., who noted that effective literacy management practices can lead to improved cognitive intelligence in children (Umiarso et al., 2021). By integrating AR and other interactive technologies into a STEAM-based curriculum that respects local genius, educators can create a dynamic learning environment that supports literacy development.

In addition to technological integration, the role of play in literacy development cannot be overlooked. Flint's research on responsive play indicates that play can serve as a transformative learning tool, facilitating literacy acquisition through engaging and interactive experiences (Flint, 2018). This is particularly relevant for early childhood education, where play is a natural mode of learning. By incorporating local cultural narratives and practices into play-based learning, educators can enhance children's literacy skills while fostering a deeper connection to their cultural heritage.

In conclusion, the implementation of a STEAM-based learning model that incorporates local genius can significantly enhance literacy skills among early childhood learners. By leveraging local wisdom, innovative technologies, and play-based learning, educators can create a rich and engaging educational experience that not only promotes literacy but also nurtures children's cultural identity and cognitive development. Finally, by implementing the STEAM approach and local wisdom in the education curriculum, we not only meet the academic needs of children but also facilitate the development of good character through contextual learning (Alifiyah, 2023; Suzanti et al., 2023). This aligns with the need to empower children with the skills required in this global era, while also nurturing the cultural values that form their identity.

The limitations and recommendations that can be conveyed at the end of this study are as follows: Although this research demonstrates the effectiveness of the STEAM-based learning model integrated with local wisdom in enhancing early childhood literacy skills, several limitations need to be considered. First, the sample size, consisting of 30 children from one educational institution, may limit the generalization of the findings. Future research could take a larger and more diverse sample from different locations to ensure the robustness of the results. Additionally, this study focused more on the impact of local wisdom and the STEAM model on literacy skills. Future

research could explore other areas of development, such as social-emotional development or critical thinking skills, to assess the broader impact of this approach.

Conclusion

The conclusion that can be drawn from this research, related to the results of data analysis and supported by theoretical studies, is that the Local Genius-based STEAM learning model has an impact on literacy skills among early childhood. The data analysis showed significant differences in literacy outcomes between the experimental group, which received the Local Genius-based STEAM model, and the control group, which followed conventional learning methods. These results are consistent with theoretical perspectives suggesting that integrating hands-on, interactive learning approaches, such as those found in the STEAM model-enhances children's cognitive and literacy development. Additionally, the incorporation of local wisdom within the model fosters a deeper connection to cultural values, which further supports children's overall learning and development. Therefore, this research reinforces the effectiveness of the Local Genius-based STEAM model in improving literacy skills, emphasizing its potential as a valuable tool in early childhood education.

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