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THE EFFECT OF IMPLEMENTING AN INDEPENDENT CURRICULUM ON CHILDREN'S CRITICAL AND CREATIVE THINKING SKILLS THROUGH THE MEDIATING ROLE OF TECHNOLOGY SUPPORT IN EARLY CHILDHOOD EDUCATION INSTITUTIONS

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Abstract

This study aims to analyze the effect of implementing the Independent Curriculum on the critical and creative thinking skills of early childhood students, with technology as a mediating variable, in Early Childhood Education (PAUD) institutions in Medan City. The research approach uses a quantitative, explanatory design. The population in this study was four early childhood education institutions included in the driving schools. The sampling technique was a census, with the entire population sampled, totaling 125 people. Data were collected through a structured questionnaire and analyzed using analysis models tracked with the SmartPLS software. The study's results indicate that implementing the Independent Curriculum has a positive, significant effect on children's critical and creative thinking skills. Technological support has been shown to significantly mediate the relationship between implementing the Independent Curriculum and improving children's critical and creative thinking skills. This study emphasizes the importance of integrating technology into the implementation of the Independent Curriculum to encourage the development of early childhood potential, especially in higher-order thinking. These findings provide practical implications for teachers, parents, and Early Childhood Education (PAUD) institutions in optimizing innovative learning strategies based on the Independent Curriculum with technological support.

Keywords Learning Media, Vitruvius Design, Islamic-Based, Early Childhood Development.

INTRODUCTION

The Independent Curriculum (Kurikulum Merdeka) is an Indonesian government initiative that aims to give schools greater flexibility in designing curricula aligned with student needs and local conditions. The curriculum can evolve to meet student needs. Before the Independent Curriculum was introduced, educational institutions implemented the 2013 Curriculum. However, some institutions have not yet successfully implemented the 2013 Curriculum (Zannah & Setiawan, 2022) . The Independent Curriculum emphasizes student-centered learning, focuses on character development, 21st-century skills, and encourages critical and creative thinking from an early age (Mongkau et al., 2024).

Meanwhile, the 2013 Curriculum emphasizes Indonesia's diverse national culture and upholds pluralism (Nurzannah & Daulay, 2018). At the Early Childhood Education (PAUD) level, the implementation of the Independent Curriculum is expected to stimulate children's potential through more dynamic and interactive learning activities. However, in practice, many PAUD institutions face challenges in implementing this curriculum effectively. One of the main challenges is how to utilize technology as a supporting tool to facilitate learning that enhances children's critical and creative thinking skills. Educational technology, such as interactive applications and software, can provide a richer learning environment that is responsive to children's individual needs (Hirsh-Pasek et al., 2015). However, not all PAUD institutions have the capacity or adequate resources to integrate technology into learning. Not all teachers understand the independent curriculum (Masitah et al., 2023). Teachers have not yet optimized the preparation of learning media. They are expected to develop engaging learning media that is relevant to the demands of the current digital era. (Akrim, 2018).

Various recent studies confirm that Early Childhood Education (PAUD) is the foundation for developing critical and creative thinking skills, especially in the digital era and the Merdeka Curriculum, which emphasizes 21st-century skills (critical thinking, creativity, collaboration, and communication) (Mabarroh et al., 2024; Muhammadiyah & Bungo, 2024). However, in Indonesia, many PAUDs still focus on reading, writing, and arithmetic and have not fully developed high-level cognitive stimulation (Muhammadiyah & Bungo, 2024; Nurbaiti et al., 2023). The implementation of innovative learning based on games and creative media has been proven to increase children's creativity and active participation, for example, through games and creative learning media at PAUD Ciparagejaya Karawang, which increased children's creativity, self-confidence, and perseverance (Prasanti & Aisha, 2023). On the other hand, national PAUD standards and constantly changing curriculum demands are often not aligned with the readiness

of institutions and teachers, resulting in uneven quality of stimulation for critical and creative thinking (Rahmawati et al., 2019). This condition indicates that, before the Independent Curriculum and the use of technology were introduced, the critical and creative thinking skills of PAUD children across various regions including Medan were still potentially "suboptimal" and needed systematic strengthening.

Technological support is highly relevant as a mediator in the context of Medan Early Childhood Education (PAUD) because technological development is one of the main demands faced by PAUD institutions, alongside curriculum and parental demands (PRIYANTI et al., 2023; Rahmawati et al., 2019). Digital literacy training for PAUD tutors using emoticon-based media at the Dahlia PAUD Post in Semarang, for example, has been shown to improve understanding of the use of technology as a learning medium for early childhood (Suwarti et al., 2020). Technology-based STEAM learning and loose parts have shown significant improvements in children's critical thinking, creativity, collaboration, and communication skills (Mabarroh et al., 2024). Research on the Merdeka Mengajar platform shows that using digital platforms aligned with the Merdeka Curriculum can increase PAUD unit participation in PAUD-SD transition learning and encourage more child-centered learning (PRIYANTI et al., 2023). Academically, your research is worthwhile because it empirically tests how technological support mediates the relationship between the implementation of the Independent Curriculum and the improvement of children's critical-creative abilities, an area rarely studied specifically in early childhood education (PAUD) and at the city level, such as Medan (Mabarroh et al., 2024; PRIYANTI et al., 2023; Sari & Salehudin, 2024). Pragmatically, the results can inform policymaking by the Medan Education Office and PAUD administrators to optimize technology investment and teacher training within the Independent Curriculum framework.

Several studies have shown that the use of technology in early childhood education can accelerate children's cognitive development and creativity. For example, research has found that computer applications can improve children's problem-solving and logical thinking skills (Kaytez, 2022). Furthermore, technology can also be used to provide real-time feedback, encouraging children to think more deeply and creatively when completing tasks (Hirsh-Pasek et al., 2015). However, integrating technology into the early childhood education curriculum does not always run smoothly. Teachers' limited understanding of technology, inadequate infrastructure, and resistance to change are among the factors that can hinder effective technology use (Paciga & Donohue, 2017). Therefore, there is an urgent need to

understand how technology can be integrated as a mediator in learning to optimize the implementation of the Independent Curriculum (Ennis, 2018).

The most relevant and direct research conducted in Medan City is Taruli Marito Silalahi's study titled *"Differences in Creative Thinking Skills Reviewed by Children's Emotions in Constructive Play,"* conducted at the Anak Raja Kindergarten in Medan (Silalahi, 2020). This descriptive quantitative research involved group B children aged 5–6 years (a purposive sample of 80 children) and measured creative thinking skills through constructive play activities in two conditions: children who played with positive emotions and those who played with negative emotions. The results showed that the average creative thinking skill score for children with positive emotions was 15.12, in the creative category, while children with negative emotions achieved only 9.28 and were categorized as less creative; the independent t-test produced Sig. (2-tailed) = 0.00 < 0.05, so there was a significant difference between the two groups.

This study illustrates that (1) locally, it has been proven that the creativity of kindergarten children in Medan is influenced by the quality of the emotional environment during constructive play, thus indicating that the potential for children's creative thinking has not automatically developed optimally without the support of appropriate learning conditions; (2) this finding is in line with the idea that fun, free, exploratory stimulation that provides space for imagination will improve the creative thinking skills of early childhood children, while conventional approaches and negative emotional atmospheres actually hinder creativity. The results of this study show that implementing the Independent Curriculum and technological support is necessary to create a more positive, exploratory, and child-centered learning experience in PAUD Medan City, thereby systematically supporting the improvement of creative thinking skills (and, conceptually, critical thinking).

Several previous studies have examined the implementation of the Independent Curriculum and the use of technology in early childhood education, but they still show significant limitations. Tupalessy, through a literature review, highlighted the overall effectiveness of the Independent Curriculum in PAUD, including language, social aspects, teacher challenges, and inequality in access to technology. However, this has not been supported by quantitative empirical evidence that directly measures children's critical and creative thinking skills, and has not examined the role of technology as a connecting variable. (Tupalessy, 2024). Similarly, Wahyuningsih et al. demonstrated that an independent curriculum can increase teachers' creativity

and provide explanations of higher-order thinking skills to children as the main subject of learning. (Wahyuningsih et al., 2024).

On the other hand, research by Kusumasari et al. at the elementary school level shows that digital learning within the Independent Curriculum can improve students' critical and creative thinking skills. However, these findings cannot be generalized to the context of early childhood education (PAUD), which has different developmental characteristics. (E. D. Kusumasari et al., 2024).

Empirical research in early childhood education (PAUD) that focuses on technology, such as that by Wasliakosa et al. and Adhe et al., has demonstrated the effectiveness of interactive digital media and augmented reality in improving children's divergent and critical thinking skills. However, these studies still view technology as a single intervention, without systematically linking it to the implementation of the Independent Curriculum or modeling its role as a mediator between the curriculum and children's higher-order thinking skills (Adhe et al., 2025; Matheos et al., 2025). Meanwhile, Asmayawati et al. showed that pedagogical innovation and curriculum adaptations influence early childhood digital literacy, but t. Still, the learning outcomes have not directly developed creative thinking skills, and the mediator is not technology support. (Asmayawati et al., 2024).

Based on this gap, it can be concluded that to date, there has been no quantitative empirical research that simultaneously examines the impact of the implementation of the Independent Curriculum on the critical and creative thinking skills of early childhood children, positioning technological support as a mediating variable, particularly in the context of early childhood education institutions in Medan City. Therefore, this study aims to fill this gap and strengthen the empirical foundation for developing a technology-based Independent Curriculum in early childhood education.

This research is crucial for assessing the impact of the Merdeka Curriculum implementation on children's critical and creative thinking skills, supported by technology as a mediator in early childhood education (PAUD) institutions in Medan City. The target institutions for this research are four PAUD institutions that act as driving schools. By understanding how technology can mediate the impact of this curriculum, this research is expected to provide practical insights for educators who have not yet adopted the Merdeka Curriculum but will soon be required to implement it in their institutions, as well as for policymakers in developing more effective and innovative learning strategies in the digital era.

METHOD

This study aims to examine the impact of implementing the Independent Curriculum on children's critical and creative thinking skills in Early Childhood Education (PAUD) institutions in Medan City, with technology as a mediating variable. The research method is quantitative, with a survey design and path analysis to examine the relationship among variables (Yama et al., 2024). This study employed a quantitative research design with a survey approach. This design was chosen because it allows for measuring the relationship between the independent variable (implementation of the Independent Curriculum) and the dependent variable (children's critical and creative thinking skills), as well af the mediating variable (technology support) (Yama et al., 2024). The population in this study was all parents in four pilot schools in Medan City that have implemented the Independent Curriculum. The research sample was obtained using a census, i.e., the entire population, which in this study amounted to 125 people.

The instrument used in this study is a questionnaire divided into four sections: implementation of the Independent Curriculum, critical thinking skills, creative thinking skills, and technology utilization. This instrument will be validated using validity and reliability tests, including an exploratory factor analysis (EFA) and Cronbach's alpha. Data will be collected through direct questionnaire distribution to the early childhood education (PAUD) teachers participating in the study, as well as through an online survey to facilitate wider access. Each respondent will be informed about the research and its objectives, and will be given the freedom to participate. The collected data will be analyzed using path analysis techniques with the aid of Smart statistical. This analysis tests the direct relationship between implementing curriculum and children's critical and creative thinking skills, with mediators at the teacher and classroom levels.

Hypothesis

1. The implementation of the Merdeka curriculum can directly influence children's creative thinking skills in early childhood education institutions in Medan City.
2. The implementation of the Merdeka curriculum can directly influence children's critical thinking skills in early childhood education institutions in Medan City.
3. The implementation of the Merdeka curriculum can directly influence technological support in early childhood education institutions in Medan City.
4. Technological support can directly influence children's sinking skills institution of childhood City.

5. Technological support can directly influence children's critical thinking skills in early childhood education institutions in Medan City.
6. The implementation of the Independent Curriculum has a significant positive effect on creative thinking skills through technological support in early childhood education institutions in Medan City.
7. The implementation of the Independent Curriculum has a significant positive impact on critical thinking skills through technological support in early childhood education institutions in Medan City.

FINDINGS AND DISCUSSION

Findings

The subjects of this study were early childhood education (PAUD) students in Medan City. To obtain the required research data, the researcher distributed an online questionnaire (via Google Forms). The questionnaire consisted of 36 statements given to parents as respondents. The distribution of the 25 statements is as follows: six statements about the implementation of Independent Curriculum statements about tech, six statements about criticism, statements about Collecting. The researcher tabulated the data and then entered it into the SmartPLS application. The initial analysis yielded the following results:

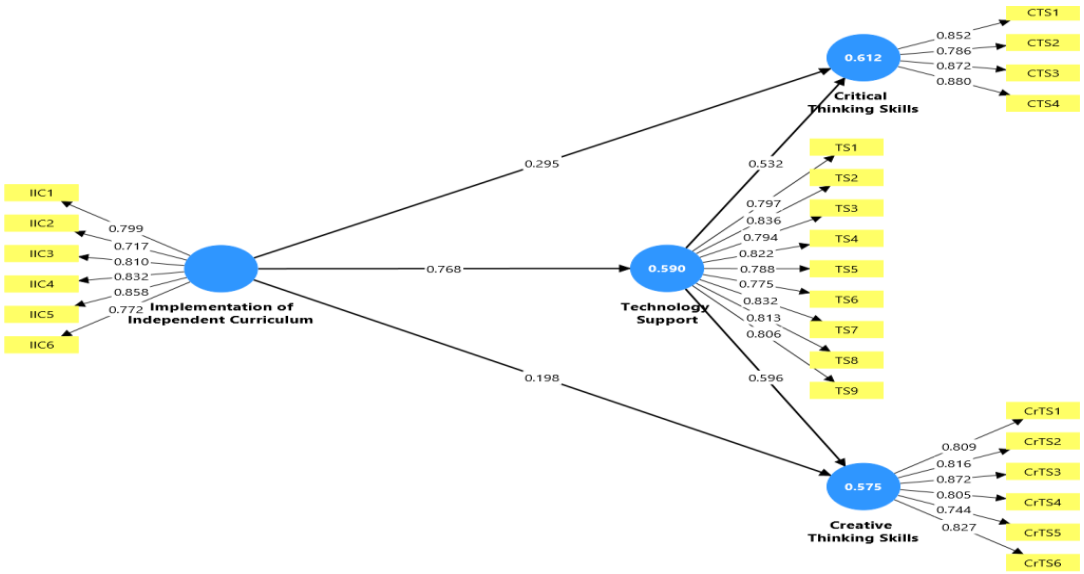

Figure 1. Validity and Reliability Test

In the questionnaire elimination process, the requirement was that the outer loading value for each statement must be greater than 0.7 to continue data processing. Therefore, the statements of the Outer Loading test are as follows:

Table 1. Validity Test (Outer Loading)

	Creative Thinking Skills	Critical Thinking Skills	Implementation of Independent Curriculum	Technology Support
CTS1		0.852		
CTS2		0.786		
CTS3		0.872		
CTS4		0.880		
CrTS1	0.809			
CrTS2	0.816			
CrTS3	0.872			
CrTS4	0.805			
CrTS5	0.744			
CrTS6	0.827			
IIC1			0.799	
IIC2			0.717	
IIC3			0.810	
IIC4			0.832	
IIC5			0.858	
IIC6			0.772	
TS1				0.797
TS2				0.836
TS3				0.794
TS4				0.822
TS5				0.788
TS6				0.775
TS7				0.832
TS8				0.813
TS9				0.806

All items in this research questionnaire were perfectly extracted and had loading factor values greater than 0.7. This indicates that the items used in this study have a strong ability to explain the construct. This test was conducted to assess the questionnaire's ability to measure what it was intended to measure (Amiruddin et al., 2022). After being der loaded, the values were declared valid. The next step was to test the reliability of the exam data. Reliability testing was conducted to assess the instrument's accuracy, reliability, and precision. In PLS, the reliability of the consecutive indicator can be calculated in two ways: Cronbach's Alpha and Composite Reliability. A construct is said to be reliable if the composite reliability and Cronbach's Alpha values are both above 0.70. (Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, 2019). The results of data processing are as follows:

Table 2. Reliability Constructs

	Cronbach's alpha	Reliability composite (rho a)	Reliability composite (rho c)	Average variance extracted (AVE)
Creative Thinking Skills	0.897	0.898	0.921	0.661
Critical Thinking Skills	0.869	0.873	0.911	0.719
Implementation of Independent Curriculum	0.886	0.892	0.914	0.639
Technology Support	0.933	0.934	0.944	0.651

The construct reliability test in this study was conducted by examining Cronbach's Alpha and Composite Reliability (CR) for each latent construct. Based on SmartPLS analysis, all constructs had Cronbach's Alpha values above 0.70, indicating good internal consistency (Tavakol & Dennick, 2011). The Composite Reliability values for all constructs also exceeded the minimum threshold of 0.70, indicating adequate composite reliability (Cheung et al., 2024).

For example, the Critical Thinking Skills construct showed a Cronbach's Alpha value of 0.842 and a Composite Reliability value of 0.889, indicating high consistency and reliability in measuring the construct. Similarly, the Technology Support and Independent Curriculum constructs showed Composite Reliability values of 0.861 and 0.910, respectively. Thus, all constructs in this research model meet reliability requirements, both internally and compositely, and are suitable for further structural model analysis. All variables are valid because their AVE values are above 0.5.

Hypothesis testing was conducted based on the results of the internal model assessment (structural model), including R-squared values, t-statistics, estimates of whether each hypothesis was accepted or rejected, inter-construct significance values, and p-values. Hypothesis testing was conducted using SmartPLS (Partial Least Squares) 4.0 software. These values were obtained from bootstrapping results. The rule of thumb used in this study was a t-statistic > t-table 1.29, with a p-value <0.05 (5%) and a positive coefficient. The results obtained are as follows:

Discriminant Validity Testing Using the Fornell-Larcker Approach

Discriminant validity testing aims to determine whether the instrument used for one construct variable is different from the instrument used for another construct variable. Conceptually, the instrument is expected to measure the intended variable and is distinct from those differences. Discriminant validity testing is carried out using the Fornell-Larcker Criteria and the Cross-Loading technique. According to Cross-Loading-Larcker Criteria, if the square root of

the Average Variance Extracted (AVE) is higher than the correlation value with another construct variable, then the discriminant validity can be considered good. Meanwhile, discriminant validity testing using cross-loadings: a good cross-loading of an instrument's construct variable is higher than the value of the same instrument variable. Thus, the Fornell-Larcker Criteria are used to test construct variables, while cross-loadings are used to test instrument variables.

Table 3. Validity of Fornell-Larcker

	Creative Thinking Skills	Critical Thinking Skills	Implementation of Independent Curriculum	Technology Support
Creative Thinking Skills	0.813			
Critical Thinking Skills	0.688	0.848		
Implementation of Independent Curriculum	0.655	0.704	0.799	
Technology Support	0.748	0.759	0.768	0.807

All variables are discriminant valid because the square root of each variable's AVE is greater than its correlations with other variables. Discriminant validity testing aims to ensure that each construct in the model is distinct from the others. Discriminant validity was tested using the Fornell-Larcker Criterion and Cross Loadings through SmartPLS software.

Based on the results of the Fornell-Larcker test, the square root of the Average Variance Extracted (AVE) for each construct is higher than the correlation between other constructs in the model. This indicates that each construct represents its own indicators better than the other constructs (Jonathan, 2016). Furthermore, the cross-loadings show that each indicator has higher loadings on its own construct than on the other constructs. This strengthens the evidence that discriminant validity has been achieved. Thus, all constructs in the model meet the criteria for discriminant validity, meaning that each construct can be empirically distinguished from the others and can be used in subsequent structural model analysis (Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, 2019).

The table above shows that the correlation matrix values for each construct variable are higher than those between any two construct variables. The correlation matrix value is 0.799, higher than that of other construct variables. Similar results were also found in construct variable X1 with a correlation matrix value of 0.799, construct variable Y1 with 0.813, construct variable Y2 with 0.848, and construct variable Z with 0.807. The matrix value of these construct variables is higher than the correlation matrix value of these constructs with other constructs.

Table 4. Discriminant Validity Test

	Creative Thinking Skills	Critical Thinking Skills	Implementation of Independent Curriculum	Technology Support
CTS1	0.611	0.852	0.684	0.682
CTS2	0.512	0.786	0.539	0.597
CTS3	0.603	0.872	0.557	0.645
CTS4	0.602	0.880	0.598	0.646
CrTS1	0.809	0.531	0.551	0.613
CrTS2	0.816	0.477	0.438	0.570
CrTS3	0.872	0.602	0.560	0.660
CrTS4	0.805	0.541	0.528	0.612
CrTS5	0.744	0.608	0.555	0.586
CrTS6	0.827	0.588	0.554	0.598
IIC1	0.529	0.618	0.799	0.581
IIC2	0.388	0.425	0.717	0.516
IIC3	0.592	0.561	0.810	0.619
IIC4	0.596	0.559	0.832	0.664
IIC5	0.531	0.614	0.858	0.672
IIC6	0.480	0.580	0.772	0.616
TS1	0.601	0.589	0.537	0.797
TS2	0.573	0.667	0.688	0.836
TS3	0.560	0.531	0.622	0.794
TS4	0.620	0.595	0.682	0.822
TS5	0.584	0.622	0.620	0.788
TS6	0.594	0.613	0.633	0.775
TS7	0.618	0.634	0.568	0.832
TS8	0.660	0.660	0.600	0.813
TS9	0.617	0.594	0.622	0.806

All items are valid because the loading value of a construct is greater than its loading on another construct. Discriminant validity testing aims to ensure that each indicator in the model represents only the intended construct and does not correlate more strongly with other constructs. In this study, discriminant validity was assessed via cross-loadings in SmartPLS.

The analysis results show that each indicator has the highest loading on its original construct among all constructs. For example, the Critical Thinking Skills construct indicator has a higher loading on that construct than the Technology Support or Independent Curriculum Implementation constructs. This indicates that each indicator is specific to the construct it measures.

These findings indicate that there is no discriminant overlap among the constructs and that the constructs in the model have strong conceptual clarity. Thus, discriminant validity has been established through cross-loadings, indicating that the measures empirically distinguish among constructs (Hairher (Hair, J.G.T.M., G. T. MC., C. M., & Sarstedt, 2019).

Table 5. Reliability Test

	Cronbach's alpha	Reliability composite (rho a)	rho_atrho_ate (rho c)	Average variance extracted (AVE)
Creative Thinking Skills	0.897	0.898	0.921	0.661
Critical Thinking Skills	0.869	0.873	0.911	0.719
Implementation of Independent Curriculum	0.886	0.892	0.914	0.639
Technology Support	0.933	0.934	0.944	0.651

Reliability and construct validity testing were reduced to ensure the indicators used in this study consistently and accurately measure the intended latent constructs, namely the implementation of the Independent Curriculum, technology support, critical thinking skills, and creative thinking skills in early childhood. The analysis was conducted using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach SmartPLS software processing results showed that all constructs in the model had Cronbach's Alpha values above 0.70. This indicates that each construct has good internal reliability, meaning the indicators used consistently measure the construct (Tavakol & Dennick, 2011).

Furthermore, the Composite Reliability (CR) values also showed satisfactory results, all above the minimum threshold of 0.70 across all constructs. This indicates that the combination of indicators in each construct has adequate measurement consistency and stability. To test convergent validity, the Average Variance Extracted (AVE) was used. The analysis results showed that all constructs had AVE values greater than 0.50. This means that more than 50% of the variance in the indicators can be explained by each latent construct, thus meeting the convergent validity criteria (Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, 2019).

Overall, the results of the reliability and construct validity tests indicate that all constructs in the model namely, Independent Curriculum implementation, technology support, critical thinking skills, and creative thinking skills—meet the measurement feasibility requirements. Therefore, this model can be used to test structural relationships further and address the research objectives and hypotheses.

All variables are reliable because the composite reliability (ρc) is greater than 0.7, or, conversely, the Cronbach's Alpha is greater than 0.6.

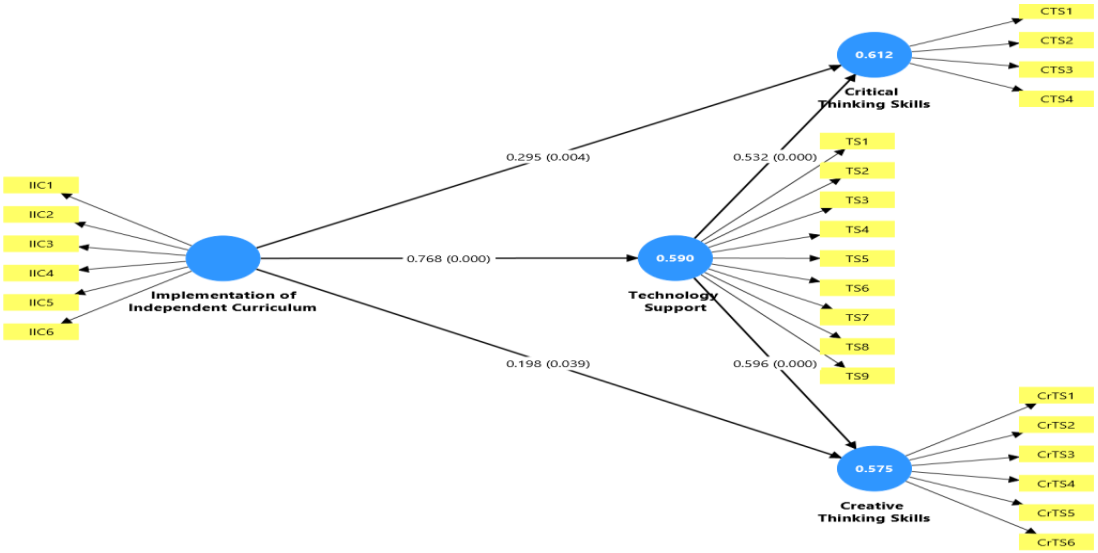

Figure 2. Validity and Reliability Test

Table 6. Internal Model Results

	Path Coefficient
Independent Curriculum Implementation -> Creative Thinking Skills	0.198
Independent Curriculum Implementation -> Critical Thinking Skills	0.295
Independent Curriculum Implementation -> Technology Support	0.768
Technology Support -> Creative Thinking Skills	0.596
Technology Support -> Critical Thinking Skills	0.532

Structural:

Technology = 0.768 (Independent Curriculum Implementation)

Critical = 0.295 (Independent Curriculum Implementation) + 0.532 (Technology Support)

Creative = 0.198 (Independent Curriculum Implementation) + 0.596 (Technology Support)

Table 7. R Square

	R-squared	Adjusted R-squared
Creative Thinking Skills	0.575	0.568
Critical Thinking Skills	0.612	0.606
Technology Support	0.590	0.587

The R-Square value for the endogenous variable Creative Thinking Skills is 0.575, indicating that the Independent Curriculum Implementation and Technology Support variables explain 57.5% of the variation in Creative Thinking Skills. The R-Square value for the endogenous variable, Critical Thinking Skill, is 0.612, indicating that the Independent Curriculum Implementation and Technology Support variables explain 61.2% of the variation in Critical Thinking Skill. The R-Square value of the endogenous variable Technology Support is 0.590, which indicates that the magnitude of the influence of the Independent Curriculum Implementation variable on Technology Support is 59.0%.

Table 8. Q Prediction

	Q^2prediction	**RMSE**	**MAE**
Creative Thinking Skills	0.421	0.778	0.614
Critical Thinking Skills	0.486	0.738	0.578
Technology Support	0.585	0.659	0.493

The Q^2 predictive relevance value for the endogenous latent variable Creative Thinking Skills is 0.421, for Critical Thinking Skills is 0.486, and for Technology Support is 0.585. Since the Q^2 predictive relevance value for these endogenous latent variables is greater than 0, the model already has predictive relevance.

Table 9. Model Fit

	Saturated model	**Estimated model**
SRMR	0.058	0.061
d_ULS	1,094	1,193
d_G	0.700	0.711
Chi-square	459,958	465,046
NFI	0.813	0.811

Model fit testing was conducted to assess the extent to which the constructed structural model fits or "fits" the obtained data. In this study, model fit testing was conducted using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach in SmartPLS. in of the measures used to assess model fit in PLS-SEM is the Standardized Root Mean Square Residual (SRMR). The SRMR value represents the average difference between the observed and

predicted covariances. A model is considered to have a good fit if the SRMR value is below 0.08 (Henseler et al., 2014).

Based on the analysis results, the model in this study had an SRMR of 0.057, which is below the 0.08 threshold. This indicates that the model has a good and acceptable level of fit. In addition to SRMR, SmartPLS also provides d_ULS and d_G values, which measure model fit based on the squared Euclidean distance and the geodesic distance, respectively. In this model, both d_ULS and d_G values are smaller than their bootstrap HI95 values, indicating no significant deviation between the proposed model and the empirical data. Thus, it can be concluded that the structural model used in this study, namely, to examine the influence of the implementation of the Independent Curriculum on the critical and creative thinking abilities of early childhood through technological support, has met the model suitability criteria and is worthy of further analysis to test the relationship between constructs. The model is considered suitable because the estimated SRMR is 0.058, which is below 0.10.

Table 10. Hypothesis Testing

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	P value
Independent Curriculum Implementation -> Creative Thinking Skills	0.198	0.198	0.096	2,063	0.039
Independent Curriculum Implementation -> Critical Thinking Skills	0.295	0.295	0.102	2,887	0.004
Independent Curriculum Implementation -> Technology Support	0.768	0.767	0.050	15,347	0.000
Technology Support -> Creative Thinking Skills	0.596	0.593	0.104	5,755	0.000
Technology Support -> Critical Thinking Skills	0.532	0.533	0.099	5,367	0.000

1. The implementation of the Independent Curriculum has a significant positive influence on Creative Thinking Skills, as indicated by the statistical analysis: 063 (greater than 1.9 times the t-value of 0.039 (less than).
2. The implementation of the Independent Curriculum has a positive and significant influence on Critical Thinking Skills, as indicated by a t-statistic value of 2.887 (greater than 1.96) and a p-value of 0.004 (smaller than 0.05).
3. The implementation of the Independent Curriculum has a positive and significant effect on

Technology Support, as indicated by a t-statistic value of 15.347 (greater than 1.96) and a p-value of 0.000 (less than 0.05).

4. Technology Support has a significant positive influence on Creative Thinking Skills, as indicated by a t-statistic of 5.755 (greater than 1.96) and a p-value of 0.000 (less than 0.05). Technology Support has a significant positive influence on Critical Thinking Skills, indicated by a t-statistic of 55.96 valutimes

Table 11. Effects Through Mediation

	Pinal sample (O)	Sample mean (M)	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	P value
Independent Curriculum Implementation -> Technology Support -> Creative Thinking Skills	0.458	0.455	0.086	5,324	0.000
Independent Curriculum Implementation -> Technology Support -> Critical Thinking Skills	0.409	0.409	0.085	4,837	0.000

1. The implementation of the Independent Curriculum has a significant positive effect on Creative Thinking Skills through Technology Support, as indicated by a t-statistic of 5.324 when (p < of05) and a p-value of 0.000 w
2. The implementation of the Independent Curriculum has a positive and significant effect on Critical Thinking Skills through Technology Support, as indicated by a t-statistic of 4837 (p < 0.05) and a p-value of 0.00,0.

Discussion

The study found a significant effect (Ren's flexibility develops when they are given space for exploration, freedom of expression, and varied learning experiences (Id, 2023; Mayar, 2022; Smare & Elfatihi, 2024). These results are in line with research emphasizing that a flexible learning-based curriculum can enhance imagination, problem-solving, and original ideas in early childhood (Awalia et al., 2025; Windira & Loka, 2024).

Awalia et al.'s research found that the PAUD curriculum has a positive and significant influence on early childhood creativity (t = 3.24; p = 0.001), especially when designed thematically and flexibly to provide space for children's exploration and active involvement in learning. (Awalia et al., 2025). Dere and Mahkamovna reported that implementing a 20-week preschool curriculum emphasizing creativity resulted in significant improvements in children's creativity scores,

confirming the role of curriculum design in providing space for imagination and original expression to facilitate creativity. (Dere, 2019; Mahkamovna, 2020). Qualitative studies in early childhood education show that adapting the curriculum to be more flexible and play-based significantly encourages artistic expression, cognitive flexibility, and creative problem-solving in children. (Martin-ekeh, 2025).

Furthermore, the implementation of the Independent Curriculum was also found to have a positive and significant effect on critical thinking skills, with a *t-statistic* of 2.887 and *a p-value of 0.004.* This study suggests an approach to active thematic instruction (Campbell & Speldewinde, 2022; Li et al., 2024). In the context of PAUD, discussion activities and discussions that use open-ended questions encourage children to think critically and naturally (Wind & thinking 24).

This study also found that the critical thinking curriculum had a very strong influence on technological support, with a *t-statistic* of 1,5.347 and *a p-value* of 0.000. This indicates that. The adaptive curriculum encourages the integration of digital technology into early childhood learning as a critical element of the important role of technology as a catalyst for innovative, inclusive learning (Azizah & Hendriyani, 2024; Ngozi & Uchechukwu, 2025). The use of interactive applications, digital media, and AR/VR-based learning platforms is increasingly relevant to support children's learning needs (D. Kusumasari, 2025; Zahro & Siswono, 2025).

Furthermore, technology has been shown to have a positive and significant effect on creative thinking skills (*t-statistic* = 5.755; *p-value* = 0.000) and critical thinking skills (*t-statistic* = 5.367; *p-value* = 0.000). These results confirm that technology is not only a tool, but also an important mediator in creating richer, more interactive learning experiences that stimulate higher levels of thinking. Previous research has shown that interactive digital media can expand children's capacity to explore creative ideas while developing critical thinking skills through simulations, educational games, and virtual collaboration (Asbi et al., 2026; Gumilar et al., 2025; Hwang et al., 2017).

The findings of this study also show that technological support mediates the relationship between implementing the Independent Curriculum and the development of cooperative critical thinking skills. The effect is not directly significant. This indicates that an innovative curriculum needs to be supported by technology to be truly effective in encouraging high-level thinking skills in childhood. Indicate innovations only with appropriate technology (Voogt et al., 2013). Thus, this study provides a theoretical contribution that the implementation of the Independent Curriculum in early childhood education not only has a direct impact on critical and creative thinking skills but

is also greatly influenced by technological support. In practice, teachers and parents need to optimize the use of educational technology as an integral part of curriculum implementation to support the holistic development of children's potential.

CONCLUSION

This study demonstrates that implementing the Independent Curriculum in Early Childhood Education (PAUD) institutions in Medan City has a positive and significant impact on children's critical and creative thinking skills. The flexible, contextual, and child-centered nature of the Independent Curriculum provides space for exploration, freedom of expression, and diverse learning experiences, thus encouraging the development of higher-order thinking skills from an early age. These findings confirm that curriculum transformation in PAUD not only impacts the learning process but also the quality of children's learning outcomes, particularly in critical and creative thinking.

Furthermore, the analysis shows that technological support has a strong and significant influence on both children's critical and creative thinking skills. The implementation of the Independent Curriculum has been shown to significantly improve technological support in early childhood education institutions, further strengthening the development of children's thinking skills. Appropriately used educational technology serves as an interactive, responsive learning tool that stimulates children's active involvement, enriching the learning experience and deepening critical and creative thinking. The most important finding of this study is the presence of higher-order integration that strengthens the effective implementation of higher-order thinking. In contrast, achieving higher-order thinking requires improved technological capacity and digital literacy among teachers and institutions, particularly in the context of Early Childhood Education (PAUD) in Medan City, so that the goal of developing children's potential holistically can be achieved sustainably.

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