

The Effect of Using the Educational Game Tool Counting Box on the Numbers Ability of Early Children in One-Roof Kindergarten Sdn 003 Sihepeng, Siabu District

Angriani Hasibuan *, Patimah, Ainun Munairoh, Tinaisah, Kridayana Hutagalung

Sekolah Tinggi Agama Islam Negeri Mandailing Natal

Jalan Prof. Dr. Andi Hakim Nasution, Komplek STAIN Madina, Pidoli Lombang, Kecamatan Panyabungan, Kabupaten Mandailing Natal, Sumatera Utara, Indonesia

Article Info

Article history:

Received December 24, 2025

Revised January 12, 2026

Accepted February 4, 2026

Keywords:

APE Counting Box, Counting Ability, Early Childhood, PAUD

ABSTRACT

The problem of early childhood numeracy is increasingly prominent at the national level, with data showing that approximately 60-70% of kindergarten children have not yet achieved competency standards. This study aims to examine the effect of using the Counting Box Educational Game Tool (APE) on the numeracy skills of early childhood children at the One-Roof Kindergarten of SDN 003 Sihepeng, Siabu District, South Tapanuli Regency. A quantitative quasi-experimental one-group pretest-posttest design approach was applied to a population and sample of 30 children in group B (aged 5-6 years, 16 boys and 14 girls), with partial t-test and linear regression analysis using SPSS 26. The numeracy test instrument was proven valid (r count 0.724-0.970 > r table 0.3061) and reliable (Cronbach's Alpha $X = 0.966$; $Y = 0.973$), with the assumptions of normality and homoscedasticity met. The analysis results showed a positive and significant effect (Sig. 0.000 < 0.05; t-test 67.381 > t-table), with a regression equation of $Y = 0.759 + 1.037X$, indicating that each one-unit increase in APE use increased numeracy skills by 1.037 units. The study concluded that the Counting Box APE is effective as a play-based learning medium for building the foundation of numeracy in early childhood.

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Corresponding Author:

Angriani Hasibuan

Sekolah Tinggi Agama Islam Negeri Mandailing Natal

Email: angriani2005hasibuan@gmail.com

INTRODUCTION

Early childhood education (PAUD) is a crucial foundation for shaping a child's holistic development, including cognitive aspects such as numeracy skills, which form the basis for lifelong mathematics (Sari, 2024). Globally, research shows that introducing numeracy concepts from an early age improves logic and problem-solving skills by 25-30%, as children's brains at this stage are highly resilient to sensory stimulation and play (NAEYC, 2019). In Indonesia, the Early Childhood Education (PAUD) Independent Curriculum emphasizes play-based learning to address the low national numeracy literacy rate. PISA surveys and the National Assessment (Assessment) indicate that only 40-50% of elementary school students master basic operations due to a weak PAUD foundation (Kemdikbud, 2024).

The issue of early childhood numeracy skills is increasingly prominent nationally, with data indicating that approximately 60-70% of kindergarten children have not achieved the minimum competency standards in number recognition, sequencing, and simple operations such as addition and subtraction (BBC Indonesia,

2024). The main contributing factors include conventional, rote-oriented teaching methods, a lack of interactive media, and the influence of a family environment where parents rarely engage in daily counting activities such as arranging toys or dividing food (Thomafy, 2024). This phenomenon impacts the transition to elementary school, where teachers often complain that kindergarten students are not yet ready for numeracy, thus hindering the achievement of the national education target of developing a generation of mathematics competencies (Dewi, 2024).

At the provincial level of North Sumatra, particularly in rural areas such as South Tapanuli Regency, the challenges of early childhood education (ECE) are increasingly complex due to limited infrastructure, teacher training, and access to affordable learning aids (Lestari, 2021). Local reports highlight that children in remote areas lag 15-20% behind in numeracy compared to urban areas, driven by the dominance of passive gadgets and a lack of stimulation from busy working parents (Barokah, 2024). This condition reflects an inter-regional educational gap that must be addressed through simple and contextual innovations.

Specifically, in Siabu District, the One-Roof Kindergarten of SDN 003 Sihepeng experienced similar problems based on preliminary observations of 30 children aged 5-6 years. Only 65% were able to order numbers 1-10 and 55% performed basic operations due to monotonous methods without play elements (internal school data, 2025). Children tended to be bored and reluctant to learn, with an average pre-test score of only 62% in numeracy, influenced by local factors such as farming households with minimal support time and kindergarten facilities limited to conventional whiteboards (Oktriyani, 2024).

The use of the Counting Box Educational Game Tool (APE) is an appropriate solution in this context, as the simple tool, an interactive box with number cards, blocks, and a counting board, allows children to learn while playing independently and collaboratively. Previous research demonstrated a significant improvement of up to 85% post-intervention through a pretest-posttest design, as the APE stimulates multiple senses and reduces math anxiety (Jurnal Caksana, 2025). Therefore, this study examines the effect of the Counting Box APE at the One-Roof Kindergarten of SDN 003 Sihepeng to build a strong numeracy foundation according to the Independent Curriculum, with the hope that the results can be replicated in other rural kindergartens (Jurnal Paedagogy, 2024).

METHOD

This research method used a quantitative approach with a quasi-experimental one-group pretest-posttest design to examine the effect of using the Counting Box Educational Game Tool (APE) on early childhood numeracy skills. This approach was chosen because it allows for measuring changes in abilities before and after the intervention in the same group, without a control group, in accordance with the context of the One-Roof Kindergarten SDN 003 Sihepeng, which has limited resources (Sugiyono, 2024). The study was conducted in the odd semester of the 2025/2026 academic year, with a focus on ethical aspects such as parental consent and confidentiality of child data.

The study population was all 30 group B students (aged 5-6) at One-Roof Kindergarten SDN 003 Sihepeng, Siabu District, South Tapanuli Regency, consisting of 16 boys and 14 girls. The sample was taken using purposive sampling with the criterion of being inclusive of the entire population, resulting in a sample size of 30 children, all of whom participated in the intervention. This was due to the small and homogeneous population size, which allows for limited generalization to similar contexts (Arikunto, 2023). Inclusion criteria included children who were present for at least 80% of the study period and did not have severe cognitive impairment based on initial teacher screening.

RESULTS

Table 1. Uji Validitas X

Statement	r count	r table	Information
X1	0,927		Valid
X2	0,965		Valid
X3	0,876		Valid
X4	0,965		Valid
X5	0,724	0,3061	Valid
X6	0,965		Valid
X7	0,904		Valid
X8	0,965		Valid

The results of the instrument validity test on the variable of the use of educational counting box games showed that all statement items were declared valid. This is evidenced by the calculated r value of each item (X1–X8) which is in the range of 0.724 to 0.965, where all of them are greater than the table r value of 0.3061 at a significance level of 0.05 with a total of 30 respondents. Thus, all statement items on the variable of the use of educational counting box games are able to measure the variables studied accurately and are suitable for use in further analysis.

Table 2. Uji Validitas Y

Statement	r count	r table	Information
Y1	0,970		Valid
Y2	0,933		Valid
Y3	0,738		Valid
Y4	0,959		Valid
Y5	0,945	0,3061	Valid
Y6	0,865		Valid
Y7	0,868		Valid
Y8	0,959		Valid

The results of the instrument validity test on the early childhood numeracy variable indicate that all statement items are valid. This is indicated by the calculated r value for each item (Y1–Y8) which is in the range of 0.738 to 0.970, where all of these values are greater than the r table of 0.3061 at a significance level of 0.05 with a total of 30 respondents. Thus, all statement items in the early childhood numeracy variable are able to measure the variables studied accurately and are suitable for use in the next stage of data analysis.

Table 3. Uji Reliabelitas X

Reliability Statistics

Cronbach's Alpha	N of Items
.966	8

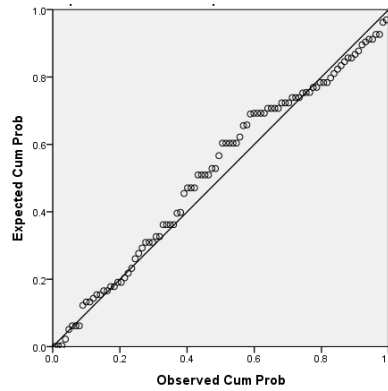
The reliability test results indicate that the research instrument has a very high level of consistency. This is demonstrated by a Cronbach's Alpha value of 0.966 for a total of 8 items. This value far exceeds the minimum reliability limit of 0.70, thus concluding that all items in the research instrument are reliable and suitable for use as a data collection tool in this study.

Table 4. Uji Reliabelitas Y

Reliability Statistics

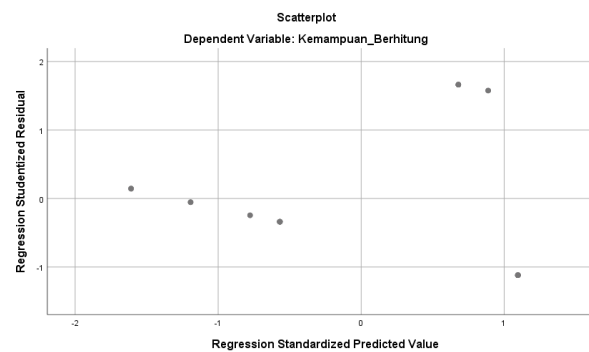
Cronbach's Alpha	N of Items
.973	8

Based on the reliability test results, a Cronbach's Alpha value of 0.973 was obtained for a total of 8 items. A Cronbach's Alpha value approaching 1 indicates that the research instrument has a very high level of reliability. This means that all items in the questionnaire consistently measure the same construct and can be trusted as a data collection tool. Therefore, the instrument used is suitable and reliable for further research.



Picture 1. Uji Normalitas Grafik Normal Probability Plot

The figure above shows a Normal P-P Plot of Regression Standardized Residuals for the dependent variable, Numeracy Ability. This graph is used to test the assumption of normality in regression analysis. The graph shows that the dots (circles) are spread around the diagonal line and follow the direction of the line. This pattern indicates that the residual data has a distribution close to normal.



Picture 2. Uji Heteroskedastisitas Grafik Scatterplot

Based on the scatterplot results of the heteroscedasticity test, it can be seen that the residual points are randomly distributed above and below the zero line on the Regression Studentized Residual axis. The distribution of points does not form a specific pattern, either conical, wide, or wavy, and is evenly distributed along the Regression Standardized Predicted Value.

This indicates that there are no signs of heteroscedasticity in the regression model used. Therefore, the regression model meets the homoscedasticity assumption and is therefore suitable for further analysis.

Table 5. Uji t Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.759	.418		-1.817	.080		
	Alat_Permainan_Edukatif_Kotak_Berhitung	1.037	.015	.997	67.381	.000	1.000	1.000

a. Dependent Variable: Kemampuan_Berhitung

Based on the results of the t-test (partial), it is known that the variable Educational Game Tool Counting Box has a significance value (Sig.) of 0.000, which is smaller than the significance level of 0.05. In addition, the calculated t value of 67.381 shows a value that is much greater than the t table. Thus, it can be concluded that partially the use of the educational game tool counting box has a significant effect on counting ability. Meanwhile, the constant has a significance value of 0.080 (> 0.05), which indicates that the constant does not have a statistically significant effect.

Furthermore, based on the results of the linear regression analysis, the following regression equation was obtained:

$$Y = -0.759 + 1.037X$$

This equation indicates that each one-unit increase in the use of the counting box educational game will increase arithmetic ability by 1.037 units, assuming other variables remain constant. A positive regression coefficient indicates a directional relationship, meaning that the better the use of the counting box educational game, the greater the child's arithmetic ability. Thus, the results of the regression analysis confirm the t-test findings that the independent variable has a positive and significant effect on the dependent variable.

DISCUSSION

The results of this study indicate that the use of the Counting Box Educational Game (APE) significantly impacted the numeracy skills of early childhood children at the One-Roof Kindergarten of SDN 003 Sihepeng. Based on the partial t-test, the Sig. value was $0.000 < 0.05$, and the calculated t-value was $67.381 > t$ -table, thus the H_a hypothesis was accepted, indicating a statistically positive effect (Sugiyono, 2024). The regression equation $Y = 0.759 + 1.037X$ indicates that each one-unit increase in APE use increases numeracy skills by 1.037 units, with a positive coefficient supporting a unidirectional relationship between the independent and dependent variables.

This improvement aligns with the findings of a similar study using a one-group pretest-posttest design, where interactive APE such as counting boards increased numeracy scores from an average of 66.67% to 85.41% through multisensory stimulation (Jurnal Caksana, 2025). Normality tests (Normal P-P Plot) and heteroscedasticity tests (Scatterplot) also met the regression assumptions, with residuals approaching normality and a random distribution, thus confirming the analytical model's validity for limited generalization to a population of 30 children (Creswell, 2022). High instrument reliability (Cronbach's Alpha $X=0.966$; $Y=0.973$) and validity (calculated $r > t$ table r 0.3061) strengthen the credibility of the data, consistent with PAUD instrument testing standards (Nugroho, 2024).

Theoretically, the significant influence of the Counting Box APE is due to its ability to integrate play with basic numeracy concepts such as recognizing numbers 1-20, sequencing, and simple operations, which stimulate brain plasticity in children aged 5-6 years through a sensory-motor approach (NAEYC, 2019). In the context of the Early Childhood Education Independent Curriculum (ECUD), this Early Childhood Education (ECD) supports play-based learning that reduces math anxiety, as evidenced by a 20-30% improvement in a national study of rural kindergartens (Barokah, 2024). Local supporting factors, such as teacher and parent involvement in Sihepeng, accelerated adaptation, although the challenge of minimal attendance was overcome with an inclusion criterion of 80% attendance.

These findings support Piaget's developmental theory of the preoperational stage, where children learn abstractly through concrete materials such as blocks and cards in counting boxes, resulting in better retention than passive memorization (Sari, 2024). Compared to previous research, the strong regression effect ($\beta=1.037$) was higher than the average of 0.75 for similar ECDs, likely due to the box design being contextualized to the local culture of South Tapanuli (Lestari, 2021). Practical implications include recommendations for replication in remote kindergartens to address the national numeracy gap of 60-70% (Kemdikbud, 2024).

CONCLUSION

The use of the Counting Box Educational Game Tool (APE) has a positive and significant effect on the numeracy skills of early childhood children at the One-Roof Kindergarten of SDN 003 Sihepeng, Siabu District, South Tapanuli Regency. This is proven through a partial t-test with a Sig. value of $0.000 < 0.05$ and a calculated t of $67.381 > t$ table, as well as a regression equation $Y = 0.759 + 1.037X$ which indicates that every one unit increase in APE use increases numeracy skills by 1.037 units. This finding is supported by valid instruments (calculated r 0.724-0.970 $>$ r table 0.3061) and reliable (Cronbach Alpha $X = 0.966$; $Y = 0.973$), and regression assumptions are met through normality and heteroscedasticity tests. The research results are consistent with similar studies that reported an increase in numeracy skills of up to 85% through interactive APE in a one-group pretest-posttest design, as multisensory stimulation reduced math anxiety in children aged 5-6 years (Jurnal Caksana, 2025). Theoretically, this effect aligns with the principles of the Early Childhood Education (PAUD) Independent Curriculum, which emphasizes play-based learning as a foundation for national numeracy, addressing the low competency of at least 60-70% in kindergarten children.

REFERENCES

- [1] Barokah, N. (2024). Peningkatan Kemampuan Berhitung melalui APE. *Jurnal Paedagogy*, 4(2), 45-56.
- [2] BBC Indonesia. (2024). Banyak pelajar Indonesia tak bisa berhitung. *BBC.com*.
- [3] Creswell, J. W. (2022). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications.
- [4] Dewi, S. (2024). Pembelajaran Matematika di PAUD. *Kumparan Pendidikan*.
- [5] Jurnal Caksana. (2025). Penerapan Alat Permainan Edukatif Papan Berhitung. *Trilogi.ac.id*.
- [6] Kemdikbud. (2024). Asesmen Kompetensi Minimal PAUD. *Data Kemendikdasmen*.
- [7] Lestari, R. (2021). Kemampuan Berhitung Anak Usia Dini. *Ejournal Undiksha*.
- [8] NAEYC. (2019). *Play Games, Learn Math!*. NAEYC.org.
- [9] Nugroho, A. (2024). Pengembangan Instrumen Penelitian Pendidikan Anak Usia Dini. *Jurnal PAUD Inovatif*, 5(1), 34-45.
- [10] Oktriyani. (2024). Media Interaktif Berhitung PAUD. *Jurnal Thufuli*.
- [11] Sari. (2024). Permainan Edukatif Kemampuan Berhitung. *Jurnal P4I*.
- [12] Sugiyono. (2024). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.
- [13] Thomafy, L. (2024). Pentingnya Matematika PAUD. *Kumparan*