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The Effectiveness of the Joyful Mathematics Model Assisted by Magic Box Media on Early Childhood Understanding of Numbers and Numerals

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Article Info

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ABSTRACT

This study aims to analyze the effectiveness of the Joyful Mathematics Model assisted by Magic Box media in improving early childhood understanding of numbers and numerals. The problem underlying this study is the low numeracy ability of children due to learning practices that remain conventional and lack play-based activities and concrete learning media. This study employed a quantitative approach with a quasi-experimental design using a pretest-posttest control group design. The research subjects consisted of 13 children from Group B at TK Aisyiyah Bustanul Athfal 9 Salawati. Data were collected using a number and numeral understanding test instrument that had been tested for validity and reliability.

The results showed a significant improvement in children's numeracy ability, as indicated by an increase in the mean score from 71.92 in the pretest to 89.23 in the posttest. The paired sample t-test results showed a t-value of -8.285 with a significance value of $p < 0.05$, indicating a significant difference between the results before and after the treatment. In addition, the distribution of students' ability categories also shifted from the "fair" and "good" categories to being predominantly in the "very good" category.

The conclusion of this study is that the Joyful Mathematics Model assisted by Magic Box media is effective in improving early childhood understanding of numbers and numerals. This study provides practical contributions for early childhood education teachers in developing mathematics learning that is innovative, enjoyable, and based on concrete media, as well as implications for improving the quality of numeracy learning in early childhood education.

Informasi Artikel

Kata Kunci:

Model Matematika Gembira; Media Kotak Ajaib; Numerasi Awal; Pemahaman Angka dan Bilangan; Pendidikan Anak Usia Dini

ABSTRAK

Penelitian ini bertujuan untuk menganalisis efektivitas Model Matematika Gembira berbantuan media Kotak Ajaib dalam meningkatkan pemahaman angka dan bilangan anak usia dini. Permasalahan yang melatarbelakangi penelitian ini adalah rendahnya kemampuan numerasi anak akibat pembelajaran yang masih bersifat konvensional dan kurang melibatkan aktivitas bermain serta media konkret. Penelitian ini menggunakan pendekatan kuantitatif dengan desain quasi-experimental berupa *pretest-posttest control group design*. Subjek penelitian berjumlah 13 anak kelompok B TK Aisyiyah Bustanul Athfal 9 Salawati. Data dikumpulkan melalui instrumen tes pemahaman angka dan bilangan yang telah diuji validitas dan reliabilitasnya.

Hasil penelitian menunjukkan adanya peningkatan yang signifikan pada kemampuan numerasi anak, ditunjukkan oleh kenaikan rata-rata nilai dari 71,92 pada pretest menjadi 89,23 pada posttest. Hasil uji paired sample t-test menunjukkan nilai t hitung sebesar -8,285 dengan nilai signifikansi $p < 0,05$, yang berarti terdapat perbedaan yang signifikan antara hasil sebelum dan sesudah perlakuan. Selain itu, distribusi kategori kemampuan siswa juga mengalami pergeseran dari kategori "cukup" dan "baik" menjadi dominan "sangat baik".

Kesimpulan penelitian ini adalah Model Matematika Gembira berbantuan media Kotak Ajaib efektif dalam meningkatkan pemahaman angka dan bilangan anak usia dini. Penelitian ini memberikan kontribusi praktis bagi guru PAUD dalam mengembangkan pembelajaran matematika yang inovatif, menyenangkan, dan berbasis media konkret, serta berimplikasi pada peningkatan kualitas pembelajaran numerasi di pendidikan anak usia dini.

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1. Introduction

Early childhood education (ECE) plays a strategic role in establishing the foundation of children's cognitive abilities, particularly in early numeracy. Globally, numeracy literacy is one of the important indicators of children's readiness to enter primary education. However, various reports indicate that early childhood numeracy skills remain at a concerning level, especially in developing countries. Appropriate early learning interventions are therefore essential to improve children's understanding of numbers and numerals as the foundation for mathematical thinking (Muñez et al., 2026).

Empirically, international studies show that children who do not receive adequate numeracy stimulation during early childhood tend to experience academic difficulties at the next level of education. Roesch et al. (2026) found that numeracy interventions based on concrete experiences significantly improved basic counting skills compared to conventional approaches. In line with this, Yustitia (2024), through a quantitative analysis, demonstrated that mathematics learning designed in a structured, active, and intensive practice-based manner can significantly improve numeracy achievement. These findings emphasize the importance of systematic and effective learning design from an early age and highlight the need for learning strategies that are appropriate to the developmental characteristics of young children.

In the Indonesian context, challenges in mathematics learning for early childhood remain quite complex. Learning practices that tend to be abstract and less contextual often result in low interest and limited understanding among children regarding number and numeral concepts. This condition is supported by the findings of Irwanti and Azizah (2025), which showed that most kindergarten children still experience difficulties in meaningfully recognizing the concept of numbers.

One approach considered effective in improving children's numeracy skills is play-based learning. This approach enables children to learn through direct, enjoyable, and meaningful experiences. Louw and Claassens (2025) stated that play-based mathematics learning can increase children's engagement while naturally strengthening conceptual understanding. This finding is supported by Utami and Crescenzi-Lanna (2025), who showed that the integration of games, including game-based learning, in early childhood learning significantly improves engagement, motivation, and the effectiveness of mathematical concept understanding compared to traditional approaches.

Furthermore, the use of manipulative media in mathematics learning has also been proven to have a positive impact on conceptual understanding. Concrete media help children visualize abstract concepts in a more tangible way. Tagalog and Oco (2025) explained that the use of manipulative teaching aids can improve numeracy skills and help children understand the relationships among number concepts. Similarly, Winarti et al. (2025) emphasized that the planned integration of play-based learning and concrete media can more optimally enhance young children's numerical and spatial reasoning abilities. Other studies also indicate that the integration of games and concrete media in mathematics learning can significantly improve learning outcomes. Adawurah (2025) found that the use of counting games and visual aids significantly improved children's numeracy skills in kindergarten classrooms. This indicates that enjoyable learning can serve as a solution to overcome difficulties in learning mathematics.

In addition, creativity- and play-based approaches have been shown to improve children's critical thinking skills. Njideka and Onwunyili (2025) emphasized that mathematics activities packaged in the form of creative games can enhance problem-solving skills and deepen children's understanding of numerical concepts.

From a pedagogical perspective, constructivist theory states that children construct knowledge through interaction with their environment. Therefore, effective mathematics learning should involve exploration, object manipulation, and direct experience. Gama Arachchige et al. (2025) showed that the use of manipulative media in a play-based context provides more meaningful learning experiences for children.

Nevertheless, although various studies have demonstrated the effectiveness of play-based learning and manipulative media, there are still limitations in the development of integrated and innovative learning models. Most previous studies have focused only on a single variable, such as the use of media or play methods, without comprehensively examining the combination of both.

Moreover, previous research has not extensively developed learning models specifically designed to improve children's understanding of numbers and numerals through enjoyable and interactive approaches. Muthuwela and Danthanarayanage (2025) emphasized the need for innovation in learning models that can systematically integrate play and instructional media.

This research gap provides an opportunity to develop a more innovative learning model, namely the Joyful Mathematics Model assisted by "Magic Box" media. This model is expected to combine elements of play, exploration, and the use of concrete media into an engaging and effective learning process.

The Joyful Mathematics Model is designed to create an enjoyable learning atmosphere so that children do not feel burdened when learning mathematics. Meanwhile, the Magic Box media functions as a manipulative learning tool that can stimulate children's curiosity and active involvement in the learning process.

Based on the above discussion, this study aims to analyze the effectiveness of the Joyful Mathematics Model assisted by Magic Box media on early childhood understanding of numbers and numerals. This study employs a quantitative approach to examine the relationship between the learning model variable and children's numeracy learning outcomes.

The hypothesis of this study is that there is a significant effect of using the Joyful Mathematics Model assisted by Magic Box media on improving early childhood understanding of numbers and numerals. The research questions proposed in this study are as follows: (1) what is the level of children's understanding of numbers and numerals before and after the treatment? (2) is there a

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significant difference between the experimental and control groups? and (3) how large is the effect of the learning model on improving children's numeracy skills.

2. Method

This study employed a quantitative approach with a quasi-experimental research design. The design used was a pretest-posttest control group design, involving two groups: an experimental group and a control group. Both groups were given an initial test (pretest) to determine their prior ability. Subsequently, the experimental group received treatment through the implementation of the Joyful Mathematics Model assisted by Magic Box media, while the control group received conventional learning. After the treatment, both groups were given a final test (posttest) to measure changes in learning outcomes. This design was selected because it enables the objective examination of the treatment effect through comparisons of learning outcomes before and after the intervention, as well as between groups (Dewi et al., 2025).

Schematically, the research design is presented as follows:

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experimental Group	O_1	X	O_2
Control Group	O_3	-	O_4

Notes:
O_1 = Pretest of the experimental group
O_2 = Posttest of the experimental group
O_3 = Pretest of the control group
O_4 = Posttest of the control group
X = Treatment using the Joyful Mathematics Model assisted by Magic Box media
Conventional learning without treatment using the Joyful Mathematics Model assisted by Magic Box media

The type of data collected in this study was primary data, namely data obtained directly from the research subjects. The main data consisted of early childhood scores on number and numeral understanding obtained through a test. In addition, supporting data in the form of observation results on children's engagement during the learning process were also collected to strengthen the interpretation of the research findings. The use of pretest and posttest data in quantitative experimental research enables a more accurate measurement of ability improvement (Adawurah, 2025).

The data collection methods included tests and observation. The test instrument was used to measure children's ability to understand numbers and numerals before and after the treatment. The test was developed based on early numeracy indicators, such as recognizing numbers, matching the number of objects, classifying, and sequencing numbers. Meanwhile, observation was used to examine children's engagement during the learning process, including aspects of attention, participation, and interaction. The combination of these methods provides a more comprehensive picture of both learning outcomes and the learning process (Rahayu et al., 2025).

The population of this study consisted of all Group B early childhood learners, aged 5–6 years, in one early childhood education institution. The research sample was determined from two classes with relatively homogeneous characteristics. The sampling technique used was purposive sampling, namely the selection of samples based on specific considerations, such as the equivalence of initial abilities and classroom conditions. This technique is commonly used in educational experimental research when full randomization is not possible (Bachtiar et al., 2025).

The sample in this study consisted of two groups, namely the experimental group and the control group, with each group comprising 15–20 children. The group division was based on existing classes or intact groups, so as not to disrupt the learning process at school. This approach enables a direct comparison between two equivalent groups in a real learning context (Febrilia & Mardati, 2025).

The research instruments used in this study consisted of a number and numeral understanding test and an observation sheet. The test was developed based on indicators of early childhood cognitive development and presented in the form of attractive activity-based worksheets, such as the use of pictures, colors, and concrete objects. The observation sheet was used to assess children's engagement during the learning process. The instruments were designed in accordance with the developmental characteristics of early childhood, which emphasize visual, concrete, and interactive aspects (Aquino et al., 2025).

Instrument validity testing was conducted through content validity by involving experts, namely early childhood education lecturers and early childhood education practitioners. In addition, empirical validity testing was carried out using the product-moment correlation. The instrument was declared valid if the correlation coefficient, or calculated r-value, was greater than the r-table value at a certain significance level. This approach was used to ensure that the instrument truly measured the intended ability (Kholifah et al., 2025).

Instrument reliability testing was conducted using Cronbach's Alpha coefficient. The instrument was considered reliable if the α value was ≥ 0.70, indicating good internal consistency. Reliability is essential to ensure the stability of measurement results in experimental research. This is in line with the findings of Yustitia (2024), which emphasized that reliable numeracy instruments play an important role in producing accurate and trustworthy data.

The data analysis techniques used in this study included descriptive and inferential statistical analyses. Descriptive analysis was used to describe the data through mean scores, percentages, and standard deviations in order to determine the level of children's ability before and after

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the treatment. Inferential analysis was used to test the research hypothesis, namely by using the paired sample t-test to determine differences before and after treatment within one group, and the independent sample t-test to compare the results between the experimental group and the control group (Husna et al., 2025).

Before hypothesis testing was conducted, prerequisite analysis tests were first carried out, namely normality and homogeneity tests. The normality test aimed to determine whether the data were normally distributed, while the homogeneity test aimed to determine the equality of variances between groups. If both assumptions were met, the analysis proceeded using parametric tests, namely the t-test. Hypothesis testing was conducted at a significance level of $\alpha = 0.05$. The entire data analysis process was carried out with the assistance of statistical software, such as SPSS, to ensure the accuracy of calculations and the interpretation of the research findings (Akfina et al., 2025).

3. Result and Discussion

Based on the pretest and posttest data obtained from 13 Group B students at TK Aisyiyah Bustanul Athfal 9 Salawati, the findings indicate an improvement in children's understanding of numbers and numerals after the implementation of the Joyful Mathematics Model assisted by Magic Box media. In general, almost all students showed an increase in scores, shifting from the "fair" and "good" categories to the "good" and "very good" categories. Descriptively, the analysis showed that the mean pretest score was 71.92, with the dominant category being "fair", while the mean posttest score increased to 89.23, with the dominant category being "very good". This indicates an improvement in children's numeracy ability after the treatment was given. In addition, the standard deviation of the pretest was 7.78, while the standard deviation of the posttest was 6.41, indicating that the variation in students' scores after the treatment became more homogeneous. The distribution of students' ability categories also changed significantly. During the pretest, most students were in the "fair" and "good" categories, whereas in the posttest, the majority of students were in the "very good" category. No students remained in the "poor" category after the treatment was implemented. This indicates that the applied learning model was able to improve the quality of students' understanding more evenly. To test the research hypothesis, a statistical analysis was conducted using the paired sample t-test. The results showed that the calculated t-value was -8.285, with a significance value or p-value of $0.0000026 < 0.05$. Therefore, there was a significant difference between the pretest and posttest results. This means that the hypothesis was accepted, indicating that the Joyful Mathematics Model assisted by Magic Box media had a significant effect on early childhood understanding of numbers and numerals. More specifically, the improvement in individual scores also showed a positive trend. Almost all students experienced an increase of between 10 and 30 points. The highest improvement was observed among several students who were initially in the "fair" category and then improved to the "very good" category. This indicates that the learning model was not only effective for students with high abilities but also for students with lower initial abilities.

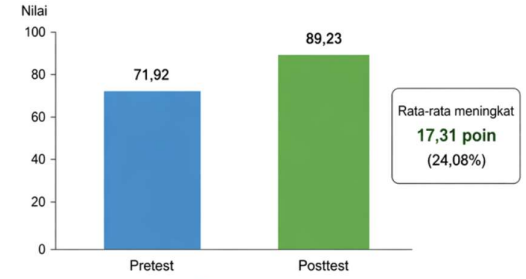

Figure 1. Mean Scores of Pretest and Posttest

Figure 1 shows the comparison of the mean pretest and posttest scores for early childhood understanding of numbers and numerals. Based on the graph, the mean pretest score was 71.92, while the mean posttest score increased to 89.23. This difference indicates a considerable improvement after the implementation of the Joyful Mathematics Model assisted by Magic Box media in the learning process.

The mean increase of 17.31 points, or approximately 24.08%, indicates that the intervention had a positive impact on the development of children's numeracy skills. Academically, this improvement not only reflects a quantitative change but also indicates an enhancement in the quality of children's understanding of number and numeral concepts, shifting from the "fair" category to the "good" and "very good" categories.

Furthermore, the noticeable difference between the pretest and posttest scores strengthens the assumption that learning which integrates play elements and concrete media is more effective than conventional approaches. Children appeared to understand the concepts more easily because they were directly involved in enjoyable and meaningful learning activities. This is also in line with the learning characteristics of early childhood learners, who tend to be exploratory and learn best through direct experience.

Thus, the graph not only illustrates a statistical increase in scores but also demonstrates the successful implementation of the learning model in improving students' overall learning outcomes. These findings reinforce that the use of the Joyful Mathematics Model assisted by Magic Box media deserves consideration as an effective alternative learning strategy for developing early childhood numeracy skills.

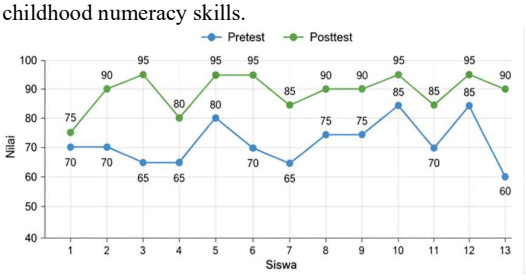

Figure 2. Comparison of Pretest and Posttest Scores for Each Student

Figure 2 presents the comparison of pretest and posttest scores for each student, providing a more detailed

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overview of individual changes in ability after the implementation of the Joyful Mathematics Model assisted by Magic Box media. In general, all students showed an increase in posttest scores compared to their pretest scores, as indicated by the green line representing the posttest, which consistently appears above the blue line representing the pretest at each student point.

Further analysis shows that the score improvement varied among students. Some students demonstrated a substantial increase, such as students 3, 6, and 13, whose scores improved by approximately 25–30 points. This indicates that the implemented learning model was particularly effective for students with relatively low initial abilities. In other words, the learning intervention had a greater impact on students who were initially in the "fair" category.

On the other hand, students who already had relatively good initial abilities, such as students 5, 10, and 12, also showed improvement, although not as large as those with lower initial abilities. This indicates that the Joyful Mathematics Model is not only effective in improving basic abilities but also capable of optimizing the potential of students who were already in the "good" category. Therefore, this model can be considered inclusive and adaptive to various levels of student ability.

In addition to the increase in scores, the graph also shows that posttest scores tended to be more stable than pretest scores. This can be seen from the green line pattern, which is more evenly distributed within a higher score range of 85–95, while the pretest scores were more widely spread across the range of 60–85. This condition indicates that after the treatment, students' abilities became more homogeneous and evenly distributed, meaning that the ability gap among students could be minimized.

Thus, the comparison of pretest and posttest scores for each student in this graph not only demonstrates an overall improvement but also provides evidence that the applied learning model was able to improve numeracy skills comprehensively and evenly among individual students. These findings strengthen the previous analysis that the Joyful Mathematics Model assisted by Magic Box media is effective in improving early childhood understanding of numbers and numerals.

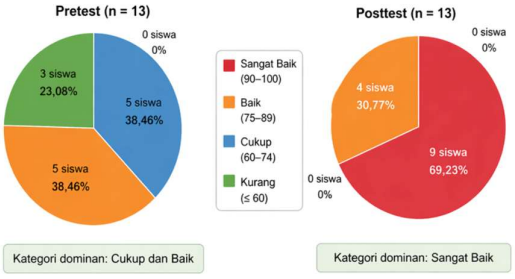

Figure 3. Distribution of Students' Ability Categories

Figure 3 shows the distribution of students' ability categories during the pretest and posttest based on four categories: "poor", "fair", "good", and "very good". At the pretest stage, most students were in the "fair" and "good" categories, with 5 students in each category (38.46%). Meanwhile, 3 students (23.08%) were still in the "poor" category, and none of the students had reached the "very good" category. This indicates that before the treatment, students' numeracy abilities were still at a lower-to-moderate level and had not yet been optimized.

After the treatment was given through the Joyful Mathematics Model assisted by Magic Box media, there was a very significant change in the distribution of posttest results. Most students moved to the "very good" category, totaling 9 students (69.23%), while the remaining 4 students (30.77%) were in the "good" category. Interestingly, no students remained in the "fair" or "poor" categories, indicating that all students experienced an improvement to a higher level of ability.

This change in distribution shows an overall shift from low and moderate ability levels to higher ability levels. Academically, this indicates that the learning intervention not only improved individual scores but also successfully enhanced the quality of learning achievement collectively. In other words, the learning model used was able to improve the abilities of all students without exception.

Thus, the distribution of students' ability categories in this graph strengthens the previous analysis that the Joyful Mathematics Model assisted by Magic Box media is effective in improving early childhood understanding of numbers and numerals. This finding also shows that enjoyable learning supported by concrete media can promote more equitable learning outcomes, thereby significantly minimizing the ability gap among students.

Table 1. Descriptive Statistics

Statistik	Pretest	Posttest	Perubahan
Rata-rata	71,92	89,23	+17,31
Median	70	90	+20
Nilai Minimum	60	75	+15
Nilai Maksimum	85	95	+10
Standar Deviasi	7,78	6,41	-1,37

Table 1 presents descriptive statistics that provide an overview of changes in children's numeracy abilities before and after the treatment. Based on the table, the mean score increased from 71.92 in the pretest to 89.23 in the posttest, with a difference of +17.31. This increase indicates a significant improvement in children's understanding of numbers and numerals after the implementation of the learning model.

In addition to the mean score, the median also increased from 70 to 90, with a difference of +20. This increase in the median indicates that the central position of the students' score distribution shifted to a higher level. This means that the improvement was not limited to only a small number of students; rather, the majority of students showed consistent progress in their learning outcomes.

In terms of extreme scores, the minimum score increased from 60 to 75 (+15), while the maximum score increased from 85 to 95 (+10). This shows that improvement occurred not only among students with high ability but also among students with lower initial ability. In other words, the learning intervention successfully improved students' overall performance, both in the lower and higher ability groups.

Meanwhile, the standard deviation decreased from 7.78 to 6.41 (−1.37),

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indicating that the variation in scores among students became smaller after the treatment. This decrease suggests that students' abilities became more homogeneous and evenly distributed. Overall, the descriptive statistics in this table strengthen the finding that the Joyful Mathematics Model assisted by Magic Box media not only improved the average learning outcomes but also enhanced the distribution and equity of students' abilities.

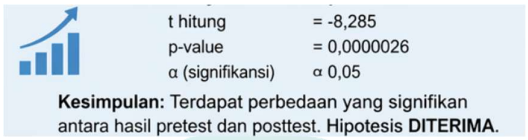

Figure 4. Results of the Paired Sample t-test

Figure 4 presents the results of the paired sample t-test, which was used to determine whether there was a significant difference between the pretest and posttest scores. Based on the figure, the calculated t-value was -8.285, with a p-value of 0.0000026 at a significance level of $\alpha = 0.05$. This value indicates that the analysis results met the requirements for statistical decision-making.

Interpretatively, the p-value, which is far smaller than 0.05 ($p < 0.05$), indicates that there was a significant difference between the pretest and posttest scores. This means that the changes in students' scores after the treatment were not merely due to chance, but were the result of the intervention provided. Therefore, statistically, it can be stated that the treatment had a significant effect on improving students' abilities.

Furthermore, the negative calculated t-value indicates that the mean posttest score was higher than the mean pretest score. In the context of a paired sample t-test, the negative sign is not a major issue; rather, it indicates the direction of the difference. The more important aspect is the relatively high absolute t-value, which indicates a strong difference between the two conditions being compared.

Based on these results, it can be concluded that the research hypothesis was accepted, namely that there was a significant effect of implementing the Joyful Mathematics Model assisted by Magic Box media on early childhood understanding of numbers and numerals. This finding strengthens the previous descriptive analysis and provides empirical evidence that the applied learning model was effective in improving students' learning outcomes.

Discussion

The results of this study indicate that the Joyful Mathematics Model assisted by Magic Box media is effective in improving early childhood understanding of numbers and numerals. This finding is consistent with constructivist theory, which states that children learn optimally through direct experiences and interaction with their environment. In this context, the use of concrete media and play-based activities allows children to actively construct knowledge, making mathematical concepts less abstract and more meaningful and contextual. This finding is supported by Byrne et al. (2023), who emphasized that the use of physical manipulatives in mathematics learning can enhance children's conceptual understanding through direct experience and exploration.

Furthermore, the findings of this study strengthen the theory of play-based learning, which suggests that learning through play can increase children's engagement, motivation, and learning outcomes. The significant increase in scores from pretest to posttest indicates that an enjoyable and non-pressuring learning atmosphere contributes to better conceptual understanding. This result is in line with Derman and Zeteroğlu (2020), who found that game-based mathematics activities significantly improved the cognitive and numeracy development of young children. Similarly, Grimmond and Neilsen-Hewett (2022) showed that play-based approaches in mathematics learning can increase children's interest and engagement in numeracy activities.

The findings of this study are also consistent with Adawurah (2025), who stated that counting games and visual aids can significantly improve children's numeracy skills. This indicates that the integration of games and concrete media is an effective combination in early childhood mathematics learning. Rojas (2025) also revealed that play-based learning has a positive impact on students' mathematical performance through interactive and exploratory activities.

Moreover, the results of this study support the findings of Tagalog and Oco (2025) regarding the effectiveness of manipulative media in improving mathematical concept understanding. In this study, Magic Box media served as a concrete tool that helped children visualize number and numeral concepts more clearly. This is in line with Laski et al. (2015), who explained that attractive and relevant manipulatives can improve mathematical concept understanding through children's active involvement. In addition, Monareng and Selepe (2026), in their scoping review, emphasized that both physical and digital manipulatives play an important role in supporting the development of early numeracy skills.

However, the findings of this study are slightly different from those of Ompok (2025), who stated that not all play-based learning produces a significant impact if it is not systematically designed. This difference may be due to the structured design of the Joyful Mathematics Model, which is integrated with learning media that are relevant to the characteristics of early childhood learners. This is supported by Dianti and Nahdi (2025), who showed that the effectiveness of guided play depends greatly on directed lesson planning and the active role of teachers in facilitating the learning process.

From a practical perspective, the results of this study indicate that early childhood education teachers need to develop mathematics learning that is innovative, enjoyable, and based on concrete media. The Joyful Mathematics Model can be used as an alternative learning strategy to improve children's numeracy skills from an early age. This is in line with Narisa et al. (2025), who emphasized that the use of manipulative media in play-based learning can significantly improve children's numeracy abilities. In addition, the use of simple media

such as the Magic Box can serve as a practical solution that is easy to implement in various early childhood education institutions, including those with limited facilities.

Theoretically, this study contributes to the development of early childhood mathematics learning models that integrate play-based approaches and manipulative media. The findings also strengthen empirical evidence that the combination of appropriate learning methods and instructional media has a significant influence on learning outcomes. This is consistent with Vogt et al. (2020), who stated that the integration of play-based approaches in mathematics learning can improve learning outcomes while supporting children's holistic cognitive development.

Nevertheless, this study has several limitations. First, the sample size was relatively small, involving only 13 students, so the generalizability of the findings remains limited. Second, the duration of the study was relatively short, making it unable to describe the long-term impact of the learning model. Third, this study did not consider external factors such as parental support and the home learning environment, which previous studies have also identified as influential in children's numeracy development.

Therefore, future studies are recommended to involve larger and more diverse samples and to use stronger experimental designs, such as randomized controlled trials. In addition, further research may examine other variables, such as learning motivation, student engagement, and broader aspects of cognitive development, in order to obtain a more comprehensive understanding of the effectiveness of mathematics learning models for early childhood learners.

Conclusion

Based on the results of the study, it can be concluded that the Joyful Mathematics Model assisted by Magic Box media is effective in improving early childhood understanding of numbers and numerals. This is evidenced by the significant increase in the mean score from 71.92 in the pretest to 89.23 in the posttest, as well as the results of the paired sample t-test, which showed a significance value of $p < 0.05$. Therefore, the research hypothesis stating that there is a significant effect of the learning model on children's numeracy ability is accepted.

This finding indicates that learning which integrates play elements and the use of concrete media can create more meaningful learning experiences for children. Practically, the results of this study imply that early childhood education teachers need to develop innovative, interactive, and enjoyable learning strategies, such as the Joyful Mathematics Model, to improve students' engagement and learning outcomes. In addition, the use of simple media such as the Magic Box can serve as an effective and easily applicable alternative in daily classroom learning activities.

However, this study has several limitations, particularly the relatively small sample size and its implementation in only one educational institution. Therefore, the findings cannot yet be widely generalized. In addition, the limited duration of the study has not been able to describe the long-term impact of the learning model on the development of children's numeracy abilities.

Accordingly, future research is recommended to involve larger and more diverse samples and to apply stronger research designs. Further studies may also examine other variables, such as learning motivation, student engagement, or other aspects of cognitive development, in order to provide a more comprehensive understanding of the effectiveness of mathematics learning models in early childhood education.

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