

Teaching Numbers Using Teaching Aids to Improve Cognitive and Positive Emotion in The Classroom

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Abstract: Mathematics is one of the skills needed in the 21st century and one of elementary school's core subjects. This study used a quasi-experimental research design with one group pre-test and post-test with a mixed method concurrent embedding model. Data was collected through interviews, participant observation, and pre-test and post-test scores, which were carried out in 4 meetings. Quantitative results show that there is a significant effect of the use of visual aids to improve students' cognitive development. The results of the qualitative description also explain students' emotional development, which is marked by feelings of pleasure and interest in participating in learning, enthusiasm and participation of students in learning, and reduced stress and pressure experienced by students during the learning process.

Keywords: teaching props, cognitive, positive emotions

INTRODUCTION

Mathematical literacy is one of the skills that elementary students must master (Rizki & Priatna, 2019). The goal is the ability to implement the mathematical concept to solve everyday life problems (Janah et al., 2019). This is because math includes critical thinking in understanding the relationship between shapes, spaces, and patterns (Masfufah & Afriansyah, 2021). Mathematics is also usually called science that requires deductive reasoning to understand (Juwantara, 2019).

Math class is often considered a complex subject at school, especially for first graders. First-grade students who just entered elementary school face challenges in learning math due to their low level of focus. Students perceive math as a scary subject (Yeni, 2015). This is a natural phenomenon since many abstract concepts, such as objects and symbols, do not exist in real life (Masfufah & Afriansyah, 2021). The occurrence hinders students from understanding and enjoying the learning process. In this case, a teacher plays an important role in helping young learners overcome their fears. Creative teaching would help to reduce students' anxiety in the younger classroom because traditional teaching provides few opportunities for them to absorb effectively (Wirabumi, 2020).

Teachers need to rethink solutions to help young students comprehend math subjects well. Moreover, teachers should consider the learner's cognitive and emotional development (Anderson et al., 2003). The learning process should be adapted to their stage of development so that the learning goal can be achieved. Teaching aids can create fun learning and explain abstract concepts easier for children. Teaching aids can stimulate students' thoughts and feelings so they can be attentively involved in the learning process (Nasaruddin, 2018). Imitation objects integrate abstract concepts into everyday subjects. Teaching aids become tools to convey messages from teachers to students (Widiyatmoko & Pamelasari, 2012). Teaching aids or props can be divided into two categories: real objects and artificial objects. Real objects refer to original properties used in preparing, such as blocks, balls, squares, fruits, etc. Meanwhile, artificial objects are purposely designed to explain a certain concept, such as counting boards, cardboard clocks, imitation human skeletons, etc.

Teaching aids have many functions in the classroom, which are 1) Attentional Function (gives an interesting impression in learning), 2) Affective Function (Gives pleasure in learning), 3) Cognitive Function (provides a concrete explanation of abstract lesson concepts), 4) Compensatory Function (helping students who have weaknesses or limitations). A study reports that using teaching aids increases motivation in learning math because props make math way easier to digest by students (Nasaruddin, 2018). Teaching aids are helpful yet handy tools to teach math to first graders whose cognitive levels are in the concrete operational stage (Agung, 2019). Jean Piaget proposed that children aged 6-12 are in the concrete operational stage, which means they have difficulty thinking and finding solutions to abstract concepts. Previous studies on using teaching aids have been conducted, and they improve students' learning outcomes (Kharisma, 2020) and student achievement (Ambarini et al., 2018; Kristina et al., 2023). Literature in the early childhood field reported empirical evidence that there is no significant relation between students-teacher relationship and their cognitive development at school (Ikie et al., 2022). Thus, this design explored the children's cognitive development deeper through the application of teaching aids. Besides seeking the cognitive aspects, this study also holistically sees the usage of teaching aids from their emotional lenses.

Literature has recorded many teaching varieties for early childhood classrooms, such as illustration images (Fajri et al., 2022), digital pop-ups (Khamidah & Ita Sholichah, 2022), flashcards (Puspitasari et al., 2023), big books (Mazidah et al., 2023) and teaching

aids (Annisah, 2017). This study was conducted in the first year of elementary context in Indonesia, with students who are seven years old and still considered early childhood learners (Su & Yang, 2022). Based on the description above, this research aims to discover and prove whether using visual aids could improve students' cognitive levels and positive emotions in learning numbers.

RESEARCH METHODS

This study is a quasi-experimental research design with one group pre-test and post-test using mixed research methods. Two quantitative and qualitative methods were applied to obtain comprehensive, valid, reliable, and objective data. This research also aims to obtain statistical and narrative data. This study was designed to gather comprehensive data to answer research questions. This was the best way since our participants were still considered early childhood learners. They were seven years old. There were 38 participants from a private elementary school on Batam Island, a small island in the Indonesian contingent. This study took two weeks with four meetings. Each meeting was conducted in 120 minutes, including the opening, main activity, and closing activities. The math subject was opted for because this was one of the mandatory subjects for Indonesian elementary schools.



Figure 1. Teaching prop: the wall of numbers



Figure 2. Teaching props: Sort the ice cream.

Two lessons were taught within this project: counting numbers from 1 to 20. For first graders, the idea of a number more than ten is complicated. We designed two teaching props using artificial objects to explain concepts of numbers (see Figures 1 & 2). At the end of the four classes, the researcher also provided gifts, such as candies and snacks, for all these young participants. This project took four meetings, and each day, students were given a pre-test and post-test to measure their prior knowledge and after teaching evaluation (See Figure 3).

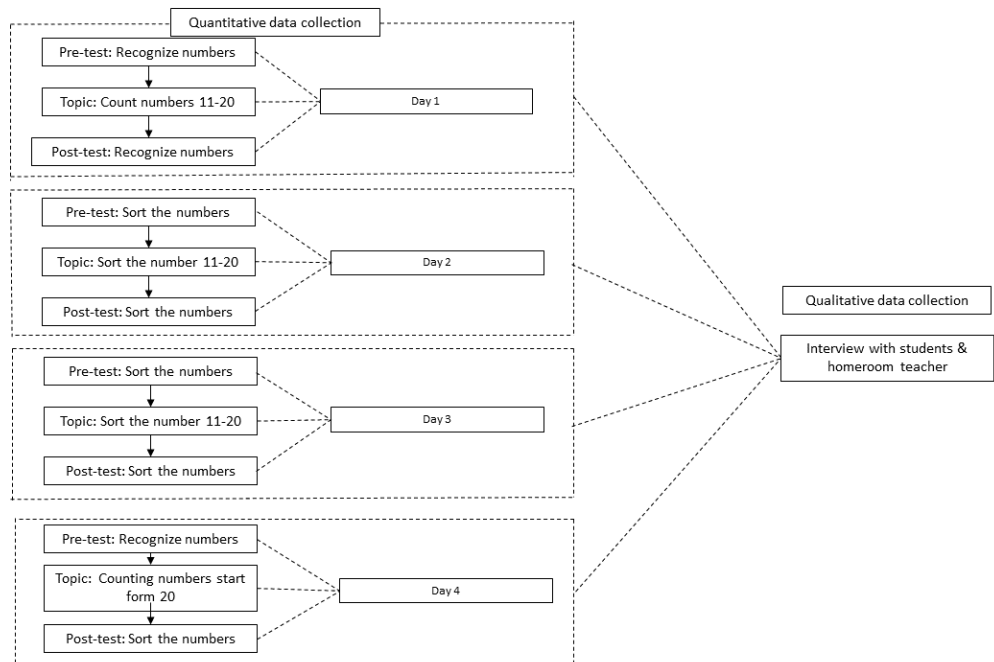


Figure 3. The research procedure

The test was taken from a standardized book published by the government for elementary students. Each test consisted of 10 to fifteen questions. The teacher also created tests and supervised the other researchers to get the interrater agreement. After the four meetings, the researcher invited some students to join the interview. The interview was purposefully designed to gather participants' points of view on the teaching process. The questions were based on the measured variables Measuring Emotions in Students' Learning and Performance: The Achievement Emotions Questionnaire (AEQ) (Pekrun et al., 2011). The original scale measured six variables; however, this study chose three dimensions: enjoyment, effort, and pressure. See Figure 3 to learn more about the process. In addition, the homeroom teacher was also invited to get her perspective on the class teaching process. Listening to the teacher's voice is important to get a whole story.

RESULTS AND DISCUSSION

This section is divided into two main findings; the first is the impact of teaching aids on students' cognitive level. The second part is the impact of teaching aids on students' positive emotions. Later, we present the discussion. The average scores from the pre-test and post-test show differences from those obtained by students before and after using teaching aids. The increase in scores was also marked by an increase in post-test scores from the first to the last meeting. The increase in students' post-test scores also occurred consistently see Table One.

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The Effect of Props on Students' Cognitive

We used the Wilcoxon test to test the significant effect of the treatment given. The results of the Wilcoxon statistical test can be called significant if the assumption

significance (2-tailed) is not smaller than the standard significance value that has been set and must be less than or equal to 0.05 (sig. ≤ 0.05). The following is a table of the results of the Wilcoxon test conducted by researchers on students' pre-test and post-test data for four meetings in the mathematics class:

Table 1. Descriptive Statistics Day 1 to Day 4

	N	Mean	Std. Deviation	Minimum	Maximum
Pretestday1	37	54.70	8.330	28	60
Pretestday2	38	43.37	16.631	0	60
Pretestday3	35	78.00	27.733	0	100
Pretestday4	36	86.11	11.027	50	100
Posttestday1	37	91.68	8.400	68	100
Posttestday1	38	92.37	10.510	70	100
Posttestday1	35	96.83	6.951	75	100
Posttestday1	36	98.61	3.507	90	100

Table 2. The Wilcoxon statistic test

	Post-test day 1- Pretest Day 1	Post-test day 2- Pretest Day 2	Post-test day 3- Pretest Day 3	Post-test day 4- Pretest Day 4
Z	-5.345 ^b	-5.400 ^b	-3.807 ^b	-4.995 ^b
Aseem. Sig. 2-tailed)	<,001	<,001	<,001	<,001

Table two shows that the Wilcoxon test with one group pre-test and post-test generates a significant value of Aseem. Sig. (2-tailed). The results of these data indicate the significant value of Aseem. Sig. (2-tailed) The Wilcoxon test from the pre-test and post-test data from the first day to the fourth day is less than 0.05 (sig. < 0.05) or 0.001 < 0.05 . Based on the test results, there is a significant influence from the use of visual aids on the cognitive development of students based on the pre-test and post-test results obtained from the experimental group. Previous studies also reported similar results that teaching aids accelerate students' understanding in the class (Kharisma, 2020; Kristina et al., 2023).

The Effect of Props on Students' Positive Emotions

Besides looking at the cognitive result, we dig deeper into the emotional dimension. Since there is a broad spectrum of emotion, this study only focused on three dimensions: enjoyment, effort, and pressure. The interviews generate a saturated conclusion that teaching aids are advantageous tools. In the first dimension about enjoyment, the researcher asked whether they enjoyed the teaching process, and the student said the class was interesting by saying:

"Interesting"

(Interview with Jason, Michelle, Rone, and Ella (anonymous), December 7th, 2023)

A student further explains why teaching using props is interesting because her mother also used teaching props at home. The research personal note also solidified this statement during teaching. It is recorded that students were happy in the classroom, as cited below:

"Children feel curious. They were happy to see the props brought by the researcher. Some

children jump, and some come forward to see the props the researcher holds. (Field Notes 01, day 1).

Children were also given questions about whether the class made them feel bored, and they replied confidently by saying, "Not bored" (Cliff, (anonymous), personal communication, December 6, 2022). They described that the props helped them to stay focused, compared to the teacher-only explanation. Children's happy feelings can be expressed through laughing, jumping for joy, clapping hands, and smiling (Fitriani & Maemonah, 2022).

In the second dimension, researchers figured out whether, during the learning process using visual aids, children put effort as effort is the causal result of interest and enjoyment. We gathered data from the interviews and field notes to prove this matter. Interview with students testified that they finished the given task cheerfully. Students were recorded saying "Done done" during the class. An interview with the homeroom teacher was also conducted to double-check this finding. She explained that students participated actively, and those who were usually shy in the class also raised their hands to answer questions. She stated:

"I see most, not most ..um, almost 90 percent of the children participate in learning activities, and they participate well.. that is it. Children who are usually quiet behind even dare to raise their hands" (Stacey, (anonymous), personal communication, November 11th, 2022).

Based on the statement above, it can be concluded that using visual aids in learning encourages children to be emotionally involved and put more effort into the learning process. Students' effort and emotional involvement affect their willingness to learn and desire to complete the assignments given to them by the teacher (Firdaus et al., 2022). Moreover, their willingness is positively caused by their learning interest in the subject (Murdiyanto & Mahatama, 2014). In the last dimension, we investigate whether the teaching aids reduce students' tension and anxiety. The interview concluded that these young learners felt no pressure in their math class. When the teacher gave them some questions, they voluntarily participated. A student explained by saying:

"I like it because I like to come forward."
(Sophie, (anonymous), Personal Communication, December 2, 2022).

This was also supported by the researcher's field notes on the third day, it is recorded that:

When doing quizzes, the class atmosphere was very lively. All the children were competing to appoint themselves so they could come to the front of the class to work on the quiz questions given by the researcher. They were not pressured when the teacher gave them quizzes; they even looked excited and happy to answer them. (Field Notes 3, day 3).

Feelings of pressure and tension occur when a person feels anxious within himself. This project confirms that teaching aids reduce students' anxiety levels. Anxiety can be characterized by worry, fear, tension, pressure, confusion, and insecurity (Apriliana et al., 2019). When student anxiety is high, it could turn math class into an unpleasant lesson (Siregar & Lisma, 2018).

CONCLUSION

Bringing teaching props to the classroom provides many valuable benefits for young learners, especially in teaching abstract concepts such as math. The earlier we introduce math to young children, the better it will nurture the mindset (Johnston et al., 2022). First graders who belong to early childhood learners need time to adjust from kindergarten to elementary school. In this stage, teachers contribute significantly to their learning journey. Early childhood learners are developing the cognitive, social, and emotional aspects (Johnstone et al., 2022). The previous study investigated the link between math scores and the plausible factors that occurred during infant development in the early childhood field (Oeri & Roebers, 2022). This paper also highlights the urgency of math skills in early childhood education. The early childhood stage provides a foundational background for mathematical development (Chan & Scalise, 2022).

Educators are also concerned with providing fun learning; thus, students can grasp and apply abstract concepts (Shin, 2022). However, preparing teaching props also demands time and energy; as we know, teachers must also do the administrative work at school. Good teaching quality is always followed by the teacher's dedicated efforts (Lundqvist et al., 2021). Teachers could set up teamwork to prepare some teaching props of durable quality so they can be used for more than one academic year. Thus, it saves their time in making the materials.

This study is not far from limitations. The authors acknowledge that future research needs to be conducted to improve body literature, especially in Indonesia's early childhood education context. Two groups, control and experiment, can be added to well-rounded research and dig deeper into conclusions that teaching props are beneficial to teaching math.

This section contains conclusions which are answers or confirmations of the findings as well as aspects of the novelty of the findings, as well as the implications for practice and subsequent theory development.

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