



Number Light Media to Stimulate Early Mathematics Abilities in Children in Kindergarten

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ARTICLE INFO

Article history:

Received January 07, 2024

Accepted March 23, 2024

Available online April 25, 2024

Kata Kunci:

Pengembangan, Number Light, Keterampilan Matematika Awal

Keywords:

Development, Number Light, Early Math Skills



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ABSTRAK

Kemampuan dan pemahaman matematika dasar pada anak khususnya usia 5-6 tahun masih sangat rendah atau kurang baik, hambatan dalam mengenal lambang bilangan, hambatan dalam mengenal konsep bilangan, dan hambatan dalam mengucapkan lambang bilangan. Tujuan utama penelitian adalah mengembangkan media number light yang bertujuan untuk menstimulasi pengetahuan matematika anak usia dini pada anak usia dini usia 5-6 tahun di TK untuk meningkatkan kemampuan awal matematika anak usia 5-6 tahun di TK. Penelitian yang dilakukan memilih model pengembangan yaitu ADDIE dan melibatkan empat orang ahli, antara lain: satu orang ahli media, satu orang ahli materi, dan dua orang praktisi yang mempunyai pengalaman belajar. Uji coba ini dilakukan pada kelompok besar yang terdiri dari 35 anak. Data dikumpulkan melalui kuesioner dan dianalisis menggunakan pendekatan gabungan antara analisis kuantitatif dan kualitatif. Hasil evaluasi menunjukkan tingkat validitas media Number Light tinggi, ahli media mencapai 92%, ahli materi 89%, praktisi 93%, dan uji coba kelompok besar 97%. Berdasarkan hasil tersebut disimpulkan bahwa pengembangan media Number Light sangat berguna dan cocok untuk menstimulasi kemampuan matematika awal anak usia 5-6 tahun di Taman Kanak-Kanak.

ABSTRACT

The ability and understanding of basic mathematics in children, especially aged 5-6 years, is still very low or not good, obstacles to recognizing number symbols, obstacles to recognizing the concept of numbers, and obstacles to pronouncing number symbols. The main objectives of the research is to develop a Number Light media with the aim of stimulating children's knowledge of early mathematics in early childhood aged 5-6 years in Kindergarten to improve initial mathematical abilities in children aged 5-6 years in kindergarten. The research carried out selected a development model, namely ADDIE, and involved four experts, including: one media expert, one material expert, and two practitioners with learning experience. This trial was carried out on a large group consisting of 35 children. Data was collected through questionnaires and analyzed using a combined approach between quantitative and qualitative analysis. The evaluation results show a high level of validity of the Number Light media, with media experts reaching 92%, material experts 89%, practitioners 93%, and large group testing 97%. Based on these results, it is concluded that the development of Number Light media is very useful and suitable for stimulating the early mathematical abilities of children aged 5-6 years in kindergarten.

1. INTRODUCTION

Mathematics is a science that plays a very important role in life and world development. Mathematics is a scientific discipline about how to think and process logic, both quantitatively and qualitatively (Garza & Travis, 2019; Syahmani et al., 2021). Mathematics is a scientific discipline about how to think and process logic, both quantitatively and qualitatively. According to previous study mathematics is the science of numbers and the relationship between numbers and the operational procedures used to solve number problems (Tanujaya et al., 2017). On the other hand, according to other study mathematics is a language that symbolizes the sequence of meanings of a message conveyed. Mathematical symbols are artificial and have meaning only if they are given meaning (Sari et al., 2017). From this we can conclude that mathematics is the ability to recognize numbers, use numbers and solve

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problems. In the world of education, mathematics is very important to teach to students, both from initial education to further education. Because mathematics is a very important science and will be useful for life and world development, mathematics is a science that studies concepts, structures and relationships between numbers, space, shapes and changes (Lestari et al., 2023; Zhu et al., 2021). Mathematics covers various fields, such as arithmetic, geometry, algebra, analysis, number theory, and statistics. Mathematics is very important in the development of science and technology, and is used in various fields, including physics, chemistry, biology, economics, and computers (Wang et al., 2018; Zubaidah, 2019). In early education, namely kindergarten (TK), mathematics is introduced in various types of media, but most of the media in kindergarten does not include new media, so students at school often feel bored. Many kindergarten schools in Indonesia do not have enough updated learning media, which can lead to feelings of boredom and boredom when studying (Haatainen & Aksela, 2021; Pratiwi, 2016).

The importance of early mathematics in every child's life, both for daily life and the future. According to previous study a very important benefit as a tool, whether as knowledge used and applied by scientists or in forming a person's thought patterns and attitudes, is the benefit for those who have knowledge of mathematics (Wahyuningsih et al., 2020). Thus, society must have an understanding and mastery of mathematics, both the elderly and young children as the next generation of the nation and state. The innovation of new learning media which is a demand to stimulate mathematics learning, especially for kindergarten educational institutions, is a problem for educators, where educators hope that the latest media can provide inspiration and insight for children in recognizing the concept of numbers (Fitriatien et al., 2020; Rekysika & Haryanto, 2019). Therefore, researchers have developed a light medium which is expected to be a unique and interesting number recognition medium combined with electricity or batteries. It is hoped that the media developed will produce maximum results in learning at the RA Kartini Tarastar PAUD school.

Based on the results of observations and interviews, researchers found the same problem in kindergarten, according to the data obtained, the ability and understanding of basic mathematics in children, especially aged 5-6 years, is still very low or not good. There are several obstacles for children in getting to know early mathematics, especially in group B1 and group B2, including obstacles to recognizing number symbols, obstacles to recognizing the concept of numbers, and obstacles to pronouncing number symbols. As for the results of interviews with teachers to obtain data, namely the practical obstacles obtained by students in groups B1 and B2, they often write number symbols incorrectly, for example (the number 6 is written as the number 9). Another problem was also encountered, namely the game media at the school was too old and not interesting, so children experience boredom. Therefore, there is a need for the latest media, such as what the researchers did, to overcome the problem of boredom and boredom in participating in early mathematics learning for children. The problems that occur in Kindergarten educational institutions, especially in groups B1 and B2, require action, namely conducting research on how teachers should provide learning that has a big impact on children in stimulating early mathematics skills in class and outside of class. Because during the observation the researcher found that in mathematics learning, guidance from the teacher was still needed in learning activities and in other activities, this was seen during marching activities and learning activities, students in groups B1 and B2 still needed help to say numbers because these students were not yet able to Say the number symbols correctly.

Every child who will be the successor of the nation and state must be able to develop knowledge, skills and interests, all of which can be obtained by learning. In learning, a person needs other people such as teachers, especially for young children, to stimulate their potential. Apart from that, in learning in this modern era, there is very sophisticated technology that can be used as a medium for learning knowledge (Solikah & Novita, 2022; Yu et al., 2022). According to previous study the teacher's role is to provide, direct, guide and motivate students in interacting with available learning resources (Dewanti et al., 2021). Not only educational materials in the form of people, but also other educational materials. Therefore, learning tools such as media are needed to improve learning abilities and success. With the help of learning materials, students can understand what they have learned, not only for adults, learning media is very good to use to help children's abilities in their lives because early childhood is often referred to as the "golden age" or golden age because at that age children early childhood has a brain that can absorb many things it has encountered (Ellizah et al., 2020; Storli & Hansen Sandseter, 2019). In this study, researchers attempted to stimulate children's initial mathematical knowledge, especially aged 5-6 years, by using learning media in the form of number light.

In mathematics, it is known as the number symbol, which is a mathematical concept that we need to develop for the next generation from an early age to prepare children to recognize number forms so that they can be conveyed orally, such as saying the numbers 1-10 (Cubukcu et al., 2020; Dorouka et al., 2020). Other study emphasizes that the cognitive development stages of children aged 4-6 years are

creating creative games, creating shapes from clay, building buildings from blocks, pronouncing and counting numbers 1 to 20, recognizing number symbols, making connections. concepts with number symbols, etc (Li & Chu, 2021).

There is stimulation to stimulate children's abilities, one way is to develop Number Light media which can stimulate early mathematical abilities in children, where in number light media there is learning to recognize numbers so that children can be helped in ordering number symbols and recognizing numbers correctly (Buck, 2017; Csapó, 2022). Number Light learning media is a media in an effort to facilitate the growth and development of children's mathematical abilities. It is hoped that this media can help children's learning activities at school and maximize the potential that children have through several activities including playing which can provide an opportunity for exploration for children, besides that, children can find and express an emotion so that children can be creative and broaden their insight (Kurniawan et al., 2020; Naderer, 2021). According to previous study stated that early childhood who are in the phase of studying in kindergarten institutions at the age of 4-6 years is education for children to have awareness about themselves, so that they can manage several habits and have a responsive nature towards things that are dangerous during activities, especially playing (Musyarofah, 2017).

Play is a term that is not easy to explain. All children definitely enjoy playing. Playing cannot be equated with studying, let alone working like an adult. Therefore, it can be concluded that a child's play is a medium for children to learn and gain knowledge, both directly and indirectly (Qurohman et al., 2019; Tytler & Prain, 2022). Early childhood play media is a tool used for play that has several functions in the child's growth and development process. According to previous study the function of games for children can develop the muscles and energy in the child's body where in this game media children can develop their potential such as cognitive development, social development, emotional and physical development (Gebre, 2018). General knowledge such as science, concepts of shape, color, size, patterns and number concepts, numerical symbols and cognitive skills are the level of development that must be achieved by children, especially at the age of 5-6 years. Therefore, all the skills mentioned above must be stimulated from an early age, both in children in recognizing numerical concepts, addition, multiplication, subtraction and division.

Kindergartens, especially groups B1 and B2, have the characteristics of children who still like to play, so that through Number Light media they don't get bored quickly and study longer, which is the key to overcoming children's problems in recognizing numbers. The novelty of this study is application of number light media is very suitable for children who have active play characteristics where this media has the principle of "learning while collaborating with play", so that the goal is clear, namely "meaningful learning". Apart from that, the results of applying this media are also expected to produce good results for children, namely a learning atmosphere that is fun and easy for educators and students to understand. The aims of this study is to develop a Number Light media with the aim of stimulating children's knowledge of early mathematics in early childhood aged 5-6 years in Kindergarten to improve initial mathematical abilities in children aged 5-6 years in kindergarten.

2. METHOD

This research includes development research or is called research and development. Research and development methods are research methods used to create certain products and to study the effectiveness of these products (Groenewald, 2004). Research and development is a process or step to develop new products or improve existing products. Based on this understanding, researchers developed a product in the form of number light media as a learning tool for students who still lack understanding of mathematics for students in class B in kindergarten using the ADDIE model. The ADDIE model is a model that serves as a guideline in producing devices that are effective, dynamic and useful for users. The ADDIE model consists of five steps or stages of development, namely (1) Analysis (analysis), (2) Design (design), (3) Development (development), (4) Implementation (implementation/execution), (5) Evaluation (evaluation/feedback) (Branch, 2009). In this development research, data collection methods can be carried out by means of interviews and questionnaires. In the interview method, researchers found a problem, namely the lack of interesting learning, students experienced difficulty in working on questions given by the teacher, and the existing game media was still less interesting. In the questionnaire, the researchers wanted to know the practicality of number light media in stimulating early mathematics abilities in group B students in kindergarten. The instrument grid for media expert is show in Table 1.

Table 1. Test Instrument Grid for Media Experts

Variable	Aspect	Indicator	Number of Items
Quality of learning media	Appearance	Interesting use attractiveness background color, Clarity of media background, Media size, Placement of numbers, Placement of media materials.	6
	Presentation	The media is designed practically, Media durability, Ease of use, Long term benefits of media.	4

Validity test uses the Gregory formula or Judges test. The content validity coefficient can be carried out qualitatively and quantitatively by several experts. The concept of validity refers to the appropriateness, meaningfulness and usefulness of conclusions made based on instrument scores. The higher the validity of an instrument, the better the conclusions drawn and the better the level of meaningfulness and usefulness. Content validity can be determined by an assessment carried out by experts (judges) by examining the instrument's grid items. From experts to the visualization media instrument grid, integrated auditory in a 2x 2 cross tabulation can be seen in [Table 2](#).

Table 2. Gregory Formula

Judges	Judges I		
	Judges' assessment	Not enough Relevant	Very Relevant
Judges II	Less Relevant	A (--)	B (-+)
	Very Relevant	C (+-)	D(++)

Then content validity is then sought using Gregory's formula, then calculate to the criteria, content validity coefficient criteria is show in [Table 3](#).

Table 3. Content Validity Coefficient Criteria

Coefficient	Validity
0.80-1.00	Content validity is very high
0.60-0.79	High content validity
0.40-0.59	Moderate content validity
0.20-0.39	Low content validity
0.00-0.19	Content validity is very low

3. RESULTS AND DISCUSSION

Result

This research was carried out in the odd semester, academic year 2023/2024. This research was carried out through five stages in accordance with the ADDIE development model, namely (analyze), (design), (development), (implementation), and (evaluation). Before the Number Light media was developed, an analysis was carried out aimed at obtaining data on product development needs such as problems faced by students and teachers, availability of learning materials or media, analysis of student characteristics, as well as collecting information about the media needed and expected by students and teachers as user. Development of Number Light media to stimulate early mathematical abilities in children aged 5-6 years in Kindergarten. The design the number light media is show in [Figure 1](#).



Figure 1. Display of Learning Media Material

After the media has been designed, then proceed with the develop stage. Where in this stage the media prototype that has been created will be tested for validity. The results of the validity test from two experts are shown in [Table 4](#).

Table 4. Validity Test Result

No	Aspect	Respondent	
		1	2
1	Interesting use	5	5
2	Attractive background color	5	5
3	Clarity of media background	5	5
4	Media size	5	5
5	Placement of numbers	4	4
6	Placement of media materials	5	5
7	The media is designed practically	5	5
8	Media durability	4	5
9	Ease of use	5	5
10	Media security	5	5
Amount		48	49

Base on [Table 4](#), the validity results obtain the processed using the formula. After obtaining the results and expert testing, the results are then converted to a benchmark assessment table on scale 5. Based on the scale 5 conversion table, the percentage achievement level is 97%, which is a very good qualification. Based on these calculations, Number Light media in stimulating early mathematical abilities in children is suitable for use.

Discussion

This research creates a new learning media known as Number Light, which is designed to improve early mathematics abilities in children aged 5-6 years. The development of this learning media aims to support teachers in managing the learning process in the classroom so that children can understand the concept of numbers more quickly. Researchers are interested in testing the effectiveness of a learning media called Number Light in stimulating children's early mathematical abilities to improve learning. This was explained by previous study state electronic-based media, Number Light Light, is a means that supports improving children's achievement through the following steps: 1) Saying the numbers, 2) Identifying the number symbols displayed on the media, 3) Sorting the numbers based on the symbols displayed on the media, 4) Matching objects with number symbols on the media, 5) Children can show number symbols that match the numbers spoken ([Mungkur et al., 2021](#)). The role of teachers is very important in efforts to enable young children to remember numbers for a longer period of time through number light learning. The introduction of number concepts in early childhood is different from the approach applied to older age groups such as children, teenagers or adults ([Hassan Al-Ahdal, 2020](#); [Kurniawan et al., 2020](#)). Because of the special characteristics possessed by young children, learning processes tailored to them must take into account the unique conditions and needs at that stage of development.

The use of various media that are interesting and appropriate to the development of early childhood can be a way to teach them mathematical concepts. The important role of learning media can be felt in implementing the learning process for these children. These media not only attract children's interest, but also help them understand the learning context more easily. The use of various learning media according to needs, as stated by previous study has the potential to motivate children in the learning process, trigger their interest, and support learning that suits their interests and capacities ([Fitriatien et al., 2020](#)). One effective means of introducing early mathematical concepts to young children, especially those aged 5-6 years, is by using Number Light media.

In research on Number Light media, the ADDIE development method was applied. The ADDIE development stages consist of five phases, namely: analysis, design, development, implementation and evaluation. The determination of the ADDIE development model was motivated by its ability to create interactive learning materials that are adapted to pre-arranged procedures. Thus, the final results produced can be applied efficiently according to students' needs ([Chuseri et al., 2021](#); [Kunto et al., 2021](#)). The specific stages in the ADDIE development model are namely the analysis stage, the first step in the ADDIE development model is to carry out an analysis related to student needs. In this process, data related to the learning media to be created will be collected, studied, and designed to suit the needs and

challenges that exist in the learning environment. As a result of the analysis, an interactive learning media known as number light was created (Ghofur & Youhanita, 2020; Harahap & Siregar, 2020). This media is designed to encourage numeracy skills in children aged 5-6 years.

The creation of number light aims to make it easier for children to remember numbers while attracting their attention so that learning becomes a fun experience. (2) The design stage involves the process of designing Number Light media according to the results of previous analysis. In this design, safe media materials were collected, including 3 A4 size acrylic sheets, 20 switches, 20 light bulbs, adapters and connectors. After all the materials are collected, the next step is to arrange these components to form learning media. The final stage, namely finishing, involves adding frames and stickers to the Number Light media to improve its appearance. (3) At the development stage, the previously planned media development process is carried out. After completing the development of Number Light media, the next step involves evaluation by experts, such as lecturers or experts who have expertise in their field. This stage also includes a validity test to evaluate the suitability of the media that has been designed (Damyanov & Tsankov, 2018; Delgadova, 2015). The content validity test of the instrument involved two lecturers, one media expert, and one material expert. The results of the validity test show that the media instrument scored 92% of 10 questions, while the material instrument scored 89% of 9 questions. This assessment confirms that Number Light media is suitable for use in learning to awaken early mathematical abilities in children aged 5-6 years. (4) At the implementation stage, researchers apply the planned media to children (Samerkhanova & Imzharova, 2018; Williams & Dries, 2022).

The aim of this implementation process is to evaluate the results of the Number Light learning media. A number of tests, including field tests, were carried out in the process. Evaluation of each test showed a score of 93% from 18 questions asked to 2 teachers and 97% from 10 questions answered by students in classes B1 and B2. These results reach very high qualification standards, ensuring that the use of Number Light media is very suitable for learning activities, especially in classes B1 and B2 in Kindergarten (5). Evaluation stage, the evaluation stage is the final stage where at this stage The researcher added suggestions provided by media expert lecturers and material experts. This evaluation process is very important to carry out in order to get better final product results. In previous research, the media created had similarities in terms of stimulating early mathematical abilities in children, but the differences lay in the target age and there were also many differences in terms of concept and appearance, whereas in previous research the numbers 1-10 were still used only, for Number Light media (Asih & Ramdhani, 2019; Yuliana et al., 2022). Still using materials such as acrylic and other materials and the appearance is still not perfect, because number light media has limitations in its manufacture and application.

Based on this explanation, it shows that the Number Light media to stimulate early mathematical abilities in children aged 5-6 years is used in the learning process and obtains a positive response from students and teachers, because the Number Light media can help the learning process in recognizing numbers. This research makes an important contribution to early childhood education, especially for children aged 5-6 years (Buckler et al., 2021; Rosmiyati & Wahyuni, 2019). The use of Number Light media can be a tool used by teachers in classroom learning to stimulate the early mathematical abilities of children aged 5-6 years. Number Light media has the advantage of being a tool that is easy for children to understand. This ease comes from its simple use and attractive visual appeal for children, as well as being a new medium in the classroom. However, the weakness lies in the use of electronic media materials which may require periodic replacement due to the risk of damage due to age of use.

The implication of this research is that there is Number Light media to stimulate early mathematical abilities in children aged 5-6 years who have very good qualifications. Number Light media can be used by teachers to expedite the learning process, especially in stimulating early mathematical abilities in children aged 5-6 years. So by using Number Light media the teaching and learning process will run according to what is expected by the teacher and children. With the Number Light media in stimulating early mathematical abilities in children aged 5-6 years, it is hoped that learning activities will be more effective and enjoyable for children. Apart from the Number Light media, this introduces number symbols, children will recognize colors on a colorful background, and also stimulates fine motor skills. child when pressing the button on the Number Light media.

4. CONCLUSION

Design the media number light using the ADDIE development model. This development model was chosen by the researcher because it is suitable for developing Number Light media and the selection of this development model has received approval from the supervisor. ADDIE development model with five stages, namely: Analysis, design, development, implementation, evaluation/research (Evaluation).

The results of the expert test and large group test, starting from the material content expert, scored 89% in the good category, the validity results of the practitioner expert got a score of 93% in the very good category, the media validity results got a score of 92% in the very good category, the validity results The large group test obtained a score of 97% in the very good category. Based on the results of this research data analysis, it is known that the Number Light media product in stimulating early mathematical abilities in children aged 5-6 years is valid for use in the learning process in Kindergarten.

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