

The Variety of Mathematics Learning Media for Early Childhood in Improving Basic Mathematics Ability

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Abstract

Introduction to mathematics in early childhood is a very important cognitive aspect to be given. One of the things that can be done is the development of innovative mathematics learning media for early childhood. This study aims to conduct a literature review related to the various uses of mathematics learning media in early childhood. Data collection was carried out by reviewing all related articles published in the 2019-2022 period. After conducting a thorough review, there were 30 reputable articles from accredited journals used in this study. The results showed that there were 27 effective learning media that could be used by teachers at the time of learning to improve early childhood math skills. The researchers found that the teachers changed the normal learning strategy to a limited face-to-face learning strategy. For example in schools, teachers as educators had their own short-time learning strategies, so the learning process can be conducted effectively.

Keywords: Online Learning, Application E-Learning, Web-Based E-Learning

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INTRODUCTION

Early childhood education is the basic foundation that can be used as a means to develop every potential and intelligence in children to the fullest. Early childhood is in the age range of 0-8 years, where this period is a very appropriate time to provide basic lessons so that children develop optimally and have readiness to enter the next level of education. Early age is often referred to as *golden age* or the golden age in which the human brain can function up to 80% to receive all the information provided by the surrounding environment (Xiong, X., Deng, L., & Li, H. 2020; Suryana, 2018). Therefore, early childhood is a period that has the potential to stimulate all aspects of development in early childhood, one of the most important aspects is the cognitive aspect which includes basic understanding or beginners in mathematics.

The provision of stimulation in introducing basic mathematical abilities to children has great potential to be developed. Recent literature studies have shown that early childhood mathematical knowledge and reasoning is highly malleable (Rosenfeld, D., Dominguez, X., Llorente, C., Pasnik, S., Moorthy, S., Hupert, N., & Vidikis, R. 2019). But unfortunately, the ability of most early childhood in Indonesia in mathematics is still

relatively low. This is evidenced by the data from a survey on a program to measure children's achievement in the field of mathematical ability conducted by the *Program for International Student Assessment (PISA)*. It was found that mathematics ability in children in Indonesia is still relatively low (Rahardi, F., & Dartanto, Q. 2021; Hewi & Salih, 2020). Even in 2018 Indonesia was ranked seventh from the bottom (73) with an average score of 379 in the field of mathematical ability, (Tohir, 2019). To improve the results of the assessment, one of the things that can be done is to optimize the provision of stimulation to aspects of early childhood development. This is because early childhood education is the initial education taken by children and is the foundation for developing each child's potential to the fullest (Chen, S., & McDunn, BA 2022; Hewi & Shaleh, 2020). The same opinion was also expressed by (Maryatun, 2016) who emphasized that early childhood education is very essential for the ability of Indonesian children because PAUD is the first foundation in optimizing child development. So it can be concluded that the development of basic mathematical abilities in early childhood is very important to do in an effort to improve the quality of mathematics learning and prepare children from an early age to enter the next level of education.

Learning mathematics is still often considered the most difficult and frightening subject by students in Indonesia. This stigma is felt by almost all students at every level of education (Laily, A., Jalal, F., & Karnadi, 2019). One of the causes is the monotonous learning system and the lack of use of mathematics learning media to make learning interesting and fun for early childhood. Some mathematics learning media sometimes have been provided by each early childhood education. However, the problem is that there are many teachers who have difficulty in choosing and applying a variety of interesting and appropriate learning media in accordance with each basic aspect of mathematics for early childhood which includes the concepts of numbers and geometry as basic mathematical abilities (Charlesworth & Lind, 2012), skills numeracy as an essential ability in mathematics (Nasution, N. 2019), and the development of mathematical logic as a determinant and supporter of other aspects in the development and introduction of mathematics in early childhood (Rahmalia, D., & Suryana, D. (2021,

the introduction of mathematics for early childhood can be optimized by using a variety of interesting and fun learning media (Disney, L., & Li, L. 2022). Learning media is an important factor in early childhood mathematics learning, because it can be interesting attention is also able to provide good and easy learning (Azhima, I. 2021).

Learning media is used to facilitate the learning process of early childhood. Moreover, early childhood learning is often associated with games to invite students to learn while playing. Even based on the latest curriculum developed by the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, it is known that playing is the essence of curriculum and learning in early childhood education, namely "Freedom to Learn, Free to Play". Play is learning, and play-learning is an activity that is essential for optimal development. Children learn through play as they explore the environment to recognize the world around them (Kemendikbudristek RI. 2021).

The early childhood learning process cannot be separated from the use of learning media because learning media can facilitate early childhood learning activities so that the stimulation provided by the teacher is easily accepted by students (Oranç, C., & Küntay, AC 2019; Nugrahani, R. 2021) . Learning media is an important component of learning that contains instructional material and can stimulate children to learn optimally (Liliyafi, 2019). In addition, learning media also plays an important role in creating an interesting

and fun learning process (Fitriani et al., 2021). Even learning media is also one of the factors to support the success of the learning process (Yuliasari & Permata, 2021).

Based on the description above, it can be concluded that learning media is one of the important components that must be developed in providing stimulation to maximize basic mathematical abilities in early childhood. Therefore, researchers are interested in making a literature review on the various uses of mathematics learning media in early childhood. So that finally this research can be useful for educators in selecting and applying various effective mathematics learning media and according to each cognitive aspect to improve basic math skills in early childhood.

METHOD

The researchers used the SLR (*Systematic Literature Review*) method, in this case there are four stages carried out namely the process of identifying, reviewing, evaluating, and finally interpreting all available research. Through this method, researchers review and identify structured journals that exist in each process (Triandini, Jayanatha, Indrawan, Werla Putra, & Iswara, 2019).

Furthermore, to complete the process of collecting the required data, the researcher collected reputable articles from various accredited journals. The search process is carried out by entering the keywords Mathematics Learning Media, and Early Childhood on Google Scholar. The articles collected were articles published in the period 2019 to 2022. From several articles, the researchers selected 25 articles that were closely related to the keywords used.

The next step is that researchers group various articles according to their respective development topics, both those relating to early childhood mathematics learning in general and development in particular. The metadata of the articles is then tabulated in the form of a table which includes the identity of the author, journal, title, year of publication, type and research results. At the end of the step, the researcher compares the findings in the article and provides conclusions (Sartika & Octafiani, 2019).

RESULT AND DISCUSSION

The term mathematics originally came from the Greek word *mathenein* or *mathein* which means to study (Fitria, 2013). Meanwhile, according to the Big Indonesian Dictionary (KBBI), mathematics is defined as the science of numbers, the relationship between numbers, and the operational procedures used in solving number problems (KBBI, 2022). Thus, it can be concluded that mathematics is a lesson that includes numbers and the relationship between numbers.

Furthermore, according to the opinion *National Council of Teachers of Mathematics* (NCTM), it was found that mathematics is a subject that is very closely related to numbers (Handayani, 2018). Apart from this opinion, James in (Jannah, 2011) reveals that mathematics can be interpreted as the science of logic regarding quantities, arrangements, shapes, and concepts that are interrelated with one another. This is also in line with the opinion (Ridwan, T. 2020) which reveals that mathematics is a discipline of logic to master the form, arrangement, magnitude, and concepts that relate to each other in large numbers and are divided into three main areas namely algebra, analysis, and geometry. (Ridwan, T., Hidayat, E., & Abidin, Z. 2020). Based on the description of these opinions, it can be concluded that mathematics is not just studying numbers and number symbols, it is more broadly to know about shapes, arrangements, quantities, and interrelated concepts.

Mathematics is one of the contexts of science which is included in aspects of cognitive development in early childhood. Learning mathematics is one way to train children's ability to think systematically and logically. The purpose of learning mathematics in young children is to stimulate children's thinking skills to have readiness in learning mathematics, so that children can master various mathematical knowledge and skills that make it easier for children to learn at a later stage and enable them to be able to solve problems in everyday life. (Katharina, J., Schmerse, D., Lankes, EM, Carstensen, CH, & Steffensky, M. 2021; Maulana, RA 2019). It can be concluded that mathematics is a scientific discipline that can train children to think logically and systematically to be able to solve problems in everyday life.

As for the basic mathematical abilities that can be introduced to early childhood, according to Suyadi and Masnival in (Kurniawan et al., 2019), it is revealed that there are several concepts of early mathematical cognitive abilities that can be introduced to early childhood, namely the concepts of shape, size, pattern, color, and space. Furthermore, *The National Council Teachers of Mathematics (NCTM)* suggests that there are five basic mathematical concepts that can be introduced to children, namely, the concept of numbers, geometry, number operations, measurement, algebra, probability, and data analysis (Hapsari et al., 2019) . However, in essence, there are two main concepts that are most important to be introduced to early childhood, namely the concepts of numbers and geometry. This is in line with the results of research from *The National Research Council Committee on Early Childhood Mathematics*, which says that there are two main concept areas that are the focus of learning mathematics in early childhood, namely the concepts of numbers and geometry (Charlesworth & Lind, 2012). Apart from these two concepts (Nasution, N. 2019) in his research states that numeracy is also a cognitive aspect that must be developed by teachers in early childhood because numeracy is a very important ability in mathematics. Furthermore, to support various cognitive aspects in early childhood, mathematical logic intelligence is also important to be developed. This is in accordance with the opinion of Rahmalia, D., & Suryana, D. (2021) in a study which suggests that one of the intelligences that must be improved in early childhood is mathematical logic intelligence because this intelligence will be a determinant and supporter of abilities in the field concerned. other. Thus, it can be concluded that there are four basic cognitive aspects of mathematics that need to be developed in early childhood, namely the concepts of numbers and geometry which are basic mathematical abilities, numeracy skills as essential abilities in mathematics, and the development of mathematical logic as determinants and supporters of these aspects. to develop math skills.

In providing stimulation of basic mathematical abilities in early childhood, a teacher certainly requires learning media that are used to facilitate an effective and interesting learning process. Moreover, early childhood learning is often associated with games to invite students to learn in a fun atmosphere. The following are the results of research from several articles related to learning media that are considered effective and able to improve children's basic mathematical abilities which include the concepts of numbers and geometry.

Table 1 Research on Learning Media Covering the Concepts of Numbers and Geometry

Research and Year	Journal	Research Results
Handayani, AD, & Iswantiningtyas, V. (2020)	<i>Journal of Physics: Conference Series</i>	This study uses <i>Research and Development (R&D)</i> with the results showing that the use of <i>gejlik</i> game media is considered very effective and able to improve the ability of early childhood in the field of basic geometric concepts, namely
Laily, A., Jalal, F., & Karnadi. (2019)	Obsession Journal: Journal of Early Childhood Education	. The research used is classroom action research with the conclusion that the use of a blackboard as a medium for learning mathematics in early childhood can improve the ability of early mathematical concepts which include numbers and geometry in children aged 4-5 in Permata PAUD Ibu Ceria
Nasution, N., Yaswinda, Y., & Maulana, I. (2019).	Obsession Journal: Journal of Early Childhood Education	This research uses a qualitative descriptive type with the results showing that Smart Prisma Media can make children know the concept of numbers, number symbols, count objects effectively and pleasantly
Ridwan, T., Hidayat, E., & Abidin, Z. (2020).	<i>Journal of Teknoinfo</i>	Research using the <i>Research and Development (R&D)</i> concludes that the <i>Game's N-Ram</i> media can be used as a learning media as well as entertainment to improve geometry learning in early childhood
Azhima, I., Meilanie, RSM, & Purwanto, A. (2021).	Obsession Journal: Journal of Early Childhood Education	Research using the literature study method concluded that the use of <i>flashcard</i> can help children understand mathematical concepts at the beginning which includes the concepts of numbers and geometry effectively and efficiently
Roostin, E. (2021).	Obsesi Journal: Journal of Early Childhood Education	. Research using descriptive qualitative methods with research results showing that the use of Montessori <i>number rods</i> can improve the ability of early childhood number concepts effectively and fun
Husna, A., & Nurhafizah, N. (2022)	Pedagogy: Journal of Educational Sciences	Using this type of qualitative descriptive research with the results of the study it was found that there were 11 mathematics learning media that could be used to introduce numbers to early childhood.

Ulfah, M., Nurhayati, E., & Abyati, H. (2019)	Al-Athfal Journal of Children's Education	This study uses <i>Research and Development (R&D)</i> results showing that <i>box of number</i> is proven to be effective for learning Beginning mathematics in recognizing numbers for early childhood
Fitriatien, SR, Mutianingsih, N., Wantika, RR, Nugraheni, L., & Sugandi, E. (2020).	Journal of Dinamisia	The conclusion obtained from the results of this study is that the use of songs can help PAUD Mothers to introduce basic mathematical concepts in the form of numbers and geometric shapes to early childhood in a fun way.
Azizah, IN, Dea, LF, Yusuf, M., Zuniati, M., & Muslimin, A. (2021).	Yaa Bunayya: Journal of Early Childhood Education	This study uses a quasi-experimental method with the conclusion that the use of educative comics media has a significant effect on increasing the ability to recognize numbers on aspects of mathematical communication disposition in early childhood
Nurhayati, E., Jazariyah, J., & Ellawati, S. (2022)	KINDERGARTEN: Journal of Islamic Early Childhood Education,	A quasi-experimental method was used in this study. The results obtained are the use of Paint application media in early childhood has the effect of increasing early childhood mathematical abilities which include the introduction of numbers, geometry, and colors.
Rekysika, NS, & Haryanto, H. (2019).	Early Horizons: Journal of Early Childhood Education	This research uses quantitative research methods with experimental types. The results showed that the snake and ladder game media was proven to increase children's learning motivation in recognizing numbers and number operations in a fun way for early childhood children
Amalia, A., Syaodih, HE, & Gustiana, AD (2019).	EDUKIDS: Journal of Growth, Development, and Early Childhood Education	This research is a Classroom Action Research (CAR) with research results showing that the use of APE puzzle learning media is proven to increase the ability to master simple number concepts in early childhood at RA AL-Kautsar Cimahi
Sutresna, J., Yanti, F., & Safitri, AE (2020).	JUSTIN (Journal of Information Systems and Technology)	This study uses the <i>waterfall</i> with the results of the study found that the use of <i>augmented reality</i> can make it easier for early childhood children to learn mathematics in an interesting way

Devi, NMIA (2020)	Scientific Journal of Teacher Professional Education	This research is a development research using the ADDIE model. The results showed that the number puzzle learning media was effective in increasing the ability to recognize number symbols for early
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In addition to the ability to conceptualize numbers and geometry, providing a stimulus to improve early childhood numeracy skills is also very important. As stated by (Nasution, N. 2019) in his research which states that the ability to count is a cognitive aspect that must be developed by teachers in early childhood. Therefore, a teacher also needs media to provide a stimulus to improve numeracy skills in early childhood. The following are the results of research from several articles related to learning media that are considered effective and able to improve numeracy skills for early childhood.

Table 2 Research on Learning Media to Improve Numeracy Skills for Early Childhood

Research and Year	Journal	Research Results
Handayani, AD, & Iswantiningtyas, V. (2020)	<i>Journal of Physics: Conference Series</i>	This study uses the Research and Development <i>Research and Development (R&D)</i> with the results showing that the use of Dakon media is considered very effective and able to improve the ability of early childhood in simple arithmetic which includes addition and subtraction of
Ramlah, R., Riana, N., & Abadi, AP (2022).	<i>SJME (Supremum Journal of Mathematics Education)</i>	This research uses descriptive qualitative method. The results show that the use of number puzzle media has proven to be effective in increasing learning motivation, and providing a clearer understanding for early childhood in recognizing the concept of geometric numbers
Maulyda, MA, & Hidayati, VR (2020).	<i>Symmetry: Pasundan Journal of Research in Mathematics Learning and Education</i>	This research uses the Classroom Action Research (CAR) method with research results showing that the use of stick board media has been shown to effectively develop early numeracy skills in early childhood
Nofriyanti, Y., & Sari, HM (2019).	<i>Journal of Early Childhood Education</i>	This research uses a qualitative descriptive method. The results of the study concluded that the use of smart dice stacking media was able to increase the ability of early childhood in simple calculation concepts

Maulana, IM, Yaswinda, Y., & Nasution, N. (2020).	Obsesi Journal: Journal of Early Childhood Education.	This type of qualitative descriptive research with the conclusion that the use of <i>rainbow</i> in introducing the concept of multiplication makes students not afraid to learn mathematics and creates a fun and effective learning atmosphere to improve student cognition
Annisa, EN, Supriyati, Y. , & Conscience, Y. (2020).	Obsesi Journal: Journal of Early Childhood Education	Using a qualitative research approach with the results of the study it was concluded that the use of <i>Rangkasbitung</i> able to improve numeracy skills and cardinality of early childhood
Maharani, S., Nusantara, T., As'ari, AR, & Qohar, A. (2020).	Obsesi Journal: Journal of Early Childhood Education	This study uses Research and Development <i>Research and Development (R&D)</i> with the conclusion, CSK media (<i>CT-Sheet for Kids</i>) meets the criteria of being effective, valid, and practical in introducing <i>Computational Thinking</i> to children after an early age
Kartinih, I ., Nurhayati, S., & Nurunnisa, R. (2021).	Journal of CERIA (Cerdas Energik Responsive Inovatif Adaptif)	This study uses a qualitative descriptive method with research results showing that the use of smart bottle cap board media can improve numeracy skills in early childhood effectively and fun
Febiola, KA (2020).	Scientific Journal of Teacher Professional Education	This research is a development research using the ADDIE model. The conclusion obtained is that the use of number tree learning media for early childhood has been proven to improve early numeracy skills in compiling, mentioning, and distinguishing numbers, and matching numbers with number symbols
Dewi, NWUR, Asril, NM, & Wirabrata, DGF (2021)	Journal Scientific Teacher Professional Education	This type of development research uses the ADDIE model. The results showed that the learning media with animated videos was considered suitable for use in the early childhood learning process to improve early numeracy skills for children

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In addition to the ability to conceptualize numbers and geometry, as well as numeracy skills, it is also important to give mathematical logic skills to early childhood to improve children's mathematical logical thinking skills. This is because mathematical logic is the main intelligence that can improve other intelligences. This is also in accordance with the opinion of Rahmalia, D., & Suryana, D. (2021) in a study which suggests that one of the intelligences that must be improved in early childhood is mathematical logic intelligence because this intelligence will be a determinant and supporter for abilities in the field of mathematics. another. Therefore, a teacher also needs mathematics learning media in providing a stimulus in increasing mathematical logic intelligence in early

childhood. from several articles related to learning media that are considered effective and able to improve mathematical logic intelligence for childhood

Table 3 Research on Learning Media to Improve Mathematical Logic Intelligence for Childhood

Research	Results	.
early& Gems, RD (2021).	<i>JCE (Journal of Childhood Education)</i>	This research uses the Borg & Call development model with the results of the study, the use of <i>lift the flap</i> flannel effective to be used as a medium for learning mathematics in improving mathematical logic intelligence in early childhood
Ulya, N., & Munastiwi, E. (2021)	<i>AWLADY: Journal of Children's Education</i>	This research is a type of Classroom Action Development (CAR) research. The results showed that the use of <i>GeoBox</i> in early childhood has been proven to be able to effectively improve mathematical logic intelligence (
Rahmalia, D., & Suryana, D. (2021).	Journal of Basicedu	The research method used is the development of the ADDIE model with research results showing that flannel board media is very effective and practical to improve mathematical logic which includes aspects of mentioning and counting number symbols in early childhood
Nabighoh, WN, Mustaji, M., & Hendratno, H. (2022)	Journal of Obsession: Journal of Early Childhood Education	Research using the Pustaka study method concluded that interactive <i>puzzle</i> proved effective to be applied in learning and improve mathematical logic intelligence of early childhood
Hanifah, M., & Alam, SK (2019)	Journal of CERIA (Smart Energetic Responsive Innovative Adaptive)	This research uses <i>a quasi-experimental</i> with the conclusion that the use of lotto learning media has a significant impact on improving mathematical logical thinking skills in early childhood.
Nisa, A., Oktavianti, YM, & Sumitra, A. (2019).	Journal of CERIA (Smart Energetic Responsive Innovative Adaptive)	This research uses a quasi-experimental method with the conclusion that the use of numeric dice media can improve logical mathematical intelligence in early childhood

Based on the description above, it was found that there are as many as 6 learning media that have been proven to be effective in increasing the mathematical logic intelligence of early childhood.

The existence of a variety of media above that has been proven to improve basic mathematical abilities for early childhood will make it easier for teachers to choose and apply the most effective learning media and in accordance with each aspect and need in early childhood.

CONCLUSION

Giving children basic math skills is a very important cognitive aspect. One of the things that can be done so that it can develop optimally is the application of learning media that is fun and in accordance with each aspect of basic mathematical abilities in young children. The results found as many as 27 mathematics learning media which were proven to be able to improve children's basic mathematical abilities effectively and fun. The variety of media consists of mathematics learning media that can be used by teachers to develop basic mathematical abilities for early childhood which include the concepts of numbers and geometry, counting concepts, and mathematical logic.

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