

# Educational Game Tools in Early Childhood Mathematics Learning

Syafdaningsih\*, Rukiyah, Febriyanti Utami

*Department of Early Childhood Teacher, Universitas Sriwijaya, Indonesia*

*\*Corresponding author. Email: [syafdaningsihsyafar@gmail.com](mailto:syafdaningsihsyafar@gmail.com)*

## ABSTRACT

Learning mathematics for early childhood is one of the aspects of cognitive development that must be developed. Mathematics in early childhood can be taught by helping with learning media, in the form of educational games tools. This study aims to provide an overview of the use of educational game tools in early childhood mathematics learning. Educational game tools can be used in mathematics learning to make it easier for teachers to deliver learning material. However, in reality, teachers rarely use educational game tools in mathematics learning. The research method used is literature study. In this literature study research, researchers use various sources of literature from books, journals and research results. The results of the literature review show that learning mathematics needs to be introduced from an early age, because learning mathematics can stimulate children's thinking abilities, so that children have readiness of the next stage of mathematics learning. The results of several studies indicate that the use of educational play tools can improve aspects of children's cognitive development, including children's abilities in learning mathematics. The use of educational play tools in learning mathematics makes learning mathematics fun and facilitates children's understanding of mathematical concepts.

**Keywords:** *Educational game tools, Mathematics, Learning, Early childhood.*

## 1. INTRODUCTION

Early childhood education is a behavior development program or habituation and optimal development of abilities in children. Optimization of child development is done through educational programs. Early childhood education programs must pay attention to all aspects of child development and also be tailored to the needs, interests and abilities of children. One aspect of early childhood development that must be stimulated in educational programs is cognitive development.

Early childhood cognitive development includes the introduction of scientific concepts and the introduction of simple mathematical concepts. Early childhood mathematics learning is a means that can be used to develop thinking skills, encourages children to develop various intellectual potentials and data is used as a means to foster various positive attitudes and behaviors in the framework of basic personality layouts as early as possible such as critical, resilient attitudes, independent, scientific, and rational [1].

Children begin to develop mathematical thinking long before they enter school [2]. The teacher can facilitate math learning in children in fun math activities [3]. One of them is by using educational games. Learning mathematics at in early age can be done with various learning methods and learning media in the form of educational games. Educational game tools are something that can be used as or equipment for playing that contains educational values and can develop all abilities possessed by children [4].

The implementation of early childhood learning is expected that educators can use educational game tools so that the expected objectives or competencies can be conveyed easily. Educational game tools have an important role in the learning process, educational play tools are part of learning media that serve to convey messages / information.

The use of educational play tools in the early childhood learning process is also in accordance with the stages in children proposed by Piaget. Early childhood children aged 0-8 years are in the motor sensory phase, the pre- operational phase and the

concrete operation phase, where the child's ability to think logically begins to develop on the condition that the object which is the source of logical thinking is present concretely, then in mathematics he uses it in try to use props where the abstract can be concreted [5].

Then, from the results of observations and interviews conducted by researchers by several PAUD teachers, especially in the District of Seberang Ulu II, Palembang City, there are still many teachers who still have not maximized the use of educational game tools in the learning process, even though they have provided educational playing tools in PAUD institutions. Teachers prefer to use worksheets that are already available in textbooks used in schools.

Besides not optimizing the learning objectives set. Children also become less focused and easily get bored in the learning process. For this reason, the use of educational play tools is considered effective in the learning process, especially in children's mathematics learning.

## 2. METHOD

The research method used is a literature study. A literature study is a data collection technique by conducting a review study of books, literature, notes and reports that are related to the problem being solved<sup>4</sup>. Researchers conducted theoretical studies from various sources related to the research topic.

Sources of literature in this study are obtained from books, journals and research results. So that in this study includes general processes such as: systematic identification of theories, literature discovery, and analysis of documents containing information related to the research topic. The method for analyzing data uses descriptive methods to obtain the results of the analysis can be described as in-depth, detail, and detail.

## 3. RESULT AND DISCUSSION

According to Reys, et al in Suwaningsih and Turlina [6], mathematics is a study of patterns and relationships, a way or pattern of thinking, an art, a language and a tool. Brewer suggests that mathematics for early childhood is a way to see the world and their experiences in it [7]. In line with Safira and Ifadah's thinking, mathematics is a way of solving problems, understanding numbers and their operations, functions and relationships, probability and measurement [8].

Furthermore, Montolalu revealed that mathematics is an abstract system for experience in organizing and sequencing [9]. Early childhood think in concrete terms, concepts or sequences will mean nothing to them unless they have something concrete to count and sort.

Mathematics is essentially a thinking process that emphasizes reasoning because of the human mind, where learning mathematics has the aim of building mathematical concepts with the ability to form understanding based on experience.

Mathematics is a subject that has an important role in children's academic learning [10]. Children's early math skills are an important predictor of later academic success [11] and set the foundation for later mathematics skills [12-15].

The mathematical concept for early childhood according to Smith [16] is matching, classification, comparing and ordering or serialization. Meanwhile, the concept of early childhood mathematics is in accordance with the National Council Teachers of Mathematics (NCTM), namely: number sense, geometry, sorting and classifying, patterns, measurement, data collection [17]. These six math abilities can represent math abilities for preschoolers [18],[19].

Nikson in Mulyardi argues that mathematics learning is an effort to help children through the internalization process to construct mathematical concepts or principles to rebuild with their own abilities [20]. Mathematics learning is essential during the early childhood years to develop a basic understanding of numbers and quantities, geometry, spatial learning, thinking patterns and algebraic thinking [21],[22].

Learning mathematics for early childhood is very useful for the development of children's mathematical logic intelligence. According to Cobb in Setiawan, learning mathematics begins with something that children can imagine as something real and interactive [23].

Schwartz [24] provides instructions / rules about learning mathematics for children, namely (1) children learn from concrete to representational, to abstract thinking, (2) children's initial understanding of mathematics grows through experiences in making collections of concrete objects, (3) The child's early progress starts from what is known to the unknown, (4) children learn mathematics from simple knowledge to complex knowledge and skills.

The main objective in developing mathematics learning for children is essential to stimulate children's thinking skills so that they have readiness in learning mathematics at a later stage, so that children are able to master various mathematical knowledge and skills that enable them to be able to solve problems in their daily life [25].

Amalina [26] stated that learning mathematics for children is directly through empirical experiences

obtained through scientific processes to encourage the development of children's mathematical abilities. Learning mathematics is still considered as difficult and fun learning, for that we need a way that can make learning fun learning, one of which is by using educational game tools. Educational game tools are games that are deliberately designed specifically for educational purposes [27].

Astini, et al [28] stated that an educational game tool is a game tool for early childhood that can optimize children's development, which can be used according to their age and level of development of the child concerned. In line with the above opinion, according to Rahman, educational game tools are games that are specially designed for educational purposes, especially for preschoolers in improving the developmental aspects of all children's potential [29].

Educational play tools are a type of game that contains educational values that function to stimulate children's imagination in the process of cognitive development, the process of which is the provision of stimulation so that it can improve aspects of development in the development process of children as assessed from gross motoric development, fine motor skills, speech and language as well as socialization and independence skills [30].

According to Aqib [31], the uses of educational game tools include: (1) educational games are able to provide varied stimuli to the child's brain, so that it can function optimally. (2) educational play tools can overcome the limitations of knowledge (experience) that children have. the experience of each child is different. (3) educational play tools can go beyond the boundaries of the classroom, for example objects that are too large in the form of houses, schools, cars and others. Tool/media object model in the form of houses, cars, the teacher can display it to the child. (4) educational play tools allow direct interaction between children and their environment. (5) educational play tools to compare new desires and interests. (6) educational games motivate and stimulate children to learn.

The use of educational play tools during learning can support children's development [32] so that learning objectives can be achieved, besides that children also find it easier to understand what is conveyed because children learn from real or concrete objects [33]. In addition, Karim and Wifroh [34] revealed that educational play tools for children are play tools that can stimulate the senses and intelligence of children, which include the sense of sight, smell, taste, touch and hearing, which will later affect the cognitive development of early childhood.

Educational play tools can increase the interaction between children and their peers so that they will produce a generation that is not individualistic and easy to mingle. This game will improve logic-math intelligence of early childhood and can increase children's interest in mathematics. The terrible impression of mathematics will turn into fun and fun to learn [35]. Educational games can motivate children and learn to be more effective [36].

Faizudin [37] revealed that early childhood math skills can be improved by using educational games. Educational game tools that can be used, one of which is a smart watch. Smartwatch games can have a real enough effect on children in improving math skills, where children play to recognize the concept of numbers, and children will be more able to sort, count, connect the number of objects with numbers. Introducing the concept of numbers in early childhood can predict the development and achievement of mathematics in primary school [11, 38, 39, 40] In addition to smartwatches, introducing numbers to early childhood can also be introduced with a frog on a log.[22]



**Figure 1.** A Frog on a log.

Learning mathematics on the concept of recognizing the symbol of numbers and geometric shapes can be taught by using an educational game tool in the form of a pin board [41]. By using board game tools, the results of board games show that learning numerical quantities, counting and identifying numbers is preferred by children. Improving children's abilities about in early mathematics requires a shorter time using board game media. Treher [42] stated that the game board by pinning can facilitate the delivery of information in the learning process because in an effective game it functions to organize the conceptual framework information to be more concrete.

In learning mathematics, the introduction of the concept of geometric shapes can also be taught by using a geometry puzzle game tool.



**Figure 2.** Geometric puzzle game tool

With the geometric puzzle game tools, children can connect one object to another, children are able to perceive the concept of a lot or a few, children can harmonize the shape, color, size and number through activities of sorting objects, distinguishing sizes "more than", "less than" and " most ", easy to use by children, attract children's attention, fun for children and can be meaningful to children [43].

Furthermore, in learning mathematics, measurement material in early childhood can also be taught with educational games of measurement material [44] as shown in the image below:



**Figure 3.** Measuring Material Game Tool

The concept of pattern recognition and classification in mathematics learning can be improved by using the cuisenaire block [45]. Eliyawati [46] suggests that Georрге Cuisenaire creates cuisenaire blocks to develop children's numeracy skills, recognition of numbers and to improve children's reasoning.

The important educational play tools to be given to young children. Without educational play tools, children will feel bored and bored with learning. In addition to aiming for children not to feel bored and bored in learning educational game tools, it will also make children happier and can explore with learning according to themes. Therefore, in every learning at an early age, parents or educators need to provide these educational play tools and choose the right type of educational play tools for their students [47].

One of the roles of teaching aids/ educational games in mathematics is to lay down basic ideas on concepts. With the help of appropriate teaching aids, students can understand the basic ideas underlying a concept, know how to prove a formula or theorem, and

can draw conclusions from the results of their observations. In addition, using educational teaching aids/ tools will increase children's attention to the teaching being carried out, because they are actively involved in the teaching being carried out. With the help of teaching aids/ educational games, the concentration of learning can be further improved. Educational aids/ games can also help children to think logically and systematically, so that they ultimately have the mindset needed in learning mathematics [48].

Educational play tools have implications for learning, namely early childhood who in the learning process always use educational game tools, then the child will get one or more of multiple intelligence. The types of educational games that can be used include lego, circle tower, geometry tower, origami, rubber ball, picture book, congklak, seesaw, swing, rocking bridge, globe, rotary car and swing train [49].

From the various literature above, the researcher can conclude that educational game tools are game tools that can optimize early childhood development, one of which is cognitive development which includes learning mathematics. The use of educational game tools can be tailored to the needs and objectives of the implementation of learning to be achieved. Educational play tools can provide children with real experiences of concrete objects, so that learning mathematics becomes easier for children to understand. In addition, learning mathematics becomes fun learning for children at an early age. Educational game tools that can be used in early childhood mathematics learning include smartwatches, board game tool, geometric puzzle, measuring material game tool, cuisenaire block, lego, geometry towers, congklak, etc.

**4. CONCLUSION**

Children can understand mathematics learning that is conveyed because by using educational games, children can learn from real and concrete objects. Educational play tools are also used in stimulating various aspects of development in early childhood.

**AUTHORS' CONTRIBUTIONS**

All authors contributed to compiling, designing, and implementing this research.

**ACKNOWLEDGMENTS**

The author would like to thank FKIP Sriwijaya University for funding this research. The author also thanks all those who have helped carry out this research.

**REFERENCES**

- [1] Mirawati, Matematika kreatif: pembelajaran matematika bagi anak usia dini melalui kegiatan yang menyenangkan dan bermakna, *PEDAGOGI: Jurnal Anak Usia Dini dan Pendidikan Anak Usia Dini*, Vol. 3 No. 3a, 2017.
- [2] L. Hansen, Early childhood corner: ABCs of early mathematics experiences, *Tecahing Children Mathematics*, Vol 12 (4), 2005. pp. 208-212. DOI: <https://doi.org/10.5951/TCM.124.12.4.0208>.
- [3] R. S. Klibanoff, et al, Preschool children's mathematical knowledge: The effect of teacher "math talk". *Developmental Psychology*, 42, 2006, pp. 59–69. <https://doi.org/10.1037/0012-1649.42.1.59>.
- [4] B. Zaman, Media dan sumber belajar, Jakarta: Universitas Terbuka, 2009.
- [5] M. Jamaris, Perkembangan dan penge-mbangan anak usia taman kanak-kanak, Jakarta: Grasindo, 2006.
- [6] E. Suwaningsih, and Turlina, Model pembelajaran matematika, Bandung: UPI Press, 2006.
- [7] J.A. Brewer, Introduction to early childhood education: preschool through primary grades, New York: Pearson, 2007.
- [8] A.R. Safira, and I.S. Ayunda, Pembelajaran sains dan matematika anak usia dini, Jawa Timur: Caremedia Communication, 2020.
- [9] B.E.F.Montolalu, Bermain dan permainan anak” Jakarta: Universitas Terbuka, 2009.
- [10] S. Lee, Mathematical outdoor play: toddler's experiences, *Proceedings of the 33rd annual conference of the Mathematics Education Research Group of Australasia*. Fremantle: MERGA.
- [11] G.J. Duncan, et all, School readiness and later achievement, *Developmental Psychology*, 43, 2007. pp. 1428-1446. <http://dx.doi.org/10.1037/10012-1649.43.6.1428>.
- [12] B. Blevins-Knabe, Fostering early numeracy at home (rev. In Encyclopedia of language and literacy development. pp. 1-9. London, ON: Western University, 2012. Retrieved from <http://v.w.w.literacvncyclopedia.ca/pdfs/topic.php?topId=245>.
- [13] H.C. Hill, Policy is not enough: Language and the interpretation of state standards”, *American Educational Research Journal*, 38, 2001. Pp. 289—318. <http://dx.doi.org/10.3102/00028312038002289>.
- [14] T. Kleemans, et al, Child and home predictors of early numeracy skills in kindergarten, *Early Childhood Research Quarterly*, 27, 2012. Pp. 471-477. <http://dx.doi.org/10.1016/j.ecresq.2011.12.004>.
- [15] J.Le Fevre,et all, Home numeracy experiences and children's math performance in the early school years, *Canadian Journal of Behavioural Science*, 41, 2009. Pp. 55—66. <http://dx.doi.org/10.10371a0014532>.
- [16] S.S. Smith, Early childhood mathematics 5th edition, USA: Pearson, 2013.
- [17] National Council of Teachers of Mathematics. Principles and standards for school mathematics. Reston, VA: Author, 2000.
- [18] D.J. Purpura, and C.J. Lonigan, Informal numeracy skills. *American Educational Research Journal*, 50(1), 2013. Pp.178–209. doi:10.3102/0002831212465332.
- [19] S.A. Gray, and R.A. Reeve, Number-specific and general cognitive markers of preschoolers' math ability profiles. *Journal of Experimental Child Psychology*, 147, 2016. Pp. 1–21. doi:10.1016/j.jecp.2016.02.004
- [20] Muliyardi. Strategi pembelajaran matematika. Padang: FMIPA UNP, 2002.
- [21] A.N. Parks, and D.C. Blom, Helping young children see math in play. *Teaching Children Mathematics*, 20(5) 2013. Pp. 310-317
- [22] A. Karabon, The use of mathematics in early childhood classroom transitions to Foster co-construction of knowledge, negotiation, and cultural mediation. *Learning, Culture and Social Interaction*, 22, 2019. 100320. doi:10.1016/j.lcsi.2019.100320.
- [23] A. Setiawan, Meningkatkan kemampuan berhitung anak usia dini melalui media pembelajaran matematika di ra ma'arif 1 kota metro, *SELING, Jurnal Program Studi PGRA*, Vol. 4 No. 2, 2018. pp. 181-188.
- [24] L.S. Schwartz, Teaching young children mathematics. Westport, CT: Praeger, 2005.
- [25] D.H. Clements and J. Sarama. Math Play: How young children approach math. scholastic early childhood today: EC, 2005.
- [26] Amalina, Pembelajaran matematika anak usia dini di masa pandemi Covid-19 tahun 2020, *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, Vol. 5 (1), 2020.
- [27] S.M. Tedjasaputra, Bermain mainan, dan permainan. Jakarta: PT. Grasindo, 2001.
- [28] M Astini, Identifikasi pemanfaatan alat permainan edukatif (ape dalam mengembangkan motorik halus anak usia dini. *Jurnal Pendidikan Anak* ,Vol. 6 (1), 2017.

- [29] S.A. Rahman, Alat permainan edukatif untuk program paud. (Tadulako University Press, Palu, 2010. p. 17.
- [30] S.N.H. Sain, Pengaruh alat permainan edukatif terhadap aspek perkembangan pada anak pra sekolah di wilayah Puskesmas Ondong Kabupaten Kepulauan Siau Tagulandang Biaro. *Jurnal e-NERS, Vol. 1 No. 1, 2013.*
- [31] Z. Aqib, Belajar dan pembelajaran di taman kanak-kanak. Bandung: Yrama Widya, 2009.
- [32] M. Hadders-Algra, Interactive media use and early childhood development, *Journal de Pediatria*, 96(3), 2020. Pp. 273-275.
- [33] D. Rahma, Penggunaan alat permainan edukatif untuk mendukung perkembangan anak usia 5-6 tahun di paud al-fikri. Skripsi, Universitas Tanjungpura Pontianak, 2017.
- [34] M.B. Karim, Wifroh, and S. Herlinah. Meningkatkan perkembangan kognitif pada anak usia dini melalui alat permainan edukatif, *Jurnal PG PAUD Trunojoyo* Vol 1 No. 2, 2014.
- [35] S. Noveradila, and D. Larasati, Alat permainan edukatif untuk meningkatkan kecerdasan logika matematika anak usia dini, *Jurnal Tingkat Sarjana Senirupa dan Desain* No 1(1), 201).
- [36] J. Derboven, et al, Playing educational math games at home: The monkey tales case. *Entertainment Computing*, 16, 2016. Pp. 1–14. doi:10.1016/j.entcom.2016.05.004,
- [37] M. Fauziddin, Peningkatan kemampuan matematika anak usia dini melalui permainan jam pintar di taman kanak-kanak pembina kec. bangkinang kota. *Jurnal PAUD Tambusai* vol 1 No 1, 2015.
- [38] D.C. Geary, Cognitive predictors of achievement growth in mathematics: A five year longitudinal study. *Developmental Psychology*, 47, 2011. Pp. 1539—1552. <http://dx.doi.org/10.1037/a0025510>
- [39] N.C. Jordan, et al, Early math matters: Kindergarten number competence and later mathematics outcomes. *Developmental Psychology*, 45, 2009. Pp. 850-867. <http://dx.doi.org/10.1037/a0014939>.
- [40] J. Sarama, and D.H. Clements, Early childhood mathematics education research: Learning trajectories for young children. New York: Routledge, 2009. [http:// dx.doi.org/10.4324/9780203883785](http://dx.doi.org/10.4324/9780203883785).
- [41] A. Laily, et al, Peningkatan kemampuan konsep matematika awal anak usia 4-5 tahun melalui media papan semat, *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, Vol. 3 (2), 2019.
- [42] E.N. Treher, Learning with board games tools for learning and retention learning with board games. The Learning Key Inc, 2011 pp. 1–12.
- [43] Mutarmin, et al, Pengembangan alat permainan puzzle geometri di kelompok b taman kanak-kanak. *Tumbuh Kembang: Kajian Teori dan Pembelajaran*, PAUD, Vol. 7 No. 1., 2020.
- [44] Juniarti, et al, Pengembangan alat permainan materi pengukuran untuk anak kelompok b di tk negeri pembina 1 palembang. Skripsi, Universitas Sriwijaya, 2018.
- [45] M.N. Lasuka, and M. Ardina, Meningkatkan kemampuan pra-matematika dengan menggunakan media balok cuisenaire pada anak kelompok a2 PAUD Haqiqi Kota Bengkulu, *Jurnal Ilmiah Potensia*, Vol. 3 (1), 2018.
- [46] C. Eliyawati, Pemilihan dan pengembangan sumber belajar untuk anak usia dini. Jakarta: Depdiknas, 2005.
- [47] A. Riany, Alat permainan edukatif lingkungan sekitar untuk anak usia 0-1 tahun, Bandung: PT. Sandiarta Sukses, 2009.
- [48] Suwardi, et al, Pengaruh penggunaan alat peraga terhadap hasil pembelajaran matematika pada anak usia dini. *Jurnal Al-Azhar Indonesia Seri Humaniora*, Vo. 2 No. 4. 2014.
- [49] U. Hasanah, Penggunaan alat permainan edukatif (ape) pada taman kanak-kanak di Kota Metro Lampung. *AWLADY: Jurnal Pendidikan Anak*, Vol. 5 No. 1, 2019.