

DEVELOPMENT OF MATHEMATIC TOWER GAMES TO PRACTICE ABILITY TO RECOGNIZE THE CONCEPT OF NUMBER SYMBOLS IN EARLY CHILDHOOD

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Abstract: This research and development to develop a Mathematic Tower game for early childhood that can stimulate cognitive aspects, especially in the introduction of the concept of the symbol of numbers in children aged 4-5 years. This research was conducted in three kindergartens in Malang district. The type of research used was the *Research and Development* of Borg and Gall which has been modified from ten research steps to seven research steps. The types of data used in this study are quantitative and qualitative data. Qualitative data were obtained from interviews, observations, and suggestions from experts. While quantitative data were obtained from validation scores and group test results. The validation results obtained by experts obtained an average of 92,39%. The small group trials have obtained results of 94,2% with the subjects of the trial as many as 10 children. Then in the large group trials the results were 94,23% with 71 subjects as the test subject. Based on these results the development of the *Mathematic Tower* game is said to be valid and can be used in learning especially for the introduction of the concept of number symbols.

Keywords: mathematic tower game, the concept of number symbols, early childhood

INTRODUCTION

Early childhood is a period that is often referred to as the golden age or golden age. This period is an important time to provide stimulation or stimulus because at the age of 4 years the intellectual potential of children has formed 50%, and will reach around 80% at the age of 8 years (Ministry of National Education, 2007). Stimulation or stimulus aims to hone and train the child's ability to grow and develop in a balanced way. Several aspects must be developed in early childhood, namely aspects of religious and moral values, social-emotional aspects, cognitive aspects, language aspects, physical aspects of motoric, and artistic aspects. One important aspect that is developed for early childhood is the cognitive aspect.

Sarama & Clement (2011) state that mathematics is the basis of cognitive abilities, with early mathematics competence a strong measure of children's success in the future. Children have a deep and wide potential for learning mathematics. For many people, sometimes this potential cannot be realized. But the existence of structured mathematical research has been proven to be effective in helping all children in learning mathematics. Having such activities will provide a foundation and train children to think mathematically for their lives.

Children's lives without realizing it can not be separated from mathematical concepts. According to Hartnett (Seefeld & Wasik, 2009) states that numbers are the most important

mathematical concepts learned by children to develop sensitivity to numbers. The concept of the number symbol is integrated with the life of the child, such as when a child is asked questions about how old he is, what is the number of his shoes, in the form of the number of pencils in the box, and many more. The importance of providing stimulus or stimulation too early childhood can be done by providing holistic learning activities, such as through speaking, listening, seeing, interacting, and can be through play activities.

Previous research conducted by Sri Agustini stated that using playing blocks of stacking numbers can improve the cognitive abilities of children in understanding the concept of simple numbers and sorting numbers 1-10 with the results of 16 children (80%) have shown an increase and only 4 children (20%) who have not yet achieved success.

In the interview and observation activities that have been carried out in three kindergarten institutions when learning activities almost all institutions use LK and very rarely use games or media in the delivery of learning material. The lack of games made in stimulating aspects of development in children will certainly affect the child's development. With the innovation of game development, it is expected to be able to help the learning process of children, which can attract children's interest so that learning objectives can be achieved, especially in the cognitive aspects of the introduction of the concept of the number symbol for children aged 4-5 years.

METHOD

The development of the Mathematic Tower game to introduce the concept of the number symbol in early childhood refers to the RnD (Research and Development) research model. Research and development is a process or steps to develop a new product or improve existing products, which can be accounted for (Sukmadinata, 2013). This research and development method uses steps proposed by Borg & Gall (in Sukmadinata, 2013: 169), which includes (1) research and data collection, (2) planning, (3) development of product drafts, (4) testing initial field trials, (5) revising the results of trials, (6) field trials, (7) refinement of field trial results, (8) field implementation tests, (9) improvement of final products, (10) dissemination and implementation.

In the research and development procedure, the researcher carries out only the seventh stage, namely the refinement of the final product. This step was carried out only to the seventh stage because in the eighth stage of the trial the field implementation involved 10-30 schools with research subjects of 40-200 children. In the tenth step is the manufacture of mass products and then spread the product to be socialized through meetings, scientific journals, and so on which is the area of the education service.

The subject of trial data collection in the study "Development of Mathematic Tower Games to Introduce the Concept of the Number Symbols in Early Childhood" is group A children with

vulnerable ages 4-5 years. The product evaluation subject was carried out by 6 experts. The experts consisted of two experts in early childhood cognitive materials, two early childhood game experts, and two early childhood education learning experts. The subject needs analysis was carried out on the homeroom teacher group A. On the subject the small group trial was conducted on 10 children. A large group trial was carried out on 71 children in three kindergartens in the district of Malang.

The types of data obtained in this research are qualitative and quantitative. Qualitative data is data obtained from expert advice and evaluation, results of interviews, and observations made in the early stages of the study. While the quantitative data obtained from the instrument data score from the validator.

Data collection instruments conducted in this research development in the form of a validation questionnaire. The questionnaire was in the form of a product validation questionnaire about the feasibility of the Mathematic Tower game to develop children's cognitive abilities, especially in the introduction of the concept of group A symbol numbers aged 4-5 years. The formula used to process qualitative and quantitative data in the form of a percentage, according to (Sudijono, 2009) is as follows :

$$P = \frac{f}{N} \times 100\%$$

Information :

- P : Percentage of figures
- f : frequency of observations
- N : Number of cases (total frequency)
- 100% : constant

After obtaining the results from the data processed using the formula above, the results are matched with the eligibility criteria as follows :

Table 1 Eligibility Level Criteria

Category	Percentage	Qualification
(Score 4)	85,01% - 100%	Very valid, or can be used without revision
(Score 3)	70,01% - 85%	Quite valid, or can be used but needs minor revisions
(Score 2)	50,01% - 70%	Invalid, it is recommended not to use it because it needs a major revision
(Score 1)	01% - 50%	Invalid, may not be used

Source: (Akbar, 2013)

RESULT AND DISCUSSION

The development of the Mathematic Tower game was validated by two early childhood cognitive material experts, namely Wuri Asturi, S.Pd, M.Pd as a lecturer in the PG-PAUD study program, Faculty of Education, State University of Malang and Yulia Ernawati, S.Pd as a group teacher A from TK Putra Pembangunan. The score results obtained are as follows.

Table 2. Results of Expert Data Scores for Early Childhood Cognitive Materials

No.	Emotional Social Expert	Total	The Highest Score	Percentage (%)	Information
1.	Wuri Astuti, S.Pd., M.Pd.	29	32	90,62	Very Valid
2.	Yulia Ernawati, S.Pd.	30	32	93,75	Very Valid
			Σ	184,37	
			Average	92,18	Very Valid

Based on table 2, the average results obtained from two cognitive material experts in early childhood is 92.18%. These results fall into the percentage category of 85.01% - 100% or very valid and can be used without revision.

Furthermore, the Mathematic Tower game to stimulate the development of cognitive aspects, especially to introduce the concept of the symbol of numbers in children aged 4-5 years validated by two experts in early childhood game material, namely Drs. I Made Seken, M.Pd as a lecturer in the PG-PAUD study program, Faculty of Education, State University of Malang, and Endah Sri Pratiwi, S.Pd as the Principal of TK Putra Pembangunan School. The data obtained from early childhood game experts are as follows:

Table 3. Results of Early Childhood Game Expert Instrument Data Scores

No.	Game Expert	Total	The Highest Score	Percentage (%)	Informatrion
1.	Drs. I Made Seken, M.Pd.	37	40	92,5	Very Valid
2.	Endah Sri Pratiwi, S.Pd.	38	40	95	Very Valid
			Σ	187,5	
			Average	93,75	Very Valid

Based on table 3, the results obtained scores from two early childhood game experts that are equal to 93.75%. These results fall into the percentage category of 85.01% - 100% or are very valid and can be used without revision.

Furthermore, the data obtained from the results of the validation of two learning material experts, namely Ida Tatik, H, S.Pd. as the class guardian of TK Dharma Wanita Persatuan 1 Karanganyar and Wahyu Irmawati as the guardian of class A KB / TK PKK Tunas Bangsa. The data obtained from early childhood learning experts are presented in table 4.

Table 4: Results of Early Childhood Learning Expert Instrument Data Scores

No.	Education Practitioners	Total	The Higest Score	Percentage (%)	Information
1.	Ida Tatik, H, S.Pd	36	40	90	Very Valid
2.	Wahyu Irmawati	37	40	92,5	Very Valid
			Σ	182,5	
			Average	91,25	Very Valid

Based on table 4, the results obtained scores from two early childhood learning experts that are equal to 91.25%. These results fall into the percentage category of 85.01% - 100% or are very valid and can be used without revision.

Small-Group Trial Results

The small group Mathematics Tower game trial was conducted at TK Dharma Wanita Persatuan 1 Karanganyar on 10 children with 2 boys and 8 girls. In the small group assessment, two aspects are assessed namely related aspects of security, convenience, attractiveness, and related to cognitive aspects. The following is presented in Table 5 related to the overall results of the small group test, namely:

Table 5. Average Results of Small Group Trial Data

No.	Aspect	Average yield (%)
1.	Safety, convenience and attractiveness	94,4
2.	Cognitive aspects	94
Total		188,4
Average		94,2

Based on table 5, an overall average percentage of 94.2% is obtained, these results fall into the percentage category 85.01% - 100% or are very valid and can be used without revision. So it can be concluded that the Mathematic Tower game is safe, easy, interesting, and can also be used as a game to stimulate the cognitive aspects of children, especially in the introduction of the concept of the number symbol of children aged 4-5 years.

Large Group Trial Results

After making several revisions to the Mathematic Tower game, the researchers continued the large group trials. The large group Mathematics Tower game trials were conducted on three kindergarten institutions, namely TK Dharma Wanita Persatuan 1 Karanganyar, TK Putra Pembangunan, KB / TK PKK Tunas Bangsa with 71 subjects.

The results of a large group trial were obtained from observations during the process of activities which included cognitive aspects and aspects of safety, convenience, and attractiveness. The Mathematic Tower game conducted by the homeroom group A in TK Dharma Wanita Persatuan 1 Karanganyar, TK Putra Pembangunan, KB / TK PKK Tunas Bangsa.

Table 6 Average Results of Large Group Trial Data

No.	Aspect	Average Yield (%)
1	Safety, convenience and attractiveness	96,08
2	Cognitive Aspect	92,39
Total		188,47
Average		94,23

The following data presented in table 6 related to the overall results of a large group trial. Based on table 6, obtained an overall average percentage of 94.23%. These results fall into the percentage category 85.01% - 100% or are very valid and can be used without revision.

Research on the development of the Mathematic Tower game to introduce the concept of the number symbol in early childhood, especially at the age of 4-5 years old, was carried out in three kindergarten institutions in Malang regency. Kindergarten institutions that are used in development research include TK Dharma Wanita Persatuan 1 Karanganyar, TK Putra Pembangunan, and TK PKK Tunas Bangsa. At the time before conducting research, researchers conducted observations and interviews with the homeroom teacher group A to analyze the initial requirements needed at the institution. This is an important activity to find out the evaluation that needs to be done before using the product widely (Mukhtar, 2016).

Research on the development of the Mathematic Tower game to introduce the concept of the number symbol in early childhood, especially at the age of 4-5 years, validated by 6 experts. The experts consisted of two cognitive material experts, two-game experts, and two early childhood learning experts. As for some of the criticisms and suggestions obtained from cognitive material experts, the game should be modified so that it does not only focus on the development of cognitive aspects but can include other aspects of children's development. This is very important because at the age of 4-5 years child development starts to grow and develop well starting from the sentence that is pronounced the better is called the development of speech functions, and the child will learn about simple mathematics such as mentioning numbers, calculating the order of numbers, and small mastery from objects.

Furthermore, criticism and suggestions from game experts were obtained, namely to add image symbols to the back of the picture and add the number of piles to the tower of numbers to make it happen, which was forced by the tower. Meanwhile, the learning experts get criticism and suggestions to add differentiators to numbers 6 and 9. At the time before being given a distinction children are confused about putting together a tower. Then, the researchers revised it by adding the line of differentiation to number 6. The results from early childhood cognitive material experts got 92.18% results. While the results of early childhood game experts get 93.75% results, and the results of early childhood learning experts get results of 91.25%. The overall average result of the validation of six early childhood experts was 92.39%. Based on these results the Mathematic Tower game is declared very valid and can be used.

After evaluating the six experts to determine the feasibility of the Mathematic Tower game for use in cognitive learning, especially in the introduction of the concept of the number symbol, then a small group trial was conducted at the Dharma Wanita Persatuan 1 Karanganyar Kindergarten using 10 children. The results obtained in small group trials of 94.2% are included in the category

of very valid. Furthermore, the implementation of large group trials using the subject of 71 children. The results obtained from large group trials amounted to 94.23% which are included in the highly valid category.

CONCLUSION

Based on the results obtained, it can be concluded that the development of the Mathematic Tower game to introduce the concept of the number symbol in early childhood is declared valid and feasible to use even though there are some revisions and improvements to increase the feasibility of the game. Seen when the game takes place the child looks very enthusiastic and actively involved in the process of playing and following well to the end of the game. Colorful media can attract children's interest in participating in learning activities.

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