

The Effectiveness Of Learning Through Play Module On The Understanding Of Number Concept Among Preschool Children

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Abstract

Playing opportunities provided by teachers for pre-school children can help to encourage children's learning and development process. This study shows that learning through play is very important in children's learning process. A module of learning through play which focuses on the concept of number was constructed to assist teachers and preschool children in the process of teaching and learning through a planned and systematic way. Piaget and Vygotsky's theories of cognitive development were the basis of the teaching module in which cooperative play activity was incorporated into cognitive play activity. The effectiveness of the implementation of learning through play module was measured through children's understanding on the concept of number. A quasi-experimental research design using pre and post- tests was applied in this study. Children's understanding on the number concept was tested twice, before and after the learning process. The teachers in the experimental group used the play module in their teaching of number concept while teachers in the control group used conventional method in teaching the same topic. While children from both groups were found to be homogeneous in the pre-test, outcome from the post test revealed that children in the experimental group significantly outperformed the children in the control group. The findings proved that the usage of learning through play module could significantly increase children's understanding on the concept of number.

Keywords: Learning through play module, understanding, number concept, preschool children

1. Introduction

Research shows that playing is a mediator in improving children's efficiency in social, communication and cognitive development (Bodrova & Leong, 2003; Trawick-Smith, 2006; Sluss, 2005; Vygotsky, 1978). The opportunity to play provided by adults to a child is said to help in the process of learning and development (Moyle, 1989; Bruce, 1991; Wood & Artfield, 1996; Drake, 2001; Riley, 2003; Broedhead, 2004; Brock *et al.*, 2009). Therefore, the approach to learning through play has been recommended for use by the National Preschool Curriculum Standards in Malaysia (2010). Learning through play approach provides opportunities for children to learn through restructuring process, new discovery, enrichment process, construction of experience and knowledge as well as the discovery of new concepts (Brock *et al.*, 2009). In addition, play activities also prevent boredom and eliminate children's fear in learning new subjects.

Hurlock (1987) explains that the play activities provided by teachers not only aim to create a pleasant learning atmosphere, but also provide input and broad meaning to children while interacting with their environment. The involvement and cooperation of preschool teachers are indispensable in providing active and effective play activities. Previous studies reported that teacher's or adults' involvements in children's play activities are able to encourage the children's ability to play and improve their social, cognitive and language development (Bennett, Wood, & Rodgers, 1997; Smilansky & Shefatya, 1990). According to Trawick-Smith and Dziurgot (2011), when teachers or adults do not perform the process of interaction during play activities, they lose the opportunity to promote children's development. Some teachers refuse to play along with the children because teachers find it difficult to control the class and they undermine the benefits of play.

A study by Sharifah Norhaidah *et al.* (2010) revealed preschool teachers' response in interview that it was difficult to carry out learning activities through play due to the difficulty in controlling the behavior of the children, lack of materials and tools as well as the lack of time to play. Some teachers were less creative and took a long time to think about the appropriate activities and playing materials aligned with the learning objectives. Due to the lack of time to plan for such teaching plan, preschool teachers tend to take a shortcut by using a relatively informal approach like 'chalk and talk'.

The above scenario corresponds to a study conducted by Hussain (1996) which showed that preschool teachers in Malaysia tend to employ formal approach as the teachers are more inclined to focus on the need to finish the syllabus as compared to fulfilling children's need. Despite more than a decade debated on the findings of this study, a formal approach is still used in the process of teaching and learning in preschool today. Evidently, the findings of preliminary studies conducted by Zakiah, Azlina and Yeo (2011) also find that preschool teachers preferred a formal approach as it enables them to focus on the objectives of the subjects and the skills that children should master before entering Year One in elementary school. When the natural needs and instincts of

children are denied by teachers, indirectly children's abilities will eventually decline. Children at preschool level still belong to the 'playful category' who are still not clear about the need and academic interests for their life in future. According to Elkind (2001), a force and too early academic exposure will result in stress and behavioral problems among children.

This scenario shows that to implement learning through play approach can invite variety of challenges, particularly on teachers' part. Teachers' inadequacies in the knowledge, understanding and skills of learning through play approach could result in children feeling depressed and loss of motivation, especially in the early acquisition of Mathematics. These factors have limited the opportunity to enhance children's ability, skills, expressing opinions and developing talents while playing. The vital role of teachers to engage students in learning Mathematics was confirmed by Abdul Razak (1994) in his findings that the interest and motivation of students towards mathematics depends on the way of teaching. According to Clements (2001), a high quality mathematics instruction should have challenge and excitement, rather than burden and stress. The implementation of play activities is better than the use of worksheets in preschool (Kamii & Yasuhiko, 2006). As the activity of playing in the process of teaching and learning in preschool is beneficial to the aspects of learning and the development of children, thus, the researchers developed a module that uses the learning through play approach as guidelines so that the teaching activities conducted by the teachers are more organized and systematic.

The learning through play module for the concept of number topic is developed with complete implementation guidelines to overcome problems and constraints faced by teachers. The concept of number is selected in the construction of the module because according to Bowman, Donovan and Burns (2001), the early mathematical concept learning is fundamental for a strong preschool education and could indirectly enhance the academic achievement of the children. This finding is parallel to a study by Duncan that shows that early mathematic skills are strong predictors than reading and thinking skills in determining individual achievement in the future (Christensen, 2010). In addition, Lee and Ginsburg (2009) also explain that the ability of children in learning mathematics at preschool education is a predictor that can determine a person's academic success. Therefore, early preschool mathematics education requires strong curriculum, competent teachers and appropriate approach to meet the development and learning needs of children so that learning is optimized.

The core of preschool mathematics is the learning of concepts including the numbering concept. The acquisition of new concepts by children occurs through abstraction of information from the existing example which enables them to form a prototype in the memory based on the existing situation and context (Nor Aini, 2002). Therefore, the mastery of early mathematic concepts by preschool children is the foundation to understand mathematical concepts at a higher level. The initial concept of mathematics includes concept of number, simple number operation, the value of money, the concept of time, form and space (NPCS, 2010). Griffin, Case and Siegler (1994) have suggested that the initial focus should be given to recognizing and counting numbers in small quantity. According to Charlesworth and Leali (2012), the basic concepts are learned from the easiest to the more complex. The use of concrete materials is very important because children require solid entities which refer to material that can be touched, felt, seen, heard and smelled. Obtaining a good concept when in preschool enables children to use a more abstract idea in the process of solving problems and in producing mathematical ideas in their later years.

Based on this explanation, the learning through play module for number concept topic is built to serve as a guideline for preschool teachers in the implementation of play activities in the process of teaching, thus providing an opportunity for children to master early mathematic concepts in a fun atmosphere. According to Shaharom (1995) and Kamdi (1990), a teaching and learning activity is more organized and systematic if implemented in a modulated way. Modulated teaching activities are more systematic and organized as teaching and learning material are divided into smaller topics and constructed in sequence which is easily understood and applied by the user. The effectiveness of learning through play module is identified through the pre-test and post-test conducted on children's understanding of the concept of numbers.

2. Learning Through Play Module

In this study, a module of learning through play focusing on the number concepts have been developed and applied to assist teachers carry out teaching and learning activities in a planned and systematic way. The application of learning through play module, indoor and outdoor of the classroom provides opportunities for children to undergo the natural process of learning with fun and joy. Learning through play module was developed based on the constructivist theory that combines Piaget's and Vygotsky's Cognitive Development theories. Based on these theories, play activities provided in the learning through play module are cognitive play activities which are performed cooperatively. It implies every learning through play activity should be conducted

in the form of cooperative learning. Learning and playing cooperatively are implemented because according to Davidson and Kroll (1991), cooperative learning could enhance knowledge, skills, conceptual understanding, communication skills, social skills and motivation. Through cooperative play, children are given the opportunity to share ideas by consulting, discussing, and cooperating in completing tasks and to train children to take part in their respective groups in order to achieve common goals.

The theory developed by Piaget proposed that children could construct an understanding as a result of biological maturation and environmental experience whereas Vygotsky believes that cognitive development or learning by the child occurs through social interaction with a skillful tutor, in this case the teacher who is using the module. The basic principles of learning of these two theories are inter-related in this module, thus giving way to curiosity and active involvement in learning besides self-initiated discovery through play activities. Environment includes not only the physical aspects but also social and cultural relations around it (Fosnot, 1996). When a child is actively interacting with the world around it, knowledge will be built on its own. Therefore, children who are given the opportunity to play will combine experience, knowledge and existing understanding (Bruce, 1991). In short, cognitive and social elements are interconnected in children's play activities especially when it is done cooperatively.

The learning through play module developed in this study has guidelines for determining the types of games to be implemented for children. The selection of the types of games depends on the knowledge, skills and values that the teachers want to instill in order to support early mathematical learning. Each activity must be in parallel to and in accordance to the standards of teaching and learning objectives contained in the National Preschool Curriculum Standard (NPCS) or known as '*Standard Kurikulum Prasekolah Kebangsaan*' (2010). The learning through play approach proposed in the module uses four types of play activities, namely the functional play, constructive play, dramatic play and play with rules. Rules of the games are simple, concise and appropriate to children's situation (Björklund, 1978). The four types of cognitive game play should be implemented in cooperative play mode, which aims to simultaneously and comprehensively improve social and cognitive development of the children. Teachers also need to provide concrete teaching aid materials that are appropriate in a particular context. However, the learning through play module concept is more appropriately conducted in the first term as the module is focusing on the topic of concept of numbers. This topic is fundamental topics that should be taught at the beginning of the school term.

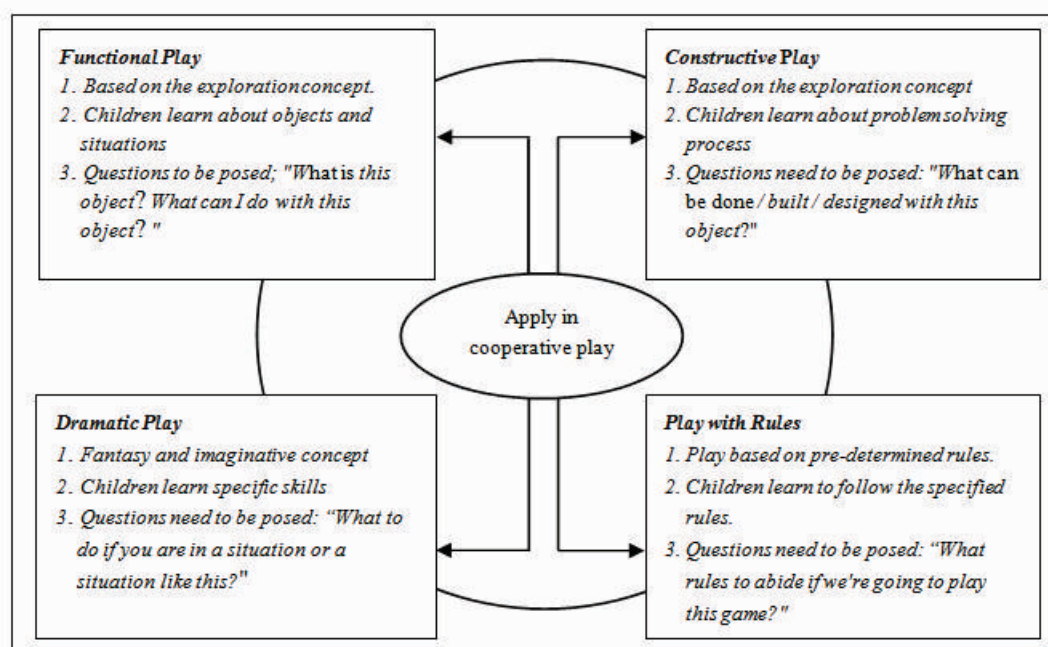


Figure 1: Guidelines for planning learning through play approach for preschool children

Figure 1 shows the outline or the model formed from the theory and serves as the basis of construction of the learning through play module. In the context of this study, the preschool teachers in the experimental group were encouraged to follow the steps suggested in the module.

3. Research Method

This study was based on quasi-experimental research design using pre-test and post-test method (Creswell, 2007; Campbell & Stanley, 1963). A quantitative approach was used to identify the impact of learning through play module towards the understanding of the preschool children's concept of numbers. This study involved two groups of children, one experimental group and one control group. The experimental group used the learning through play module in the teaching and learning process while the control group followed the usual learning activity which may have some forms of play activities.

3.1 Subjects

The study involved four preschools under the Ministry of Education, Malaysia located in the state of Johor. Two preschools were chosen as experimental groups while the other two preschools as the control group. The two preschools involved in the experimental group were selected for their willingness, cooperation and encouragement given by the preschool teachers to the researcher in conducting the research along with the educational qualifications held by the teachers.

A total of 4 preschool teachers and 96 preschool children: 52 male and 44 female between 4 + and 5 + years old, participated in this study. A total of 47 children were in the experimental group and another 49 are in the control group. In the context of this study, the selection of subjects was based on the 'intact sampling' method to ensure that all subjects in a class is maintained as the sample according to their respective classes (Best & Kahn, 1998).

3.2 Research Instruments

A test was developed to measure children's understanding in number concepts. Pre-test was conducted to both the experimental and control groups before children from the experimental group were taught by using the learning through play module. The post-test was conducted after the teacher has implemented the developed module for two months in the early mathematics teaching and learning process. This is to identify the effectiveness of the module on children's understanding on the topic of number concepts.

Pre- and post-test is an equivalent test set. According to Lim (2007), the pre-test and post-test questions were proposed to be equivalence and not similar. In experimental research using the same achievement test can pose a threat to the internal validity of the study. This test consists of 10 question items. The researchers developed questions based on the content standards of 7.0 and 6.0 and learning standards of Mathematics in the National Preschool Curriculum Standard (2010).

The question items provided by the researcher have been reviewed by subject matter experts and preschool teachers to ensure the content validity and relevance of the questions to be answered by the children. This technique has been used by Jinks and Morgan (1999) in his study to verify the content. Thus, two subject matter experts and three teachers were appointed to determine the validity of the categorization and appropriateness of the question items. The panels who verified the test items were also involved in the verification of the play module developed in this study. The teacher evaluator was selected based on knowledge and experience acquired as well as in their willingness to help the researcher to improve the developed module and instrument.

To determine the test reliability of the test, a pilot study is carried out to 45 children from two preschools which did not involve in the actual study. Cronbach Alpha analysis showed a reliability index for the number concept test was high with $r = 0.901$, thus ensuring the test to be reliable and to be used in this study.

3.3 Data Collection Procedures

Data on the understanding of concepts of numbers were collected from a total of 96 children. In the first week, children in the experimental group and control group answered the similar pre-test on number concepts. Teachers from each participating class conducted the test on all children. Directions and instructions on how to answer the test questions were clearly explained so that the children could understand and confused. After the pre-test, teachers in the experimental groups carried out their teaching on early mathematics by using the learning through play module for eight weeks. In the tenth week, the children in the experimental group and the control group answered the similar post-test on concept of number.

4. Research Findings

Descriptive analysis of the pre-test and post-test of experimental group and the control group on the topic of concept of number is indicated in Table 1 below. For the experimental group, pre-test minimum score is 0 and the maximum score is 10. The minimum score of post-test showed a value of 3 and the maximum score is 10. Meanwhile, for the control group, pre-test score displays a minimum of 0 and a maximum of 9. The minimum score for post-test is 1 and the maximum score is 10.

Based on Table 1, it is found that the experimental group and the control group had higher post-test mean score than pre-test mean score. The experimental group obtained the pre-test mean score of 5.62 and post-test mean score of 8.85. The increase in the mean score of 3.23 occurred in the experimental group. For the control group, the pre-test mean score was 5.43 and the post-test mean score was 6.59. The test mean score of the control group increased 1.16 compared to the experimental group 3.23.

Table 1: Descriptive analysis of number concepts topic test for the experimental group and the control group.

Group	Experimental Group		Control Group	
	Pre-Test	Post-Test	Pre-Test	Post-Test
N	47	47	49	49
Mean	5.62	8.85	5.43	6.59
Standard Deviation	2.56	1.47	2.45	2.30
Minimum	0	3	0	1
Maximum	10	10	9	10

Data on pre- and post-tests were also analyzed by inferential statistical method. Paired samples t-test was used to identify the differences between pre- and post-tests. The findings of the study are displayed in tables 2 and 3 as follows:

Table 2: Min score and standard deviation for the number concept topic between the experimental group and control group.

Group	Total	Pre-Test Number Concept		Post-Test Number Concept	
		Mean	Standard Deviation	Mean	Standard Deviation
Experimental	47	5.62	2.56	8.85	1.47
Control	49	5.43	2.45	6.59	2.30

* Significant at the level $p < 0.05$

The test results showed that the mean scores for number concept in pre-test and the mean score for post-test for the experimental group were 5.62 and 8.85 respectively. The mean scores for number concept in the pre-test and the mean score for post-test for the control group were 5.43 and 6.59.

It is found that the mean scores of both experimental and control groups showed an increase in the post-test as compared to pre-test. However, the experimental group displayed a noticeable difference in the mean score value (8.85) as compared to the control group (6.59) after the teachers in implemented the learning through play module.

Thus, for this sample groups of children ($n = 96$), who receive instruction using the learning through play module acquired significantly higher inferential score ($M=8.85$, $SD=1.47$, $n=47$) than the group who followed the normal process of teaching ($M=6.59$, $SD=2.30$, $n=49$) as described in Table 2.

Table 3: The results of the t-test output to motivation score in early mathematics learning.

Group	Value -t	Degree of Freedom (df)	Value p
Experimental	-10.13	46	.000
Control	-4.11	48	.000

* Significant at the level $p < 0.05$

Results of paired samples t-test in Table 3 showed significant differences in the experimental group ($t = -10.13$, $df = 46$, $p < 0.05$) as well as in the control group ($t = -4.11$, $df = 48$, $p < 0.05$). This finding indicates that the implementation of teaching and learning by using the learning through play module enhanced the understanding of the number concept in early mathematics learning for children.

Thus, through the analysis of paired samples t-test, the research hypothesis was rejected. The experimental group has gained a significant and higher increment in the mean scores than the control group. Based on the test results too, it shows that the use of the learning through play module by the experimental group influence children's understanding and comprehension on the topic of number concept.

5. Discussion and Summary Review

The results showed that learning of number concept using the learning through play module provides positive impact on children's understanding. The comparison results using paired samples t-test at $p=0.05$ level between the experimental group (using the teaching learning through play module) with the control group (regular teaching) showed that the experimental group scored significantly higher than the control group.

Results of this study showed that there was a significant increase in children's understanding in the topic on number concept of preschool Mathematics. It can be explained that children who were involved in the teaching and learning of early mathematics by using learning through play module gained better understanding of number concept than children who have followed the normal teaching. This finding is supported by Bodrova and Leong (2001, 2003), Bruce (2001), Owocki (1991), and Sawyers and Rogers (1998), who previously explained that the approach of learning through play is able to enhance children's cognitive development. This finding also reinforces the findings of a study conducted by Trawick-Smith (2006), Sluss (2005) and Vygotsky (1978) who explained that playing is the mediator in improving children's social, communication and cognitive competencies.

Play activities give children the opportunity to express their feelings, exploring relationships, expressing experiences and help the children in developing competence and self-esteem. Implementation of cognitive cooperative play among preschool children could promote social and cognitive development. As proposed by Vygotsky (1978) and Davidson and Kroll (1991), cooperative learning enhances knowledge, skills, conceptual understanding, communication skills, social skills and motivation. This finding also supports Skemp (1989), who emphasizes that children's learning of mathematics requires 95 per cent meaningful learning and only 5 per cent learning through memorization. Children's mastery of basic math concepts grows through hands-on experience and meaningful activities in the environment. Hands-on experience and meaningful activities can be obtained through play activities performed inside or outside the classroom.

The advantages of learning through play were further emphasized by Kamii and Yasuhiko (2006) who explained that play activities are better than using the worksheet to children. The play activities act as stimulus and children will react automatically to it. Clements and Sarama (2004) also pointed out that children are encouraged to play with the material or object given before they use it for problem-solving activity. By exploring the place, tools, objects and common concepts through play activities, children will construct the meaning of concepts with a better and deeper understanding. The innate curiosity of children will lead them to find ways to solve the problem successfully (Charlesworth & Leali, 2012).

The study of early childhood education has emphasized learning through play in the teaching and learning environment so that children can explore, investigate and solve problems together (Broadhead, 2004). The findings of this study demonstrate that the practice of learning through play, especially in learning beginning math skills showed a positive change to the understanding and interest of the children. Through cooperative play activities, children were seen to play, discuss and solve problems together. Children were given the opportunity to express themselves, make inquiries with a group of friends and try to complete a given task.

Based on these findings, the approach of learning through play implemented in a modulated way is an example of early mathematics teaching and learning in a systematic and effective manner. Play activities carried out in this study aimed at helping children to have a strong basic knowledge in number concepts to enable them to proceed to the next level with ease. Children who were engaged in a meaningful and fun experience in learning math during preschool will better appreciate and participate in continuous learning of mathematics in primary schools, secondary and higher levels. The early learning experiences through play approach cultivate positive attitude and subsequently maintain children's interest in the mathematics subject (Linder & Stegeline Powers-Costello, 2011). These findings have implications for preschool teachers to implement learning through play in the teaching and learning process, especially in the early learning of mathematics.

6. Conclusion

Findings reported in this study demonstrated the importance of learning through play on children's understanding of number concepts in preschool. The module on the approach of learning through play has provided general implications to the practice of preschool teaching. The module serves as a guide for teachers in constructing learning activities particularly for teaching number concepts. Obstacles and constraints that arise previously could be reduced and to some may be eliminated. Through organized and systematic cooperative cognitive play activities, children have the opportunity to perceive and build the relationship between early math concepts naturally. Teaching and learning activities could be structured to help children acquire optimum knowledge, skills and values in preschool. Thus, it could be concluded that the construction of the module in this study has systematically and effectively assisted the teaching and learning of early mathematics in preschool. The findings

of this study showed an improved understanding on the number concept among children who were involved in the implementation of the learning through play module at two selected preschools. The previous teaching process which was based on 'chalk and talk' was transformed to fun teaching and learning.

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