EFFECTS OF CREATIVE PLAY ACTIVITIES ON EARLY MATHEMATICS PERFORMANCE AMONG PRESCHOOLERS

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FACULTY OF EDUCATION
UNIVERSITY OF MALAYA
KUALA LUMPUR

2021

EFFECTS OF CREATIVE PLAY ACTIVITIES ON EARLY MATHEMATICS PERFORMANCE AMONG PRESCHOOLERS

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DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF EDUCATION
(EARLY CHILDHOOD EDUCATION)

FACULTY OF EDUCATION
UNIVERSITY OF MALAYA
KUALA LUMPUR

2021

UNIVERSITI OF MALAYA

ORIGINAL LITERARY WORK DECLARATION

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Title of Dissertation : Effects of Creative Play Activities on Early Mathematics Performance among Preschoolers

Field of Study : Early Childhood Education

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ABSTRACT

The purpose of this study was to examine the effects of creative play activities on early mathematics performance among preschool children's number operations in addition and subtraction skills. The sample consisted of 60 six years old children from two different *Sekolah Kebangsaan* preschools who were selected to participate in this study. 30 children from Preschool A were placed in the Experimental group and 30 children from Preschool B were placed in the Control group. The research instruments consisted pre-test and post-test addition and subtraction questions, 10 lessons of creative play activities on early mathematics in addition and subtraction games for the Experimental group and normal teaching in mathematics for the Control group. The research was conducted using a quasi-experimental design. Creative play activities had significantly affected the performance in early mathematics among the Experimental group children in addition and subtraction skills as revealed in the post-test results. Paired-samples t-test for both addition ($p<.000$) and subtraction ($p<.001$) showed a significant difference between the pre-test and post-test. The findings of the SPANOVA multivariate test showed there was a significant interaction effect for both the Control and Experimental groups in addition ($p<.024$) and subtraction ($p<.041$). The findings indicated that 10 lessons of creative play activities in early mathematics in addition and subtraction games conducted for the Experimental group were more effective than the normal teaching in mathematics conducted for the Control group. Moreover, creative play activities had also indirectly enhanced creativity, imagination, Higher Orders Thinking Skills (HOTS), problem solving skills and social skills among preschool children. It is hoped that the findings from this research will be used as a guidance to the preschool teachers. The various creative games in addition and subtraction can be used for future implementation in teaching and learning in a

systematic way instead of using worksheets for the preschool children to guarantee a high quality of achievement in early mathematics education in future.

KESAN AKTIVITI PERMAINAN KREATIF KE ATAS PRESTASI MATEMATIK AWAL DALAM KALANGAN KANAK-KANAK PRASEKOLAH

ABSTRAK

Tujuan kajian ini adalah untuk mengkaji kesan aktiviti permainan kreatif ke atas prestasi matematik awal dalam kemahiran operasi nombor tambah dan tolak dalam kalangan kanak-kanak prasekolah. Sampel terdiri dari 60 orang kanak-kanak berumur enam tahun dari 2 buah prasekolah Sekolah Kebangsaan yang telah terpilih untuk mengambil bahagian dalam kajian ini. 30 orang kanak-kanak dari Prasekolah A diletakkan dalam Kumpulan Eksperimen dan 30 orang kanak-kanak dari Prasekolah B diletakkan di dalam Kumpulan Kawalan. Instrumen penyelidikan terdiri daripada ujian pra dan ujian pasca yang mengandungi soalan operasi tambah dan tolak, 10 pelajaran aktiviti permainan kreatif dalam matematik awal dalam operasi tambah dan tolak untuk Kumpulan Eksperimen dan pengajaran biasa dalam matematik untuk Kumpulan Kawalan. Kajian ini dijalankan dengan menggunakan rekabentuk penyelidikan kuasi-eksperimen. Aktiviti permainan kreatif memberi kesan yang signifikan terhadap prestasi matematik awal dalam kalangan kanak-kanak prasekolah kumpulan eksperimen dalam operasi tambah dan tolak seperti yang dinyatakan dalam keputusan ujian pasca. Ujian-*t* berpasangan bagi kedua-dua operasi tambah ($p<.000$) dan operasi tolak ($p<.001$) menunjukkan terdapat perbezaan yang signifikan diantara ujian pra dengan ujian pasca. Dapatan ujian multivariat SPANOVA menunjukkan ada kesan interaksi yang signifikan untuk kedua-dua Kumpulan Kawalan dan Eksperimen dalam operasi tambah ($p<.024$) dan operasi tolak ($p<.041$). Hasil kajian menunjukkan bahawa 10 pelajaran aktiviti permainan kreatif dalam matematik awal dalam

permainan tambah dan tolak yang dijalankan untuk Kumpulan Eksperimen lebih berkesan daripada pengajaran biasa dalam matematik yang dijalankan untuk Kumpulan Kawalan. Tambahan pula, aktiviti permainan kreatif juga secara tidak langsung meningkatkan kreativiti, imaginasi, Kemahiran Berfikir Aras Tinggi (KBAT), kemahiran menyelesaikan masalah dan kemahiran sosial dalam kalangan kanak-kanak prasekolah. Diharapkan hasil kajian ini akan digunakan sebagai panduan kepada guru-guru prasekolah. Pelbagai permainan kreatif dalam operasi tambah dan tolak boleh digunakan untuk pelaksanaan masa depan dalam pengajaran dan pembelajaran secara sistematik, dan bukannya menggunakan lembaran kerja untuk kanak-kanak prasekolah dalam menjamin kualiti pencapaian yang tinggi dalam pendidikan matematik awal pada masa yang akan datang.

ACKNOWLEDGEMENT

First and foremost, I would like to express my deep and sincere gratitude to my research supervisor Dr. Mohd Nazri in provide invaluable guidance, help, comments and motivation throughout this research. Besides that, I would also like to thank my masters course lecturers in enhance my knowledge in early childhood and methodology of the research related to this field. I am also grateful to my research readers who are Datin Prof Dr. Mariani and Dr. Suzieleez for all their comments given to improve my thesis.

In addition, I express my gratitude to Prof. Dr Chua for his sincere help in replying to my numerous emails and answering every question I had asked to solve my problems in the progress of my research. I also express my heartfelt thanks to my friend Jonathan Yu for his patience and guidance in teaching me at the beginning of writing this thesis. I would also like to thank all the other experts for their comments and sharing their knowledge of the theories and teaching experiences to improve my research instruments. I thank the preschool teacher who conducted the instruments in her class to complete my data collection.

I am extremely grateful to my mentor, *Daisaku Ikeda* whose wisdom in his books encouraged and inspired me when I faced difficulties during the progress of this research. I would like to thank my family members and boyfriend for their love, understanding, prayers, encouragement and support to complete my thesis.

Last but not the least, I would like to thank all the peoples who have helped, accompanied, encouraged and supported me during the long and difficulty journey these 4 years to complete my masters study and research work.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Children are the building blocks who shape the world of the future. They can change the world if their potentials are fully developed in a holistic manner by making them knowledgeable, competent, with high moral standards, responsible and capable through education. In fact, the main factor that determines a child's future is education. The Early Childhood Care and Education (ECCE) curriculum performs an important role for children before they enter formal education.

Besides that, when children were born, parents are early educators in the upbringing of children. They are the first to educate them and develop their attitudes. As such they have the right to decide what types of preschools are suitable for their children in the learning process. Parents with different educational background, cultural and economic status have different views towards their children' education. Presently learning through play is not preferred by parents as they would like teachers to focus on the academic achievements of children. On the other hand, there are also some parents who prefer teachers to focus on holistic development through play learning.

According to a survey conducted by Lin and Yawkey (2013), most Taiwanese parents value the contributions of children's play in their development that exhibits positive behaviours. Isenberg and Jalongo (2001) have pointed out that over the years, researchers, theorists and educators across different perspectives have documented that in the development of early childhood years, play has an important influence on them. When there is social interaction among children with their peers through play,

children become better learners. The absence of play is often an obstacle to the development of happy, healthy and creative children (Smithner, 2011; Dere, 2019). Play is also the lens through which children see their world and the world of others. If deprived of play, children will suffer both in the present and in the future (Goldstein, 2012).

Apart from that, Dodge and Colker (2001) have stated that children discover concepts in science, mathematics, literacy and social studies through active, concrete and everyday experiences as they play. Hence, the implementation of a creative curriculum with play activities included can create the environment that supports children's natural desire and ability to learn. In Malaysia, the National Preschool Standard-Based Curriculum (NPSC) from 2010 to 2016 has recommended learning through the play approach in the preschool curriculum (Zakiah Mohd Ashari, Azlina Mohd Kosnin & Yeo, 2013; Hafsah Jantan, Abdul Rahim Hamdan, Fauziah Hj Yahya, Halimatussadiah Saleh & Mohd Hanafi Azman Ong, 2015).

Since 2017, the preschool curriculum is based on National Preschool Standard-Based Curriculum 2017 Revision (NPSC 2017 Revision). The new NPSC 2017 Revision that emphasises on teaching and learning strategies in the preschool classroom that includes child-centred learning, learning through play, inquiry based learning, integrated approach, thematic approach, project-based learning, mastery learning, contextual learning and multiple intelligences. Moreover, Higher Order Thinking Skills (HOTs) have been also explicitly stated in the learning standards. To fulfil the need of the 21st century and achieve the objective of the NPSC 2017 Revision; creativity, innovative thinking and problem solving skills in learning as well as in daily life are needed (Curriculum Development Division, Ministry of Education, 2017). Creativity in children is developed in the early years through play because play has a

value for creative learning (Wood & Attfield, as cited in O'Connor, 2012). It has been said mathematics can be seen as one of the opportunities for creativity development and the education goals at any school level should encourage pupils to think creatively and logically and be able to solve problem (Svecova, Rumanova & Pavlovicova, 2014).

In the 21st century, mathematics relates to everything in the universe. It has became part of the daily routine of the classroom in both planned and spontaneous activities (Smith, 2009). Furthermore, Ozdogan (2011) stated that the mathematical process starts before the kids go to school. Mathematics can also help children to understand the world around them which teaches them logic and problem solving. Accordingly, all the strands in mathematics engage young children in creative and persistent thinking (Smith, 2009).

1.2 Background of the Study

Early mathematics is a powerful and interesting learning subject for children in their early life. Based on Sharma (2013), mathematics is the foundation of technological and scientific knowledge for social-economic development of the nation. In order to provide wide variety of oppunities for each child to experience a challenge in the mathematics curriculum, there are some professional standards stipulated by major organization for mathematics which include the National Council of Teachers of Mathematics (NCTM), the National Association for the Education of Young Children (NAEYC) and the National Council for the Accreditation of Teacher Education (NCATE) to prepare the children to compete in the 21st century (Smith, 2009). Therefore, an important subject that needs to be taught in early education is mathematics. Every child, regardless of gender, language or race should participate in mathematics to the fullest extent possible (Smith, 2009).

In Malaysia, the early mathematics curriculum provides early mathematics experience to the children which include pre-numbers, number concepts, number operations, shapes and space, value of money and time concept. After the early mathematics is implemented to the children, they are able to foster interest in math through various activities based on everyday experiences that help them to master the basic concepts of mathematics and improve their thinking skills and problem solving abilities (Curriculum Development Division, Ministry of Education, 2017). The contents of early mathematics in Malaysia is almost similar to the contents in other countries and it can be concluded that the compulsory content for pre-schoolers are number concepts and number operations (Jamilah Harun, Munirah Ghazali, Zainab Bee Abd Hamid & Md Irzan Md Nasir, 2017). Therefore, number operations are an important study content for preschool children and the researcher emphasises on the domain of early mathematics in number operations of addition and subtraction.

In order to compete with the best in the world, Malaysia's education system must develop young Malaysians who are knowledgeable, be equipped with leadership skills, having the ability to think critically and creatively and are able to communicate with the rest of the world. It is important our students are enriched with values, ethics and a sense of nationhood, enabling them to make the right choices for themselves, their families and the country with a view towards enduring and overcoming life's inevitable challenges (Malaysia Education Blueprint, 2013-2025). In the National Education Philosophy for Malaysia, the vision of education is "the holistic development of all children which include intellectually, spiritually, emotionally, and physically". Education in Malaysia is undergoing further development of the potential of individuals in a holistic and integrated manner to produce those who are individuals who are knowledgeable, competent, high in moral standards, responsible and capable

of achieving high levels of success that can contribute to the harmony and betterment of the family, the society and the nation (Malaysia Education Blueprint, 2013-2025). Therefore, the Malaysian government is committed to transform the country's education system over the next one-and-a-half decades. As such, the goal and the purpose of the education system is to equip our students holistically to enable them to succeed in the challenges of the 21st century.

To fulfil the 21st century education, learning through play is one of the teaching strategies to be implemented in the preschool curriculum (Curriculum Development Division, Ministry of Education, 2017). Ozdogon (2011) has explained that play isn't only used for making activities enjoyable, it also includes logical processes and helps children to configure the events, relations and connections. Moreover, play also stimulates the thinking, creativity and discovering processes of children. In addition, preschool teachers have to emphasize on HOTs in the classroom (Curriculum Development Division, Ministry of Education, 2017). Consequently, children can enhance their creative thinking skills through creative play activities that involve early mathematics on addition and subtraction in the form of games.

The word "creative" is used in contemporary society and it refers to having the power to create, invent or produce; and also includes being imaginative, artistic or literary; and involves somethings that are useful, constructive and purposeful (Isenberg & Jalongo, 2001). Creative processes involve a series of stages which are necessary for generating new ideas, whereas others consider the final creation or product. For example, an idea or product which is original and appropriate is called creative and creativity is a style of thinking that is both a potential and an ability of individuals to generate creative works (Yaftian, 2015).

Apart from Malaysia Education Blueprint, 2013-2025 and the revised preschool curriculum that used NPSC 2017 Revision intends to transform the Malaysia's education system over the next one-and-a-half decades. The Industrial Revolution 4.0 (IR 4.0) also has given a new impetus to educational transformation. In recent years, education experts have recognised the profound impact of a myriad of technological innovations in ICT that have on education. Besides, researchers predict that IR 4.0 will necessitate important changes in major aspects of education that include content, pedagogy and management of education (Md Abdul Haseeb, 2018). To fulfil the change of the new policy, teachers have to adapt their method of teaching to maintain the children high levels of motivation in their learning and give them time to explore, experiment and play with ideas. Children who are active, and creative attempt to explore and are not afraid to try out their ideas and express their own thoughts (Lopez, 2013).

1.3 Statement of Problem

In the era of science and technology, early mathematics is important for children as they may one day contribute to the society. However, the current issue in the society is that children have shown less interest in mathematics. It has been noted that many children have little interest in mathematics as the teaching method in the classroom is not interesting for them (Sharma, 2013). On the other hand, the children do not see the relationship and relevance of mathematics in their everyday lives (Smith, 2009). Besides, some of the children may not have sufficient basic mathematic skills that later enable them to acquire the arithmetical skills (Elofsson, Gustafson, Samuelsson & Träff, 2016).

Moreover, Smith (2009) has stated that the National Council of Teachers of Mathematics has recommended problem solving in addition and subtraction are the focus of school mathematics. Clements and Sarama (as cited in Jamilah Harun et al., 2017) have also concluded that topics like number and number operation are most important for children in their early school stages. However, many children are taught mathematics by memorize facts and formula but they are unable to apply what they have learned in problem-solving situations (Dodge & Colker, 2001). These students have been reported to have difficulties in solving mathematics problems although it is one of the most important parts in mathematics curriculum which requires mathematics concepts and skills in Malaysia, like many others countries (Tarzimah Tambychik & Thamby Subahan Mohd Meerah, 2010).

In addition, children who were lack of basic early mathematics skills will affect their performance in primary and secondary schools. To support this claim, secondary school students were under achieved the minimum level in their mathematics performance in Malaysia. Chin and Effandi Zakaria (2015) have stated that Malaysian students' performance in Mathematics is still low at the international level whereby a decline in Trends of International Mathematics and Science Study (TIMSS) has been observed from 1999 to 2011. Although the average score in Mathematics for Malaysian students in grade 8 (Form 2) in 1999 was the best achievement (519 points), it declined to 508, 474 and 440 from 2003, 2007 and 2011, respectively. Nevertheless, the average score improved 25 points in 2015 to 465 points (Ministry of Education, 2015). Apart from that, reports from TIMSS in 2007 showed that Malaysian respondents had significantly low achievement in cognitive dimension which emphasized on thinking skills and problems solving (Tarzimah Tambychik & Thamby Subahan Mohd Meerah, 2010).

Furthermore, the Ministry of Education reported that 60% of the 15-year-old students who participated in the Programme for International Student Assessment (PISA) failed to achieve the minimum requirement level in mathematics. Besides, the process of transitioning to KSSR (*Kurikulum Standard Sekolah Rendah*) with the first cohorts in 2011 started in primary one had adopted more critical thinking and problem solving skills. Therefore, the Primary School Evaluation Test (UPSR) in 2016 had adopted a new format which covered basic and higher order thinking skills (HOTs) and the questions were more challenging to the students (Noor Azimah Abdul Rahim, 2016). Thus, the results of the UPSR for Mathematics indicated that there was still a large number of pupils who obtained grades D or E (Chin & Effandi Zakaria, 2015).

Therefore, mastery of the basic early mathematics skills during the preschool years is crucial before the children proceed into the primary and secondary schools. Sarama, Lange, Clements and Wolfe (2012) have indicated that mastery of mathematics at the early stage that is during preschool ages is crucial and it becomes the indicator of achievement and mastery of advanced mathematics. Literature also proves that the numeracy skills mastered by primary students depends on the early numeracy skills learned in the preschool curriculum. Thus, children need to be taught basic numeracy skills that helps to prepare them for the next stage of mathematics education (Jamilah Harun et al., 2017; Kamariah Abu Bakar, 2017).

Moreover, the lack of knowledge in play teaching among the preschool teachers is an issue too. Some studies revealed that most of the Malaysian preschool teachers are facing difficulties to implement the games-based approach because lack of knowledge and skills (Sharifah Nor Puteh & Aliza Ali, 2012). On the other hand, 20 preschool teachers agreed that there is a need for developing a module as a guideline

to implement game-based teaching and learning in early mathematics (Chin & Effandi Zakaria, 2015).

Currently, there are inconsistent opinions and conflicting statements from past research about early mathematics, play learning and teaching method. This is also one of the purposes why this research is carried out. According to Hafsah Jantan et al. (2015), teachers viewed play as a useful method in every place of teaching and learning and they give chance to children to participate actively through play activities. However, the research conducted by Zakiah Mohd Ashari et al. (2011) outlined that preschool teachers prefer a formal approach because it enables them to concentrate on the mastery in one subject and skill before children enter year one. Furthermore, parents are generally worried about their children's readiness to enter Year One and refuse play activities (Lily Muliana Mustafa & Mohamed Nor Azhari Azman, 2013). In addition, Rohaty Mohd Majzub (2013) stated that some teachers do not see the value of play activities as an important method of teaching because of parental pressure where they perceive play approach as unfavourable. However, according to Lin and Yawkey (2013), most Taiwanese parents strongly have agreed that play contributes to children's development, as they are willing to be supportive of this approach. Recently, the Malaysian Minister of Education announced that the education system in 2019 will be changed in such a way that Years One to Three pupils do not have to sit for examinations but focus on learner centred assessments and numerous hours in the classroom are to be replaced with play. This may help pupils to have fun, learn good values of friendship, respect and love (Menon & Sheila Sri Priya, 2018). This example shows inconsistency in past opinions and conflicting statements. This research problem guides the researcher to state his speculation and establish the research

objectives which are to examine how creative play activities affect early mathematics performance among preschool children.

Apart from that, the research problem arises when there is an inconsistency from the results of the previous research. A study conducted by Chin and Effandi Zakaria (2015) showed that there were significant differences in mathematics scores of students across three testing time (pre-test, post-test 1 and post-test 2) in which the participants in Experimental group who underwent GBLM showed higher understanding of number concepts and operations compared to the Control group. However, Chin and Effandi Zakaria (2015) also reported that there was no major effects for the mean score in mathematics achievement between Experimental and Control groups. The results also showed that there was no significant difference in mathematics achievement between Experimental and Control groups. Moreover, Zakiah Mohd Ashari et al. (2013) indicated 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 preschool children of the Experimental group which was higher than the Control group. Nevertheless, based on the result of paired samples t-test of their study, p values for both Control and Experimental groups were also show to be significant. Furthermore, the research conducted by Takeuchi, Towers and Plosz (2016) showed that many young children described their feeling towards mathematics as “great, good and happy”. However, when they reached grade 2, some young students showed that they disliked challenging and complex mathematics problems, felt maths problems were hard to figure out and required to do a lot of exercises. To investigate this problem, research needs to be conducted to relate the differences between the Experimental and Control groups in preschool children’s number operation skills.

Furthermore, from 2017 onwards, the new curriculum of NPSC 2017 Revision accentuates on HOTs that covers critical and creative thinking skills, reasoning, and thinking strategies. Besides, in the new curriculum, preschool teachers have been encouraged to incorporate creativity in selecting, arranging, improvising and diversify learning activities that suited pupils according to their learning standard (Curriculum Development Division, Ministry of Education, 2017). Creativity is fundamental for the preschool curriculum and preschool teachers should give opportunities to the children to imagine and express their ideas (Dere, 2019). Therefore, creative play will be the focus of this study. NPSC 2017 Revision also focuses on child-centred learning which includes problem solving and decision making.

Apart from the revision of preschool curriculum, the Standard Curriculum for Primary Schools (KSSR) mathematics syllabus also focuses on HOTs. This is a new method to learn mathematics in the 21st century, as the students not only learn to calculate the numbers but are also required to think (Chan, 2015). Teaching early mathematics through creative play is an informal and child-centred teaching strategy that can suit the child's interests. Leggett (2017) stated that children think creatively as they are engage in play based learning activities and the role of the educator is pivotal in assisting children in the early development of creative thinking. Therefore, elements of creativity and innovation should be integrated in teaching and learning.

On top of that, previous research findings in Malaysia on number operations were only limited to the range of numbers from 0 to 10 (Zakiah Mohd Ashari et al., 2013; Chin & Effandi Zakaria, 2015). The revision of the content standard of mathematics in the NPSC 2017 Revision has changed the range of number from 0 to 10 to the range of 0 to 18 for addition and subtraction operations (Curriculum Development Division, Ministry of Education, 2017). Hence, this research study

focuses on addition and subtraction operations that can provide new findings in the range of number between 0 and 18 based on the revision of the content standard of mathematics in NPSC 2017.

Apart from the revision of the content standard of mathematics in NPSC 2017 Revision, previous research had explored aspects that focused on developing a module of learning through the play of number concepts and number operations (Zakiah Mohd Ashari et al., 2013; Chin & Effandi Zakaria, 2015); teaching mathematics through play (Sharma, 2013; Elofsson et al., 2016); early years students' relationships with mathematics (Takeuchi, Towers & Plosz, 2016; Elofsson et al., 2016); mathematics creativity (Nadjafikhah, Yaftian & Bakhshalizadeh, 2012; Yaftian, 2015); Malaysia preschool teachers' belief, attitude, and competence in using play activities (Hafsah Jantan et al., 2015); understanding of parents' perceptions of child's play to their development and behaviours in supporting their child's play (Holland, 2012; Lin & Yawkey, 2013); creative play (Merrick, 2008) and creative thinking of teaching strategies used by educators (Jeffrey & Craft, 2010; Tiberiu & Balas, 2015; Leggett, 2017; Kim et al., 2019). Nevertheless, there has been a lack of studies that have integrated creative activities and play together in early mathematics and creative play activities in addition and subtraction as a guideline for preschool teachers. In order to bridge the gap between the previous research in the area of play, creative play and early mathematics, the researcher aims to explore in depth the area of creative activities and play integration in early mathematics. This is to understand and examine 1) the level of early mathematics performance among preschool children after the revision of content standard of mathematics in NPSC 2017, 2) how creative play activities affect early mathematics performance among preschool children 3) the significant

differences between Experimental group and Control group in preschool children's number operations skills.

1.4 Rationale of the Study

Mathematics relates to understanding everything in this universe and builds a strong foundation of the numerical. During early years, children can develop a wide variety of mathematics concepts, not only from formal instructions but also from everyday practices in which they are involved, such as play (Takeuchi, Towers & Plosz, 2016). Additionally, mathematical creativity is an ability to analyse a given problem from a different perspectives, discover patterns, differences and similarities, generate multiple ideas and chose a proper method to deal with unfamiliar mathematical concepts (Laycock, as cited in Nadjafikhah et al., 2012). Hence, creative play activities are important in early mathematics learning and preschools teachers play an important role in conducting the different types of games for the children. Isenberg and Jalongo (2001) stated that teachers must adapt their curriculum so that all the children can benefits from the power of play.

The researcher used quasi-experimental with non-equivalent group pre-test and post-test design where the respondents were not randomly assigned due to the government preschool setting which was not suitable for the researcher to select the respondents according randomly to Control and Experimental groups. In the Malaysian Government Preschool setting, each preschool class is taught by a preschool teacher. In order to examine how creative play activities in early mathematics affects preschool children's number operations in addition and subtraction skills, two groups' of respondents were selected to compare the findings. According to Chua (2016), quasi-experimental non-equivalent group pre-test and post-test design are most often

used and the research design consists of two groups of respondents which are treatment group and control groups.

In this study, creative play activities in early mathematics with lesson plans and the different steps of learning activities will be provided to the preschool teacher as a guideline to implement the research. Thus, the rational of this research is, preschool teachers can conduct creative play activities in early mathematics in a systematic and effective manner to create a fun environment for the children. This is to enhance their development, creativity, imagination, problem solving and critical thinking skills through fun learning that indirectly enhances their addition and subtractions skills. Moreover, a creative way of teaching mathematics should have excitement and challenge instead of stress. Accordingly, teaching early mathematics through creative play is suitable and better than applying worksheets in a preschool children's classroom (Clements, as cited in Zakiah Mohd Ashari et al., 2013). Since we are competing with mobile technology and stimulating video games outside the classrooms, we need to provide children with fun and creative practice tools that engage and promote successful learning (Pike, 2014). The outcome expected at the end of this research is that children can enhance their number operations in addition and subtraction skills based on 3 levels of performance standard in the NPSC 2017 Revision. This can be achieved through the creative play activities of addition and subtraction activities in the Experimental group.

1.5 Purpose of the Study

The purpose of this study is to examine the effects of creative play activities on early mathematics performance among preschool children's number operations in addition and subtraction skills.

1.6 Research Objectives

1. To examine the level of early mathematics performance among preschool children.
2. To examine how creative play activities affects early mathematics performance among preschool children.
3. To determine the significant differences between Experimental group and Control group in preschool children's number operation skills.

1.7 Research Questions

1. What is the level of early mathematics performance among preschool children?
2. To what extent does creative play activities affect early mathematics performance among preschool children?
3. Is there any difference between the Experimental group and Control group in preschool children's number operation skills?

1.8 Research Hypothesis

1.7.1 H_o = The creative play activities do not affect early mathematics performance among preschool children.

H_1 = The creative play activities affect early mathematics performance among preschool children.

1.7.2 H_o = There is no significant difference between Experimental group and Control group in preschool children's number operation skills

H_1 = There is a significant difference between Experimental group and Control group in preschool children's number operation skills.

1.9 Significance of the Study

The significance of this research is to offer a valuable and unique contribution to the Early Childhood Care and Education (ECCE) in the early mathematics' field. This is by addressing the effect of creative play activities in early mathematics among preschool children's number operations in addition and subtraction skills. This research is conducted after the revision of the content standard of mathematics in NPSC 2017 Revision which has been changed from the range of numbers 0 to 10 to the range of 0 to 18 in addition and subtraction operations.

In the area of creative play, the researcher explored in depth in the area of creative activities and play integration in early mathematics. This would help the children in the development of their creativity, imagination and to think in creative ways through the 10 lessons of creative play activities in addition and subtraction. Oncu and Unluer (2010) pointed out play is an essential part of childhood creative activity and it is an important elements that develops their creativity and imagination. The combination of play and creativity is a complex and inspirational phenomenon (Smithner, 2011).

For teachers or educators, they will understand creative play better. They will also be able to teach in a systematic and effective manner in number operations of early mathematics through the lesson plans and steps of these learning activities as guidelines. Teachers can improve their teaching skills by incorporating more creative activities as teaching method to enhance interest among children. Isenberg and Jalongo (2001) stated that teachers must adapt their curriculum so that all the children can benefit from the power of play.

For the parents, they can know more about the integration of creative activities and play and the importance of creative play in the ECCE early mathematics field.

Parents should be the role model in their children's upbringing and they have the right to decide the types of preschools that suit their children in the learning process. Parents who have witnessed the relevance of a play-based curriculum in the current education system that can help to broaden their children's lives and serve as resources to determine what information they can accept when making decisions about early education for their children (Turk, 2015).

1.10 Limitation of the Study

The research design applies quasi-experimental with non-equivalent group pre-test and post-test design. According to Chua (2016), quasi-experimental research design is used to evaluate the effectiveness of a programme where respondents cannot be randomly assigned and the researcher will choose two groups with nearly identical traits. Hence, the limitation of the research often crops up as the researcher is unsure whether the change of the respondents in the treatment group at the end of the research was caused by the treatment administered to them or caused by external factors before treatment (Chua, 2016). Hence, the 10 lessons of creative play activities in early mathematics will be implemented in the Experimental group for a designated period of time to ensure the validity of data for the research findings. The creative play implementation activities will be conducted for 10 weeks due to time constraint and to avoid influence or interference by external factors in the Experimental group.

Besides, the 10 lessons of creative play activities in the early mathematics of addition and subtraction was implemented during the 1st term of the school year in 2019 in which the children will start the new semester of the school. They will be more into learning in pre-numbers and number concepts in the first few months, thus, the

experiments can only be conducted in 1st term of the school year after they have mastered pre-numbers and number concepts.

Furthermore, this study only applies to the Selangor state and two preschools were selected. Thus, the findings of the study were also restricted to the goverment preschools. The findings of the research might not represent private or international kindergarten. Apart from that, the sample in this study was limited to 60 children of six years old.

On top of that, creative play activities in early mathematics only focuses on two topics which include addition and subtraction in the range of number 0-18 in the early mathematics content area under NPSC 2017 Revision. Hence, the findings from the study will be able to show whether the children who were placed in the Experimental group can enhance their number operations of addition and subtraction skills based on the 3 levels of performance standard through creative play activities in early mathematics.

1.11 Operational Definition

1.11.1 Early Mathematics

According to the Curriculum Development Division, Ministry of Education (2017), early mathematics curriculum in Malaysia is based on new NPSC 2017 Revision. It provides early mathematics experiences to the children that includes pre-numbers, number concepts, number operations, shapes and space, value of money and time concept. After implementing early mathematics to the children, they are able to foster interest in math through various activities and everyday experiences, master the basic concepts of mathematics and improve their thinking and problem solving skills. In this study, early mathematics refers to the content standard of early mathematics in

NPSC 2017 Revision which includes number operations of addition and subtraction skills between the range of 0 to 18.

1.11.2 Performance

Performance refers to Levels that children need to show when they have acquired a particular skill, knowledge or value (Curriculum Development Division, Ministry of Education, 2017). In this study, there are 3 Levels of addition performance standard in the NPSC 2017 Revision which refer to Level 1 - can state sum of two groups of objects, Level 2 - can solve problems of addition within 18 using concrete objects and Level 3 - can solve problems of addition within 18. Besides, there are 3 Levels of subtraction performance standard in the NPSC 2017 Revision which refer to Level 1 - can state the balance when objects are removed from a group, Level 2 - can solve problems of subtraction within 18 using concrete objects and Level 3 - can solve problems of subtraction within 18.

1.11.3 Creative Play Activities in Early Mathematics

Burton (2010) defined that learning mathematics through play can enhance and improve children's logical thinking skills and work on procedural knowledge such as addition, subtraction, multiplication and division problems. In addition, Svecova, Rumanova and Pavlovicova (2014) have defined mathematics should be seen as one of opportunities for creativity development. The education goals at any school level should encourage pupils to think creatively, think logically and to be able to solve problem. On the other hand, Smithner (2011) defined that creative play needs time, space and imagination; make belief that play is not always encouraged at home or day care centres; it is unrealistic to believe that the ideal circumstances for play is in the

context of formal schooling. In this study, the researcher emphasizes on integration of creative activities and play in 10 lessons of the activities in addition and subtraction to examine whether creative play activities in early mathematics affects preschool children's number operations in addition and subtraction skills and indirectly enhance their' development, creativity, imagination, problem solving and high thinking skills through fun learning.

1.11.4 Preschoolers

Government preschool consists of children aged between 4+ to 5+ learning within a year or more before entering year one. Preschool education aims to nurture students' potential in all aspects of development which is to master basic skills and to develop a positive attitude as preparation to enter primary school (Ministry of Education, 2018). In this study, preschool children refer to those who are at the age of six years old (5+).

1.12 Summary

Mathematics is a subject in which children explore many kinds of reasoning. The children see, listen and talk, touch and move to discover how math explains the real worlds (Smith, 2009). Therefore, early mathematics is one of the important subject to the children. To make the children learn early mathematics more effectively, creative play activities need to be integrated into preschool teacher teaching strategies. Through creative play of addition and subtraction games, children can engage different kind of creative activities in their number operations learning process. According to the Curriculum Development Division, Ministry of Education (2017), teaching with different kind of activities can instill the children to be able to think critically,

creatively and innovatively; able to solve problems and make ethical decisions. Hence, creative play activities in early mathematics can enhance children' addition and subtraction skills and indirectly enhance children' creativity, imagination, problem solving and HOTs through fun learning. Additionally, parents have an important role when preparing their children for preschool as they are considered to be their first educators. Therefore, parents need to understand more about creative play program in preschools and support their children to engage in creative play learning. Thus, this research by contributing to the field of ECCE. It also provides for the parents and teachers in future to get more information and understanding about creative play activities in early mathematics of addition and subtraction.

Chapter 2 presented the history of preschool education in Malaysia, ECCE and government preschool curriculum in Malaysia, the design of NPSC 2017 Revision and the early mathematics curriculum in Malaysia preschools. In addition, play, cognitive play, social play, creative play, learning mathematics through play, past research, theoretical and conceptual framework are also covered in the literature review.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is defined as making critical and systematic references to documents that contain ideas, research designs, data and details of specific knowledge related to the research topic (Chua, 2016). The researcher reviews and evaluates previous research works in order to obtain information for his own research. After deciding on the title of his research, the researcher will review the literature from research conducted previously on ideas and themes related to the topic. Much useful information such as research findings, can be gathered from the existing knowledge in the literature review.

The goal of the literature review in this study is to describe critically the different aspects contained in it especially the history of preschool education in Malaysia, Early Childhood Care and Education (ECCE) and government preschool curriculum in Malaysia, the design of National Preschool Standard-Based Curriculum 2017 Revision (NPSC 2017 Revision) and the early mathematics curriculum in Malaysia preschools. In addition, play, cognitive play, social play, creative play, learning mathematics through play are discussed. Besides that, the theoretical framework that includes Parten's cooperative play theory, Jerome Bruner's theory of mathematics, Singapore Math Model Method, theory of Torrance's creative process and theory of Lev Vygotsky are also explained. Moreover, the conceptual framework of creative play activities in early mathematics and number operations of addition and subtraction skills, past research in the areas of play, creative play, creative thinking and early mathematics are also covered in the literature review.

2.2 The History of Preschool Education in Malaysia

Preschool education in Malaysia was started by the Ministry of Education (MOE) in 1992. It was to implement the preschool programme as a pilot project based on the decision made by Cabinet on 18 December 1991. The purpose of this project was to create 1131 preschool classes. At the same time, the cabinet agreed that the Ministry of Education (MOE) could continue to expand the preschool programme from 2002. Since then, the expansion of the preschool programme has been conducted from time to time and continue the policies of the Education National Key Result Area (NKRA), as contained in the 10th Malaysia Plan and the Malaysia Education Blueprint 2013-2025 (Ministry of Education, 2018).

On the other hand, MOE is responsible to give attention to the development of preschool education in Malaysia. Moreover, the Education Act of 1996 provides the important role of preschool education which include the establishment of kindergartens, the minister's power to establish and maintain kindergartens, preschool curriculum and medium of instruction and teaching of Islamic studies (Ministry of Education, 2018).

In the democratisation of education, a particular policy enables children with special education needs to enjoy preschool education, regardless of family income, ethinicity and place of residence. The government's preschool education is a programme for children between 4+ to 5+ years old to be introduced to the learning experience within a year or two year berfore entering year one (Ministry of Education, 2018).

On the other hand, the aims of the preschool education were to develop the full potentials, master basic skills and develop a positive attitude as preparation to enter primary school among children. Moreover, the objectives of preschool education also

included the encouraging positive personal traits, self-concept and patriotism. They were to be taught the correct use of the Malay language. The preschool objectives also included the development of language and communication skills, use of English in their daily lives in line with its status as the second official language. The other aims included incalculating the practise of noble values in their daily lives based on religious teachings. They were also to acquire cognitive skills to solve problems, develop emotional maturity and social skills, attain creative and aesthetic values to appreciate natural beauty and cultural heritage. The objectives also emphasised the correct use of the Chinese and Tamil languages to communicate in schools where the medium of instructions are Chinese and Tamil. At the same the objectives also encouraged the practice of Islamic values in the daily lives of the Muslim students (Ministry of Education, 2018).

2.3 Early Childhood Care and Education in Malaysia

There are three agencies namely the government, social organizations and private sectors that are responsible for Early Childhood Care and Education (ECCE) in Malaysia. Malaysia' ECCE is based on the notion that every child has the right to quality care and a holistic development during the early years of their lives that deal with their physical, emotional, social, intellectual and health aspects (Education for All 2015 National Review Report). ECCE plays an important role in fulfilling the need and to transform the education of Malaysia. Consequently, government preschools, private kindergarten, social organizations, preschool teachers, parents and children need to cooperate and know their roles and responsibilities to achieve the goals by 2025.

2.4 Government Preschool Curriculum in Malaysia

The government's preschool in Malaysia started in year 1992 as a pilot project by Ministry of Education (MOE). The preschool curriculum is based on the Malaysian Preschool Education Guideline from 1993 to 2002. Then, the Preschool Education Guideline was revised and became the National Preschool Curriculum (NPC) and was implemented from 2003 untill 2009 (Ministry of Education, 2018). Besides, Jamilah Harun et al. (2017) had pointed out that the National Preschool Standard-Based Curriculum (NPSC) was developed and implemented in all government and non-government preschools after revised the National Preschool Curriculum (NPC) to achieve the development of physical, emotional, spirituals, socials and intellectual. The first NPSC recommended learning through play approach in the preschool curriculum (Zakiah Mohd Ashari et al., 2013).

From early 2017, the preschool currciculum was based on the National Preschool Standard-Based Curriculum 2017 Revision (NPSC 2017 Revision). In order to fulfil the needs to transform the Malaysia education, the new NPSC 2017 Revision emphasised on High Order Thinking Skills (HOTs) and focus on child-centred learning which included problem solving and decision making (Curriculum Development Division, Ministry of Education, 2017).

Table 2.1

Curriculum of Government Preschool Education in Malaysia (1993-2017)

Year	Curriculum
1993 – 2002	Malaysian Preschool Education Guideline
2003 – 2009	National Preschool Curriculum
2010 – 2016	National Preschool Standard-Based Curriculum
2017	National Preschool Standard-Based Curriculum 2017 Revision

2.5 National Preschool Standard-Based Curriculum 2017 Revision Framework

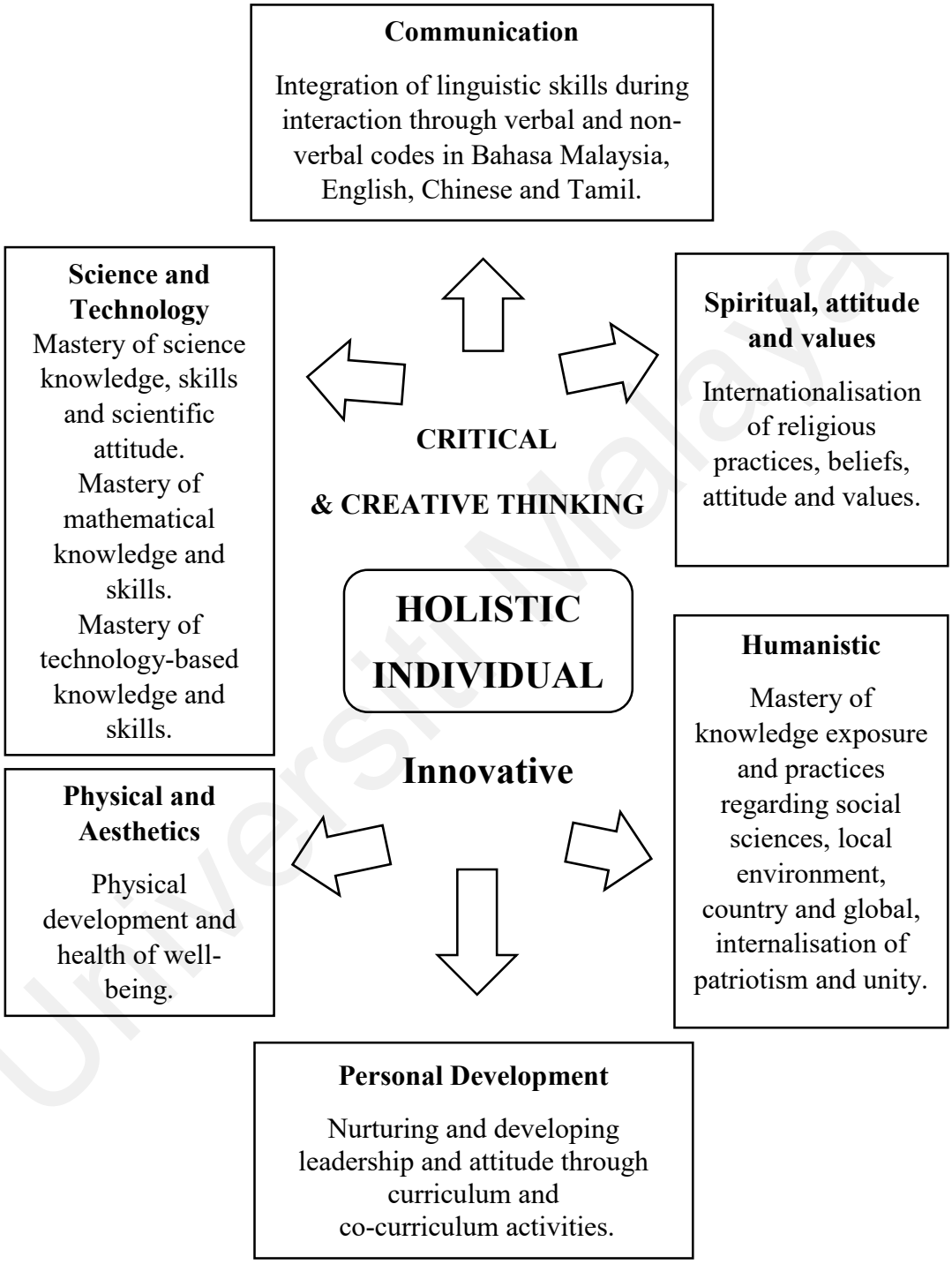


Figure 2.1 The Framework for National Preschool Standard-Based Curriculum 2017 Revision (Curriculum Development Division, Ministry of Education, 2017)

2.6 Early Mathematics' Curriculum in Malaysia Preschools

Early Mathematics was under science and technology and followed the National Preschool Standard-Based Curriculum (NPSC) from 2010 to 2016. NPSC was developed and implemented in all government and non-government preschools starting from 2010 (Jamilah Harun et al., 2017). From the curriculum, children can gain early mathematics experience which includes pre-numbers, number concepts, number operations, shapes and space, value of money and time concept (Curriculum Development Division, Ministry of Education, 2017). One of the early mathematics content listed in NPSC is number operations which is only introduced to six-year-old children (Jamilah Harun et al., 2017). Number operations cover the skills of addition and subtraction in the range of number 0-10 (Chin & Effandi Zakaria 2015; Jamilah Harun et al., 2017). The skills of counting that children have acquired before will be used to state the sum of two numbers. Thus, they need to apply counting as a strategy to get the sum. In addition, the children also need to talk using their own language and make sentences involving addition. Apart from that, the children will learn the concept of subtraction such as removing or taking away from the objects and the subtraction in real life will be revealed by them (Jamilah Harun et al., 2017).

In the beginning of 2017, early mathematics curriculum was based on the new NPSC 2017 Revision and children were able to foster interest in mathematics through various activities and everyday experiences, master the basic concepts of mathematics and improve their thinking skills and problem solving. On top of that, the difference in new NPSC 2017 Revision is, children at the age of five have started learn basic number operations and the range of numbers changed from 0-10 to 0-18 (Curriculum Development Division, Ministry of Education, 2017). In this study, the researcher has emphasized content standard of early mathematics in the NPSC 2017 Revision which

included the number operations of addition and subtraction skills in the range of numbers 0 to 18. Number operations skills is important to the children before they enter year one. Clements and Sarama (as cited in Jamilah Harun et al., 2017) stated that topic of number and number operations are the most important for the early school ages children.

Table 2.2

Differences of Content Standard in Early Mathematics Curriculum

Curriculum	Addition	Subtraction
2010 – 2016 National Preschool Standard-Based Curriculum (NPSC)	ST 8.1 Understand operation of addition within 10 (0-10)	ST 8.2 Understand operation of subtraction within 10 (0-10)
2017 National Preschool Standard-Based Curriculum 2017 Revision (NPSC 2017 Revision)	MA 3.1 Solve operation of addition within 18 (0-18)	MA 3.2 Solve operation of subtraction within 18 (0-18)

(Curriculum Development Division, Ministry of Education, 2017)

According to the Table 2.2, the curriculum of NPSC (2010-2016) for the strand of Science and Technology includes science and mathematics. The content standard for early mathematics is ST 8.1 Understand operation of addition within 10 for addition and ST 8.2 Understand operation of subtraction within 10 for subtraction. For the new curriculum of NPSC 2017 Revision (2017), the strand of Science and Technology includes early science and early mathematics. The content standard in early mathematics curriculum includes MA 3.1 Solve operation of addition within 18 for

addition and MA 3.2 Solve operation of subtraction within 18 for subtraction. The difference between NPSC and revised NPSC 2017 is the inclusion of five years old children in learning addition and subtraction compared to the former which only involved the learning subject at the age of six. Apart from that, the revision of the content standard of mathematics in NPSC 2017 Revision has changed the range of number from 0-10 to the range of 0-18 for addition and subtraction operations.

2.7 Play

Play is an activity that can let children explore their discovery, inquiry and develop direct experience in nature. The growing children learn almost everything through play (Goldstein, 2012). It is also a channel which can expand a child's development to a higher level and it offers a chance to connect with others (Anderson-McNamee & Bailey, 2010). According to Hafsah Jantan et al. (2015), play is a child's right that should be given to them. Nursery operators, parents, teachers, kindergarten and the community need to play an important role to make sure they have sufficient opportunity to play unrestricted.

Apart from that, the play context is ideal for supporting children's creative and imaginative growth because it offers a risk-free environment (Isenberg & Jalongo, 2001). The qualities of spontaneity, wonder, creativity, imagination and trust are best developed in early childhood play (Goldstein, 2012). Besides, play allows children to learn to communicate their emotions, to think, be creative and to solve problems. They learn to think, remember and solve problems (Anderson-McNamee & Bailey, 2010).

In addition, Vygotsky (1978) explained that play is a critical scaffold that enables children to advance to higher ability levels in all developing areas. Scaffolding is particularly important as we examine the range of teacher's roles in play setting.

Often there are tasks that a child cannot accomplish independently but can accomplish with the assistance of an adult or a more capable peer. This "zone of proximal development" is the optimum time for teachers to assist children in their learning. Moreover, play helps to build strong learning foundations because later levels of learning are built upon earlier ones, a process referred to as scaffolding (Goldstein, 2012).

Furthermore, playtime in school such as recess allows learning and practising of basic social skills. Children develop a sense of self awareness, learn to interact with other children, learn how to make friends and know the importance of role-playing. Exploratory play in school allows children time to discover and manipulate their surroundings (Anderson-McNamee & Bailey, 2010). In play, the learning process is self-sustained because the natural love of learning is preserved and strengthened. The power of play also enhances self-esteem and interpersonal relationships (Goldstein, 2012).

Besides, Froebel (as cited in Maheshwari, 2013**)** stated that the children needed real experiences and to be physically active. There is a link between play and learning. According to Froebel, play is the work of the children. On the other hand, when children are engaged in running, jumping and playing games such as hide and seek, physical play can offer a chance for children to exercise and develop muscle strength. Physically play can also increase the range of motion, agility, coordination, balance, flexibility and gross motor exploration for the children (Anderson-McNamee & Bailey, 2010).

On top of that, there are few types of play such as cognitive play and social play. According to the Isenberg and Jalongo (2001), cognitive play reflects children's age, conceptual understandings and experiential background. Besides, social play

helps children to develop a sense of belonging to a group as they interact with others and learn how to negotiate rules for positive social interactions (Kennedy & Barblett, 2010).

2.7.1 Cognitive Play

There are four categories of cognitive play that include functional play, symbolic play, constructive play and games with rules (Piaget; Smilansky; Smilansky & Shefatya, as cited in Isenberg & Jalongo, 2001). Functional play (birth to age two) is characterized by simple, pleasurable, repeated movements with objects, people and languages to learn new skills or to gain mastery of physical or mental skills. It is also referred to as sensorimotor, practice or exercise play (Piaget; Smilansky; Smilansky & Shefatya, as cited in Isenberg & Jalongo, 2001).

Besides, symbolic play (2 to 7 years) is also called pretend, dramatic or sociodramatic, fantasy or make-believe play. Symbolic play reflects children's growing mental ability to make objects, actions, gestures or words stand for something or someone else. Play at this stage is called symbolic because it focuses on social roles and interactions. While symbolic play involves two or more children who communicate verbally about the play episode, it is called sociodramatic play. Sociodramatic play is considered a higher level of symbolic play behaviour. The children can exchange information and ideas during a jointly elaborated play sequence or theme, they can also simultaneously be actors, interactors and observers. It also offers children rich solving problem, intellectual and social abilities (Smilansky & Shefatya, as cited in Isenberg & Jalongo, 2001).

Apart from that, in constructive play, children create something or engage in

problem-solving behaviour according to a preconceived plan. Constructive play often combines functional and symbolic play and predominates during preschool years (Forman, Rubin, Fein & Vandenberg, as cited in Isenberg & Jalongo, 2001). Whitman (2018) has pointed out that constructive play allows imagination, cultivation of new ideas that can be create through experimentation in the activities.

Moreover, games with rules rely upon prearranged rules that guide acceptable play behaviour of reciprocity and turn taking. Games with rules such as board games, card games or outdoor games are the most famous activities. Games with rules enhance children's physical coordination, refine their social and language skills, build conceptual understanding and children's understanding of cooperation and competition (Devries, as cited in Isenberg & Jalongo, 2001). In addition, games with rules allow the children learn to cooperate and take turn. When they play simple games such as "Go Fish or Simon Says", they can also learn how to obey the rules and understand that there's only a winner in each game (Whitman, 2018).

2.7.2 Social Play

Play is important for children's social development because social play encourages social interactions. For example, children learn how to solve problems, resolve conflicts, take turns, to be patient and to get along with peers (Beaty, 2014). Children around the age of three start engaging in the social play where they begin to socialize with other children. By interacting with other children in play settings, the children learn social rules such as give and take and cooperation. Children are able to share toys and ideas. They begin to learn to use moral reasoning to develop a sense of values (Anderson-McNamee & Bailey, 2010). Therefore, social skills are just as important as cognitive skills and support for their development should not be neglected.

Social play has been the focus of such research since Parten first looked at "Social Participation among Preschool Children" in the late 1920s and published her findings that were divided into six stages which included unoccupied play, onlooker play, solitary play, parallel play, associative play and cooperative play (Beaty, 2014; Withman, 2018). As an example of cooperative play, the children play act as working in a restaurant stall and that may alternate their roles in the play as customer, chef and waiter through pretend play. They need to cooperate with peers to complete the tasks (Van Hoorn, as cited in Beaty, 2014).

Furthermore, social play has become a big part for the pre-schooler. When the children are playing or participate in the group activities, interactions occur and relationships are built. The impact of social play in a child's environment makes a difference in their lives. Through social play, the children learn how to control and express their emotions. This is crucial during the preschool years because when children regulate their emotions, they develop their social skills and build relationships with their peers (Withman, 2018).

2.8 Creative Play

The word "creative" means the power to create, innovations to develop the ideas or skills, approaching the realm of art which includes imaginative, artistic and literary (Isenberg & Jalongo, 2001). A review of more than 40 studies have revealed that play is significantly related to creative problem-solving, co-operative behaviour, logical thinking, IQ scores and peer group popularity (Fisher, as cited in Goldstein, 2012). Besides, play allows children to be creative while developing their own imaginations and it is important to healthy brain development. Playing with other children also helps them to know how to be part of a group and learn the skills of negotiation, problem

solving, sharing and working within groups. In addition, children practice decision making, move at their own pace and discover their own interests during play (Anderson-McNamee & Bailey, 2010).

Creative play includes creative individuals and the interrelation of the development area between the intellectual, creativity, physical, social and emotion (Hendy & Toon, as cited in Smithner, 2011). According to Vygotsky, children's play begins with the social interactions among adults through pretend play and creative play. During this latter phase, the child begins to develop autonomy and takes charge of their play experiences. They become more confident and adventurous and develop rules which they may share with their peers (Gray & Macblain, 2012).

Moreover, Smithner (2011) pointed out that in the changing technology of the 21st century, creativity arises from play and it is an essential survival skill encompassing the ability to be alert at the moment, have either conscious or unconscious insights and to continually learn and imagine something new. Creativity is the ability to use imagination in gathering, assimilating and generating ideas or create something new or original through inspiration or combination of existing ideas (Curriculum Development Division, Ministry of Education, 2017; Yates & Twigg, 2017). Thus, teaching creativty is crucial because it is intended to develop young people's own creative thinking and behaviour (Jeffrey & Craft, 2010). Creative thinking is a transformative activity that leads to new ways of thinking and doing that is novel for the children or useful to children's communities (Leggett, 2017). Creative thinking requires imagination, creativity, play, sharing and reflection (Merrick, 2008).

Apart from that, the children's experience of play in group activities have showed more evidence of creative thinking, being both more inventive and creative in the strategies they used and more persistent in their attempts to solve problems

(Genova, as cited in Fumoto, Robson, Greenfield & Hargreaves, 2012). Children are imaginative by nature but imagination requires nurture and encouragement at all ages. There is a great need for arts based inquiry in this area; a methodical examination of creative play in the classroom would surely reveal the inherent benefits for communication, socialization, emotional and group dynamics. Thus, education should tap into the relationship between play and exploration, between multiplicity and openness, as students learn how to navigate and contribute to the new creative and cultural development for future (Smithner, 2011). In order to enhance creative play in the preschool curriculum, preschool teachers need to teach using different approaches in the preschool classes, they should also be creative in teaching using various methods to avoid boredom and poor responses from the children (Rohaty Mohd Majzub, 2013). Besides, the best way to enhance children's development and high level of thinking skills is using creative techniques that allows children to express themselves with different methods (Lopez, 2013). Young children's creative abilities are most likely to be developed in an atmosphere in which the teacher's creative abilities are properly engaged (Jeffrey & Craft, 2010).

2.8.1 Criteria for Creativity

In order for a behavior to be creative, it must meet four basic criteria which are original, appropriate, fluent and flexible (Guilford; Jackson & Messick; as cited in Isenberg & Jalongo, 2001).

Original	Low probability of occurrence; producing unusual, unique or clever ideas.
Appropriate	Appropriate and relevant to the goals of the person who produced it.
Fluent	It results in many new, meaningful forms; building up collections of related ideas.
flexible	It explores and uses non-traditional approaches to problem solving.

2.8.2 Creativity in the Preschool Curriculum in Malaysia

In the beginning of 2017, one of the aspirations of the NPSC 2017 Revision is to produce pupils with 21st century skills by focusing on thinking and living skills and their future careers which are based on moral values (Curriculum Development Division, Ministry of Education, 2017). The important of creativity was recognized as an essential 21st century skills in education (Kupers et al., 2019). Consequently, teachers are encouraged to creatively choose, arrange, devise and develop various activities that are based on Learning Standards that fulfil the needs of the children. The teachers have to make the best choices when planning lessons by using various teaching and learning strategies appropriate with the development, abilities, needs, talents and interests of the children (Curriculum Development Division, Ministry of Education, 2017).

On top of that, High Order Thinking Skills (HOTs) have been explicitly stated in the learning standard in the Malaysia preschool curriculum. HOTs skills also play an important role and teachers need to emphasise on HOTs in teaching and learning in the classroom. HOTs focuses on the four thinking levels shown in the Table 2.3. Furthermore, HOTs is the ability to apply knowledge, skills and values in reasoning and reflecting to solve problems, make decision, be innovative and have the ability to be creative. Four skills encompasses in HOTs shown in the Table 2.4 (Curriculum Development Division, Ministry of Education, 2017).

Table 2.3

Four Thinking Levels in HOTs (Curriculum Development Division, Ministry of Education, 2017)

Four Thinking Levels	Explanation
Application	Using knowledge, skills and values in different situations to complete a task.
Analysis	Ability to break down information into smaller parts in order to understand and make connections between these parts.
Evaluation	Ability to consider and make decisions using knowledge, experience, skills, value and justify decisions made.
Creation	Produce creative and innovative idea, product and method.

Table 2.4

Four Skills Encompasses in HOTs (Curriculum Development Division, Ministry of Education, 2017)

Four Skills	Explanation
Critical Thinking Skills	Critical Thinking Skills are the ability to evaluate ideas logically and rationally in order to make reasonable judgements based on valid evidences.
Creative Thinking Skills	Creative thinking skills are the ability to produce or create something new and valuable using original and imaginative thinking.
Reasoning Skills	Reasoning skills are the ability of individuals to make considerations and evaluations logically and rationally.
Thinking Strategies	Thinking strategies are a way of thinking that is structured and focused on problem solving.

2.9 Learning Mathematics through Play

In the 21st century, mathematics relates to almost everything in the universe. Literature in mathematics education spanning the past two decades seems to have attributed great significance to the term "discovery", and every child must engage in the progress of discovery (Baur & George, 1976). Mathematics has became part of the daily routine of the classroom in both planned and spontaneous activities (Smith, 2009). Ozdogan (2011) has also stated that the mathematical process starts before the kids go to the school. However, research shows that this richness and complexity is not always recognized in preschool because they emphasize more on children's academic learning than on play (Wood, 2013). Preschool teachers are encouraged to be creative in early childhood when the teaching method allows the children to explore, experiment and play with ideas. The children will become enthusiastic learners, active and creative explorers who are not afraid to try out their ideas and to express own thoughts (Lopez, 2017).

Apart from that, mathematics can also help children to understand the world around them which teaches them logic and problem solving. The major goals of early childhood mathematics is to foster a productive disposition that includes imagination, curiosity, risk taking, persistence, inventiveness and creativity (Clements & Sarama, 2014). Besides, Sharma (2013) has stated that during the early life, children learn concepts of numbers, size, quantity and shapes through the play way method. Learning mathematics through play is important because play activity is children's work (Anderson-McNamee & Bailey, 2010; Smithner, 2011; Hafsah Jantan et al., 2015). Children increase their problem-solving abilities through games and when they are involved in make-believe play it can stimulate several types of learning (Anderson-McNamee & Bailey, 2010). Mathematical games are also good for strengthening

children's knowledge of sums (Kamii, Lewis & Kirkland, 2001). In addition, learning mathematics through play supports logical thinking and offers daily life solutions for the children (Ozdogan, 2011; Burton, 2010).

On the other hand, Burton (2010) stated that learning mathematics through play can also work on procedural knowledge such as addition, subtraction, multiplication and division problems. Children at play begin to learn essential math skills such as counting, equality, addition and subtraction, estimation, planning, patterns, classification and measurement. Their informal understanding provides a foundation on which formal mathematics can be built (Fisher, as cited in Goldstein, 2012). A high quality mathematics should have excitement and challenge instead of stress (Clements, 2001). Teaching through play can enhance early numeracy skills and understand numbers after they experience a lot of activities in mathematic games (Sharma, 2013). However, according to Vygotsky, children nowadays prefer to engage in fantasy play through the medium of computer games instead of playing with real materials and objects (Gray & Macblain, 2012).

In this 21st century learning, children are encouraged to play with materials or objects before they use them for problem solving activities. By exploring the places, tools and objects through play activities, children will construct the meaning of problem solving with deeper understanding (Clements & Sarama, 2004). In addition, Goldstein (2012) explained that by providing play equipment and resources and using them in multiple ways can promote children's exploration and creativity. When the lessons are integrated with different activities or methods, the learning results become better because the children are more interested and they do not realize they are learning (Lopez, 2017). The research conducted by Takeuchi, Towers and Plosz (2016) showed

that the children enjoyed the mathematics lesson which were centred on student's creativity, hands-on experience or role playing.

2.10 Theoretical Framework

Theoretical framework presents the theory related to the research problem of a study. It is the existing knowledge that supports the study. With the theoretical framework, the researcher can understand, predict and explain the concepts and their relationship in the phenomenon under study (Chua, 2016).

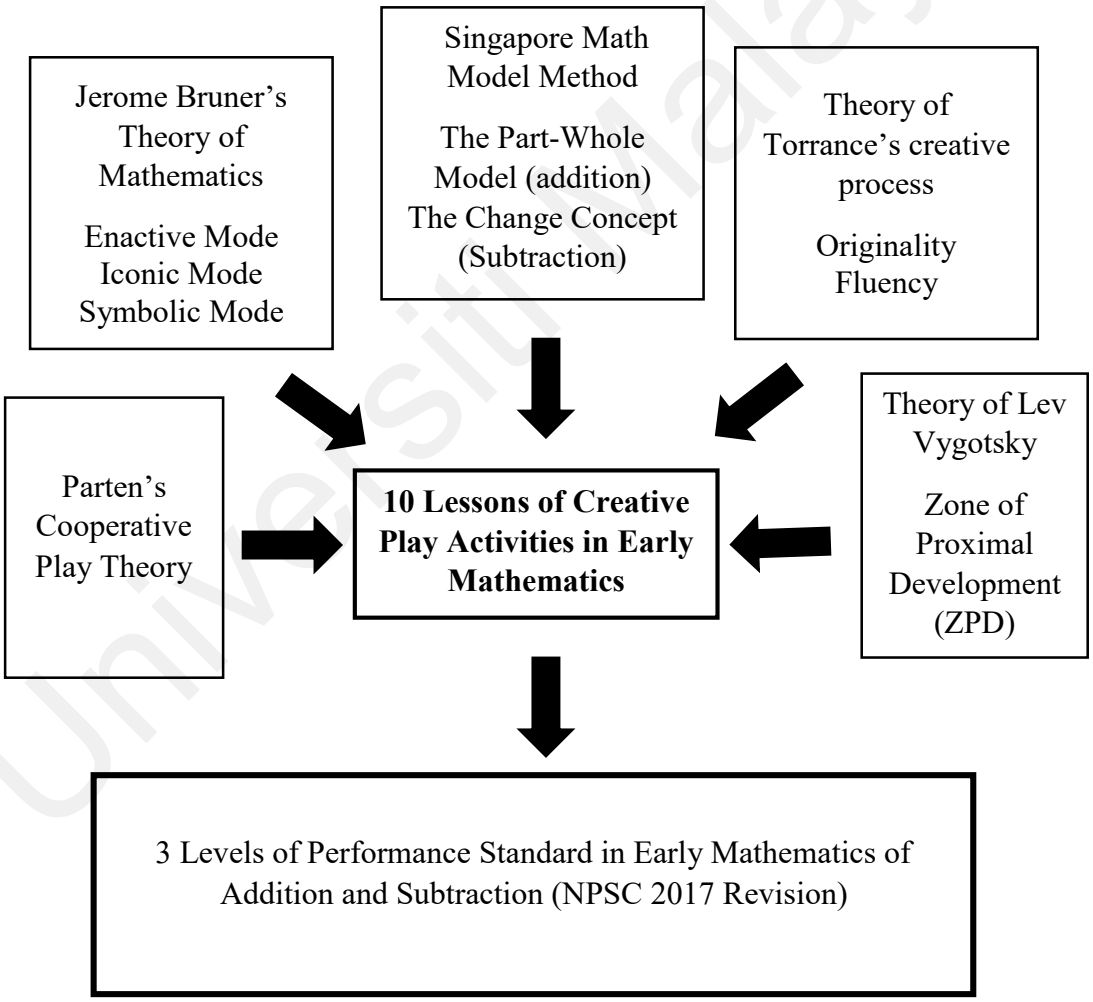


Figure 2.2 Theoretical Framework of the Study

In this study, the Parten's Cooperative Play Theory, Jerome Bruner's Theory of Mathematics that includes the enactive mode, iconic mode and symbolic mode, Singapore Math Model Method that includes the part-whole model and the change concept, theory of Torrance's creative process which includes originality and fluency and the Theory of Lev Vygotsky which emphasizes on Zone of Proximal Development (ZPD) are integrated into 10 lessons of creative play activities in early mathematics as independent or treatment variable are to be conducted by preschool teachers in the Experimental group to evaluate their effects on the mathematics performance (dependent variable) based on the 3 Levels of performance standard in early mathematics (as shown in Figure 2.2).

2.10.1 Parten's Cooperative Play Theory

Stages of play is a theory developed by Mildred Parten Newhall (1932). She found that classification of children's participation in play among preschool children can be categorized closely with age and maturity. She identified there are six behaviour categories of play that include unoccupied play, onlooker play, solitary play, parallel play, associative play and cooperative play. Researchers like to use Parten's play categories when observing children at play because these behaviours can be seen in the interactions of play among young children (Beaty, 2014).

Stage one is 'unoccupied play', a type of play where the children are not engaged in the play. They only observe the environment and watch other kids playing. Whereas, the children who are engaged in stage two - 'onlooker play' become an observer and watch others kids play but they do not want to join in (Parten, 1932).

On the other hand, stage three is 'solitary play' and it can be defined as 'independent play' where children play by themselves or alone. They are very focused

on the games or activity during this period. The children do not have any connection or conversation with others and do not care for anything that happens around them. The children who are engaged in the 'parallel play' (stage four), play separately from others in the group with their own activity. However, they play with similar toys side by side and sometimes they will use other's toys but play independently. For children who are engaged in the stage five that is 'associative play', they play and communicate with others but their play is not coordinated with the same objective, interest or goal. They talk to each other and share materials or toys together (Parten, 1932).

Stage six - the 'cooperative play' is the focus of this study. Parten (1932) has explained that the children who are engaged in cooperative play, play in a team have a common goal, interest and purpose. The children who are interested in both the 'associative play' and the 'cooperative play' enjoy playing with their friends and activities or games they are doing. They also need to learn to work with friends or others, accept rules and form social bonds with team members. In addition, Parten also mentioned that cooperative play occurs when children play together in a group using the same materials for the same purpose or pretending play on a common theme. A great deal of group play happen in most early childhood programs (Beaty, 2014). However, the lack of cooperative play provided by the preschool teachers to the children makes them less engaged in cooperate skills in group activities. They seldom share toys, communicate and understand each other with their peers (Dadan Suryana, 2017). Preschool teachers are encouraged to engage children in the cooperative play because cooperative learning can promote and enhance critical thinking, develop better interpersonal and social skills, have more supportive relationship with peers and have motivation to learn (Navarro-Pablo & Gallardo-Saborido, 2015).

Moreover, through cooperative play, the children are given the chance to share ideas by discussing, guiding and cooperating in completing the tasks and they are trained to take part in their group to achieve common goals (Zakiah Mohd Ashari et al., 2013; Dadan Suryana, 2017). For example, the cooperation of children in socio-dramatic activities develop interactions between players when they acting out their roles, communication and imitating a person through imagination (Wood, 2013).

Parten suggested that children between the ages of 4 and 6 years should engage in cooperative play. Through games or group activities, they can learn how to share their new ideas, needs, thinking and create things together (Whitman, 2018). Cooperative play is also important for children to enhance their problem solving skills and creativity. They play in a group that has its own organization to do a particular thing and whose members have taken on different roles like exploration, cooperation with friends, tolerance, expressing creative ideas and emotion, discussion and use their mind to complete the tasks (Bennett, Wood & Rogers, 1997; Fumoto et al., 2012; Beaty, 2014; Dadan Suryana, 2017).

2.10.2 Jerome Bruner's Theory of Mathematics

Jerome Bruner is considered one of the leading thinkers of our time. References to Bruner's work mostly addresses learning and development. Besides, regarded by most academics working in the fields of education and psychology as a theorist, Bruner has devised new ways of teaching to help children learn effectively. He was interested in the strategies that children used when they were learning and engaged in problem-solving tasks and experiences that underpin and lead to concept formation (Gray & Macblain, 2012).

On top of that, Bruner explained that children should engage in the process of discovery and problem solving in order to effectively learn. He believes that manipulations of physical objects is essential to learn and feel (Baur & George, 1976; Smidt, 2011). Moreover, Gray and Macblain (2012) have stated that Bruner did not view learning as something that happened to individuals but more as a process in which the individual was actively engaged within their thinking between stimuli being emitted and the individual making a response. In other words, he was concerned primarily with those cognitive processes that underpin the direct actions of individuals (Stimuli ---- Response ---- Actions).

Apart form that, Bruner influenced education over the past century. He described intellectual development as proceeding from an enactive mode to an iconic mode and then, finally to a symbolic mode (Smith, 2009). Bruner believed that children needed to move through these stages successively in order to make connections and to generate their own undesrtanding (Smidt, 2011). Intellectual development is crucial for children in the progress of learning early mathematics, thus, it has been selected and integrated into theoretical framework in this study.

Intellectual Development

2.10.2.1 First Stage: Enactive Mode (Actions)

The first level of learning is the enactive mode where the children manipulate concrete materials (Baur & George, 1976; Smidt, 2011). In addition, Smith (2009) stated that when children are physically doing mathematics they are manipulating in this mode. Furthermore, children engaged in this stage learn through play and should be encouraged to play (Smidt, 2011).

2.10.2.2 Second Stage: Iconic Mode (Images & Pictures)

In the iconic mode, a child can internally represent an object in the form of an image (Gray & Macblain, 2012; Smidt, 2011). For example, children do mental mathematics by thinking in terms of memories of visuals, auditory or kinaesthetic forms (Smith, 2009). On the other hand, Baur and George (1976) explained that the iconic mode is when the children work with the mental images of the physical objects. Through this mode, the children are able to develop their cognition significantly, have the ability to create and hold images that can apply their internal processing or thinking of objects. However, the children will not be able to internally represent higher order concepts such as joy, happiness and playfulness (Gray & Macblain, 2012).

2.10.2.3 Third Stage : Symbolic Mode (Words, Symbols and Languages)

Bruner suggested of a much higher order and he saw the inferences that children made by using symbols and words as being key to their learning and cognitive developments and this was referred to as symbolic mode (Gray & Macblain, 2012). When 5 or 6 years old, children can use symbolic mode such as oral language, picture story drawing or writing of numbers to represent thinking (Smith, 2009). When language develops in the progress of learning, children increasingly remove themselves from situations by way of their thinking. They can engage in problem solving and critical reflection, as both are fundamental to higher order thinking as proposed by Bruner. This developmental process is of enormous importance in the early years which can provide the opportunities to develop their language in tandem with their thinking (Gray & Macblain, 2012). Besides, the children can use abstract ideas to represent the world. The ability to use symbols and symbolic systems allows

them to evaluate and make judgments and to think critically (Smidt, 2011). Thus, in the symbolic mode, 6-year-old children are able to solve addition problem such as 6+7 (Smith, 2009).

2.10.3 Singapore Math Model Method

Kaur (2015) indicated that the Singapore Math Model method is a tool for representing and visualising relationship. The Ministry of Education in Singapore introduced the bar model method and became important in the primary school mathematics curriculum in the 1980s (Soo & Liu, 2014). Singapore Math Model Method is an innovation in teaching and learning to solve problems in 1970s when the students could not achieve basic numeracy skills and were not able to solve word problems sufficiently (Kho, Yeo & Lim, as cited in Soo & Liu, 2014). Hence, a team named as the Primary Mathematcis Project led by Dr Kho Tek Hong worked on producing instructional materials to improve the quality of teaching and learning in mathematics and later developed the Singapore Model Method for problem solving (Soo & Liu, 2014 ; Kaur, 2015). On top of that, Singapore's Model Method starts in elementary school with addition and subtraction problems. Then, the Math Model Method was extended to work with multiplication, division, fractions, ratios and percentages.

In this research, the researcher emphasizes on addition which is the part- whole model and the change concept for subtraction. The part-whole and the change concept are selected in this study because children can understanding easily addition and subtraction concepts. Soo and Liu (2014) stated that the visual representation of part-whole and the change concept have provided better knowledge of the known and

unknown quantities in the word problem are related. The understanding of this concept enables children to understand better word problems.

Besides, the Singapore Model Method is a word problem-solving process taught to elementary school children. The model was developed in part through consultation of two theorists in cognition and mathematics education who are Jerome Bruner and Zoltan Dienes (Yeap, as cited in Mahoney, 2012). Bruner described intellectual development as proceeding from an enactive stage to an iconic stage and finally to a symbolic stage. At the age of 5 or 6 years, children can use symbolic mode such as oral language, picture story drawing or number writing to represent thinking. For example, in the symbolic stage, 6 years old can solve addition problem "6+7" (Smith, 2009). Apart from that, Dienes (1967) writes about 5 levels of mathematics thinking. The first stage is free play when a child enjoys exploration with the physical environment. The second stage is generalization, when children can recognize patterns, regularities and common attributes across different model. The third stage is representation, when children can use a peg on which to hang an abstract thought. The fourth stage is symbolization that occurs when children use formula and words to describe relationships. The fifth stage is formalization which is the relationship and properties of all two-dimensional and three-dimensional figures that are categorized, ordered and recognized (Smith, 2009).

2.10.3.1 The Part-Whole Model - Addition

According to the Soo and Liu (2014), the part-whole model can be used to solve problems which include addition such as given a part and a part, students add to find the whole.

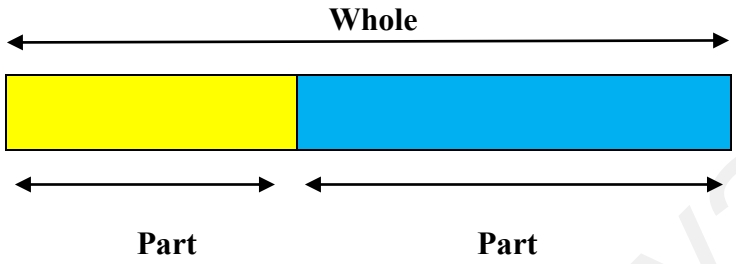
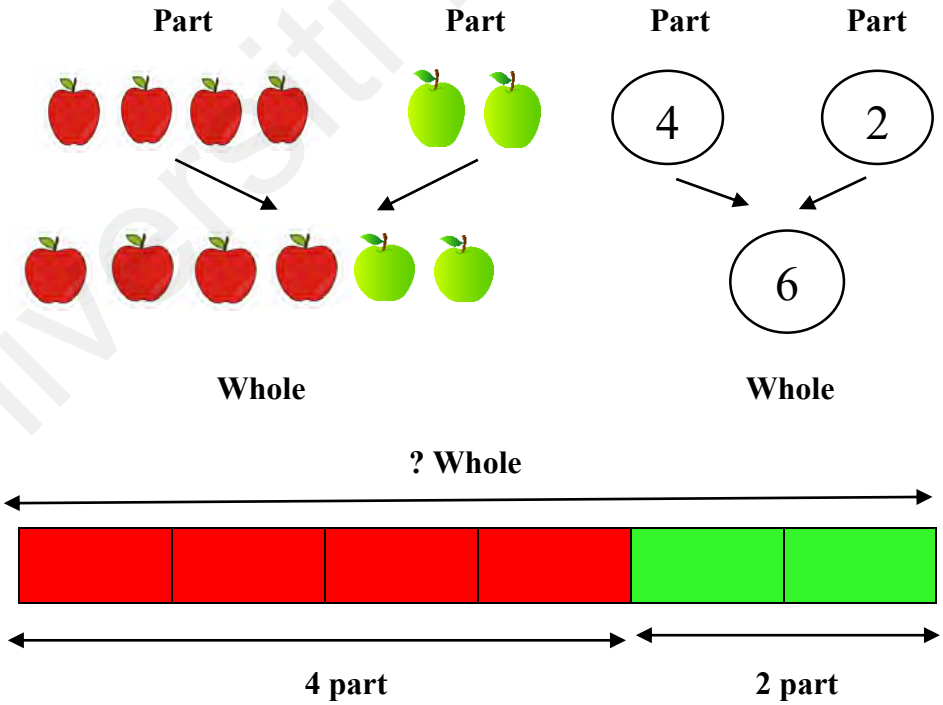


Figure 2.3 Adapted a part-whole model from Soo & Lin (2014)

Example: Adding the parts to find the total (How many apples are there altogether? Let's add)



Answers: Let's count on from 4, 5, 6. There are 6 apples altogether. 4 and 2 make 6.

Figure 2.4 Adapted example of adding the parts from Kaur (2015)

2.10.3.2 The Change Concept - Subtraction

According to Chua (2012), the change concept helps the children to understand subtraction such as how to subtract 1 from 3 (Figure 2.5). Besides, once the child is familiar with substraction, the child can proceed to use a more abtract representation, in this step, can replace the objects with blocks (Firgure 2.6).

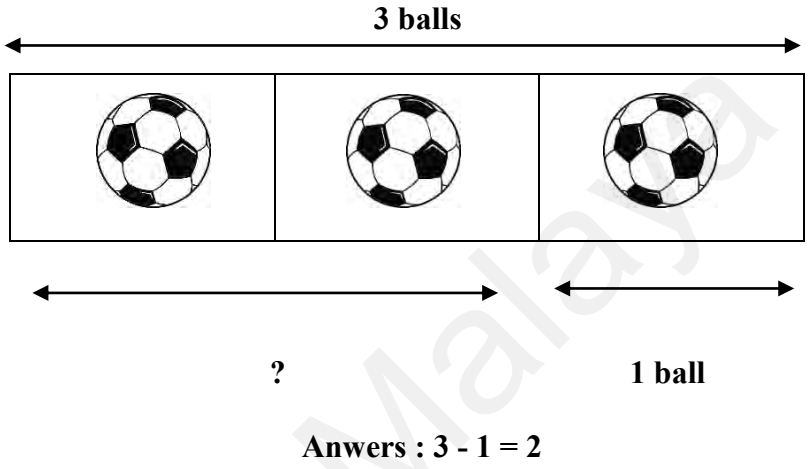


Figure 2.5 Adapted example of subtracting from Chua (2012)

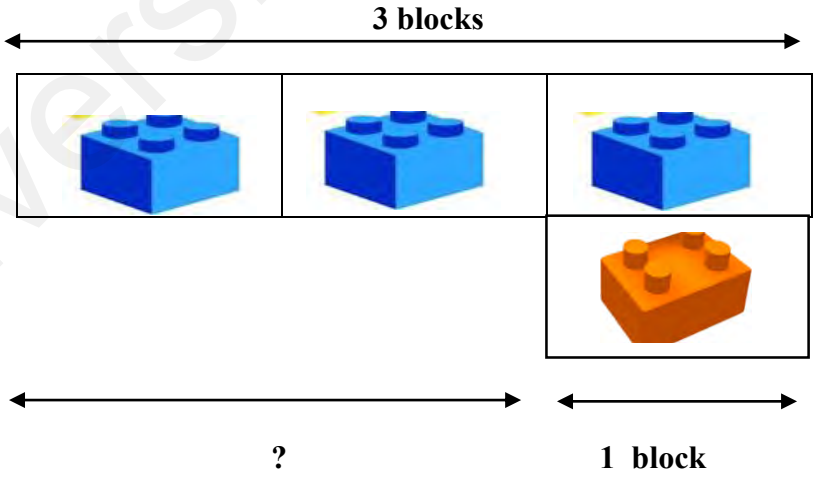


Figure 2.6 Adapted example of subtracting replace the objects with blocks from Chua (2012)

2.10.4 Theory of Torrance's Creative Process

One of the most common characteristics found among world-renown contributors in the area of science and technology is creativity. Torrance is the most distinguished researcher in the field of creativity and the definition of creativity by Torrance has been applied widely in over 30 countries (Palaniappan, 2008). According to the Torrance (1963), creativity is man's most important weapon in coping with life's daily streses and problems. Thus, creativity has come to be revered in all walks of life. Apart from that, creativity is a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies and so on; identifying difficulties; searching for solutions, making guesses or formulating hypotheses about the deficiencies; testing and retesting them; and finally communicating the results (Torrance, 1974, p.8). Besides, the most powerful training to develop creativity invloves both cognitive and affective attributes (Torrance, as cited in Kuan, 2012).

There are four components in the Torrance's creative process framework which include fluency, originality, flexibility and elaboration. All four componets are interconnected and make up the process of creative development and are used as dimentions in creativity assessments. They developed by Torracnce which is known The Torrance Tests of Creativity (TTCT). TTCT have yielded acceptable reliable and valid indices of creativity (Torracnce, as cited in Yong, 1994). To fulfill the context of this study that uses 6-year-old children as sample, only two components nanely fluency and originality were selected and integrated into the theoretical framework in this study.

2.10.4.1 Originality

Originality is the ability to produce uncommon responses, unusual or unconventional associations (Torrance, as cited in Yong, 1994; Palaniappan, 2008). Besides, originality is combining known ideas into some new form and connecting the seemingly unconnected (Guilford; Sternberg, as cited in Isenberg & Jalongo, 2001). Moreover, originality is the extent to which ideas are different from those suggested by other generators (Guilford; Torrance, as cited in Montag-Smit & Maertz, 2017). Furthermore, originality demostrate thinking ability that can produce new, unique and interesting ideas (Norfishah Mat Rabi & Mohd Nasir, 2016). In order to enhance creative thinking skills among children, they should have sufficient opportunity to grow and to realize their potential along these constructs. We believe that any system of education that aspires to give all children a chance to become whatever they are capable of must respect their originality and individuality (Torrance, Raina, 2000).

2.10.4.2 Fluency

Fluency is the ability to produce a variety of ideas or hypotheses concerning possible solutions to problems (Torrance, as cited in Yong, 1994; Palaniappan, 2008). Besides, fluency in creativity is comparable to fluency with language; it means that the child can generate one idea after another with apparent ease (Isenberg & Jalongo, 2001). Problem solving skills and creative thinking can be taught in irrespective of their ages (Torrance,1962). However, presently teaching method without the inclusion of creative activities that can develop of creative thinking and problem solving skill (Beghetto, Kaufman & Baer; Torrance & Torrance, as cited in Schroth, 2015). Thus, children need to be given more opportunity to explore and

generate new ideas through creative activities in developing their creative thinking and problem solving skills.

2.10.5 Theory of Lev Vygotsky

Lev Semenovich Vygotsky (1896-1934) was a famous Russian psychologist and he espoused two kinds of development which were natural and cultural. Natural development influences learning as the result of maturation while cultural development is through a child's interaction with others friends of the same culture and enhance the use of language (Smith, 2009). On the other hand, Vygotsky emphasized that learning happens when children are working within the concept of zone of proximal development (ZPD), which is the transitional state between "actual development" and "potential development". The ZPD encompasses tasks that the child cannot do alone but can be accomplish with the help of classmates or adults who can guide by their thinking and talking to them (Smith, 2009 ; Lin & Yawkey, 2013). For example, a first – grade students were asked to count 3 yellow and 4 blue buttons. "How many buttons do we have?" The children started with the number 1 and touches the button. In this situation, the teacher prompts the children and guide them, "can we count on from the 3 yellow buttons? Let's see, we have 3 yellow buttons, can we say…..3…..and count 4-5-6-7?" After few examples, the children see the pattern and can accomplish skills of "counting on". Hence, this skill is the ZPD. If the children continue to start again over each time with number 1, then the task is not developmentally appropriate (Smith, 2009).

However, not every situation involves a mentor, a child and a task that is related to ZPD, except those situations that reveal or enhance the development of the psychological functions of children. It would be unsuccessful to apply the notions of

ZPD to a situation like teachers simply helping students with specific reading problem or math without setting any cognitive developmental targets for the activities (Kozulin, 2015).

In addition, Vygotsky feels that the children need supports or scaffolding in the early stages of learning such as teachers can encourage "talking aloud" about how a student got the answers or when children in the cooperative play, can hear other peoples thoughts and assimilate their idea (Smith, 2009). Consequently, play and people with better skills can act as a scaffold in the ZPD. Children's cognitive development may be enhanced from lower to higher levels through interactions and play with teachers, parents and peers. The teachers need to plan according to the needs of each individual and act accordingly in the classroom (Vygotsky, 1978).

Furthermore, cooperative learning enhances knowledge, communication and social skills, conceptual understanding and motivation. Besides, children can do with the help of others better than what they can do by themselves. They might move to higher level in their mental development with assistance of peoples (Vygotsky, 1978).

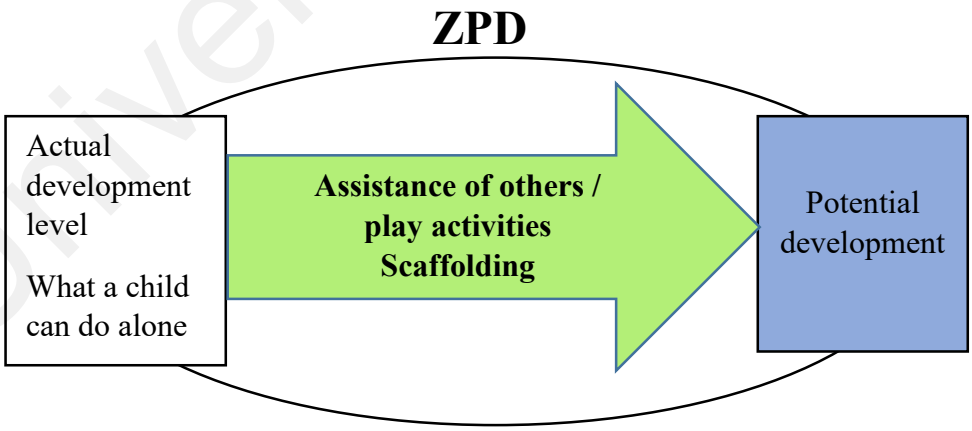


Figure 2.7 Zone of Proximal Development (ZPD)

According to the figure 2.7, the zone of ZPD encompasses tasks that the child cannot do alone but can be accomplished with help from classmates or adults who can guide them by their thinking or by talking to them (Smith, 2009; Lin & Yawkey, 2013).

2.11 Conceptual Framework

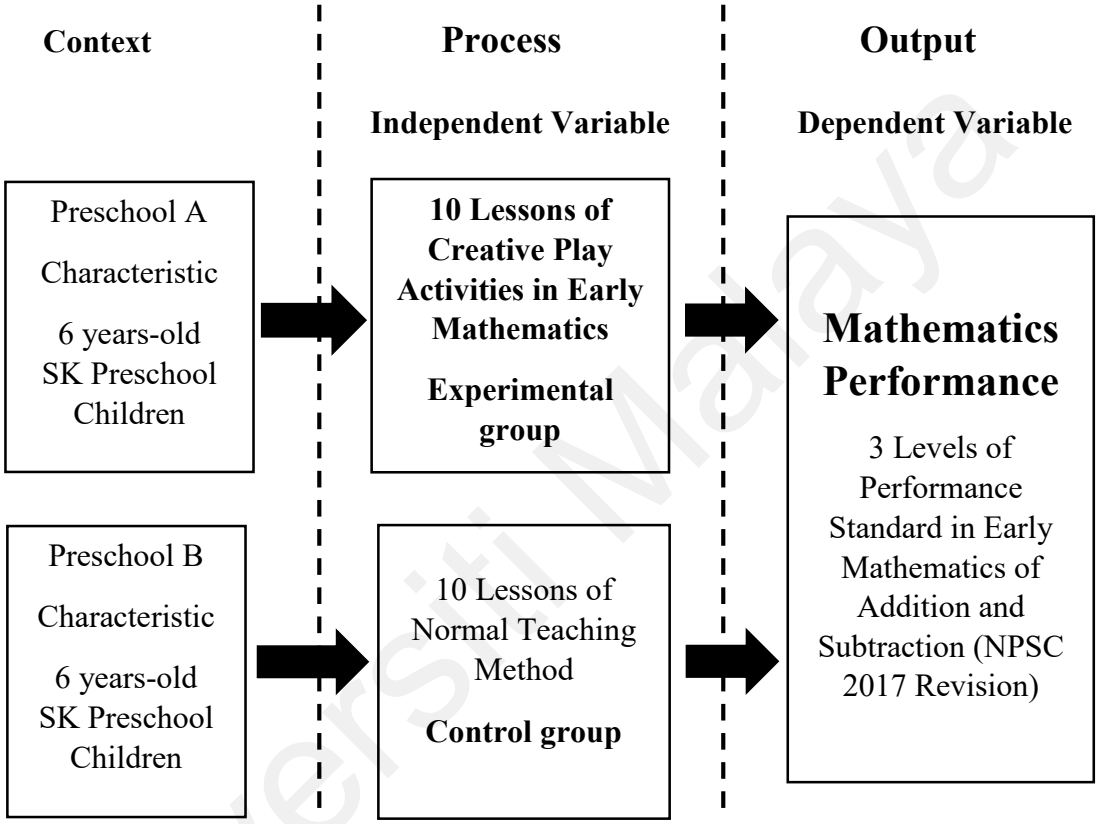


Figure 2.8 Conceptual Framework of Quasi Experimental Study

According to the Figure 2.8, the age for both groups are 6 years-old *Sekolah Kebangsaan* preschool children. The independent variable for the Experimental group are 10 lessons of creative play activities in early mathematics that include 5 addition and 5 subtraction games. The independent variable for the Control group are 10 lessons of normal teaching method in addition and subtraction. The output or dependent variable is the mathematics performance of 3 levels of performance standard in early mathematics of addition and subtraction which follow the NPSC 2017 Revision. A

single-headed arrow indicates the relationship between variables with causality (cause-and-effect) and it represents a regression from the independent variable (Creative Play Activities in Early Mathematics) to an output or dependent variable (3 Levels of Performance Standard in Early Mathematics) in this study for the Experimental group.

2.11.1 Creative Play Activities in Early Mathematics

Creative play involves the body that promotes physical development and corporeal articulation and listening; most educators agree that creative play is a necessary prerequisite to learning, mental health and developmental growth (Smithner, 2011). In addition, early mathematics helps children to make sense of the world around and teaches them to reason and solve problems, as it is a natural part of young children's play and daily activities (Sharma, 2013). The result showed that children's basic numerical knowledge and arithmetical skills could be improved by playing number games (Elofsson et al., 2016). The process of teaching and learning can be more effective if the curriculum is play-based (Roslinda Rosli & Teo, 2018). In a nutshell, creative play activities in early mathematics play a vital role in their early education. Hence, in this modern society, traditional ways of teaching are not the major or only methods in teaching children (Lin & Yawkey, 2013).

Research supports that play and creativity are related because they both rely on the ability of children to use symbols (Johnson et al., 1999; Singer & Singer, 1998; Spodek & Saracho, 1998, as cited in Isenberg & Jalongo, 2001). On the other hand, creativity for young children involves cognitive processes that develop through social interactions, play and the imagination (Leggett, 2017). Creativity is also a mental process that generates novel, unique and intuitive insights to a given problem (Yaftian, 2015). Therefore, creative problem solving should not be neglected in the development

of mathematics curriculum at all levels of education. Students should have a lot of opportunities to engage in challenging mathematical problems that lead them to experience mathematics creativity (Yaftian, 2015).

On top of that, Zakiah Mohd Ashari et al. (2013) concluded that 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. In this study, the researcher has used creative play activities in early mathematics by developing lesson plans and steps of learning activities as a guideline to the preschool teacher in the Experimental group on how to use creative play in addition and subtraction games in a systematic way to assist the teaching and learning in the classroom.

2.11.2 Number Operations in Addition and Subtraction Skills

According to the Merriam-Webster dictionary, skills are defined as the ability to use one's knowledge effectively and readily in execution or performance. Besides, children who study in government preschools at the age of six need to master the skills of addition and subtraction within 0-18 which followed the content standard of early mathematics in the NPSC 2017. In order to enhance the addition and subtraction skills of children, Sharma (2013) stated that teaching through the play method can enhance early numeracy skills and understanding of numbers in children as they experience a lot of activities in mathematic games. The research findings of Chin and Effandi Zakaria (2015) showed that different types of games involving addition and subtraction activities help children in the post-test achievement in which children were capable of building number relationship to expand arithmetic. Games Based Learning Module has significantly influenced the learning of number operations (1-10) of the

Experimental group children compared to the traditional mathematics activities of the Control group.

Moreover, Sharma (2013) pointed that if mathematics is taught in an enjoyable and interesting way, it can influence the fun among children in learning and indirectly their understanding of concepts in mathematics become clear, memorable and their performance can be improved. Apart from that, those engaged in a meaningful and fun experience in learning mathematics during preschool will appreciate better and participate in the continuous learning of mathematics in primary school, secondary and higher levels (Zakiah Mohd Ashari et al., 2013). As children invest time and energy in playing, there are opportunities for learning when they do play. Besides, verbal reinforcement from the teacher during games, play may build self-confidence, competence and self-esteem in students (Chin & Effandi Zakaria, 2015).

2.12 Research in the Areas of Play, Creative Play and Creative Thinking

According to past research in the area of play, creative play in Malaysia and overseas, the survey design which focuses on play employed questionnaires as instruments to conduct the studies (Lin & Yawkey, 2013; Hafsah Jantan et al., 2015). However, the samples were different in the research conducted by Hafsah Jantan et al. (2015) that used 150 preschool teachers and the sampling was stratified random sampling. In addition, the study emphasized on the contributing factors like belief, attitude and competence of Malaysia preschool teachers' in using play activities. The findings showed that teachers need to implement play activities in or outside classroom and play methods can increase the self-concept and positive attitudes among children toward learning in the area of belief. In the area for attitude, the findings showed that teachers' views about materials and time management was necessary, parents and

society's opinions had to be improved and children had to participate actively in play activities. The finding also showed that the implementation construct was strongly supported by the dramatic play that had an important role in the growth of children in the area of competence.

Another study was conducted by Lin and Yawkey (2013) that used 142 Taiwanese parents in the study. The study conducted in Hsinchu city emphasized on Taiwanese parents' perceptions of child's play showed that some parents still cared for their children's academic learning and paid more attention to it than playing. The findings also revealed that most Taiwanese parents do value the contributions of children's play to their development and these parents exhibited positive behaviours in relation to play with other children.

Moreover, the study conducted by the Leggett (2017) in New South Wales focused on the role of educators to develop intentionally develop creative thinking in children. The qualitative study which used a social cultural approach and the sample consisted of 5 women, 6 educators and 60 children. On the other hand, the instruments of the study were intentional teaching strategies. However, what kind of the strategies were used were not clearly explained in the study. In addition, the theory in the study was constructivist grounded theory. Besides that, the findings also showed that a greater focus was needed on the processes involved to recognise the intellectual capacities for developing the creativity of children, the role of the educator in developing the creative thinking of children and the educators who supported creativity in the learning environment. Apart from that, the finding also included new definition for creativity which was a cycle of creativity that included dispositions, creative process, productivity and creativity.

On top of that, the research conducted by Subadrah Madhawa Nair, Najeemah Mohd Yusof and Arumugam (2014) focused on the effects of using the play method to enhance the mastery of vocabulary among preschool children. Besides, the methodology of the study was a quasi-experimental design and involved 100 preschool children from two Tamil-medium government preschools. In addition, the instruments of the study included teaching with play method, pre-test and post-test and structured interview questions. Moreover, the researchers discussed the theories related to play method which included Vygotsky (1967), Dewey (1938), Piaget (1962), Froebel (1970), Rousseau (1956) and Locke (1632-1704). However, the researchers didn't mention which theories were used specifically in the study. Apart from that, the findings showed that the independent sample t-test on the pre-test indicated that there was no significant difference between the Experimental and Control groups in their scores in their interest in learning the Malay Language. The findings from the post-test showed that the Experimental group obtained higher and significant scores in their interest in learning the Malay Language compared to the Control group ($t=8.18$, $df=98$, $p=0.00$). This indicated the use of the play method had helped to arouse the interest of the children significantly in learning the Malay Language compared to the conventional method.

Furthermore, the study conducted by Merrick (2008) emphasized on architecture for curious, reconfigurable robots as a toy that encouraged creative play. The instrument was computational models of intelligence that is adaptive to, curiosity to develop new goals. On the other hand, the findings showed that the robots adapted their behaviour as different sensors and actuators, they could learn new behaviour in response in their structures. As such the adaptive behaviour of the robots responded to

their changing structures that encouraged reflection, imagination and ongoing creative play.

In Summary, the literature review in the areas of play, creative play and creative thinking support the present study in which preschool education need to integrate variety of play activities in teaching and learning. However, some previous studies shown some inconsistent opinions and conflicting statements about play learning and teaching method whereby some of the teachers support play learning and some focus on children academic although play learning is important. Besides, some of the parents were also emphasized on their children's academic learning and paid more attention to it than playing. Moreover, there has been a lack of studies that integrated creative activities and play in early mathematics teaching and learning. This is also one of the purposes which is why the research is carried out.

2.13 Research in the Area of Early Mathematics

Past research in the area of early mathematics in Malaysia that incorporated play module as an instrument revealed that through play or games, children gained better understanding and developed their comprehension of the concepts of numbers (Zakiah Mohd Ashari et al., 2013; Chin & Effandi Zakaria, 2015). Through the games based learning module (GBLM), it could help the children in the Experimental group to enhance their addition and subtraction skills (Chin & Effandi Zakaria, 2015). The GBLM instrument is a game approach which involves manipulative games that have been designed and adapted by the researcher, so that children can learn concepts of numbers and number operations through game activities (Chin & Effandi Zakaria, 2015). Moreover, the instrument of learning through play module was developed by the researcher that incorporated the play activities guidelines for preschool teachers in

the process of teaching, so that children could master the early mathematics concepts in a fun atmosphere (Zakiah Mohd Ashari et al., 2013).

On the other hand, both the studies used the same method which is a quasi-experimental research to conduct the research study. However, both studies involved varying number of samples as in the study which was conducted by Chin and Effandi Zakaria (2015) that consisted of 47 children who were five-year-old (23 in Experimental group, 24 in Control group) and the study conducted by Zakiah Mohd Ashari et al. (2013) which consisted of 96 children who were four and five–year-old (47 children in Experimental group, 49 in Control group).

In addition, the findings conducted by Chin and Effandi Zakaria (2015) showed significant differences in mathematics scores of students across three tests (pre-test, post-test 1 and post-test 2). The participants in the Experimental group who underwent GBLM showed better understanding of number concepts and operations compared to the Control group ($p < 0.05$, Ho1 rejected). However, there was no main effect for the mean score in mathematics achievement between experimental and control group ($p > 0.05$, Ho2 accepted). On top of that, the findings conducted by Zakiah Mohd Ashari et al. (2013) showed that learning through play module enhanced the understanding of the number concepts in the early mathematics learning for preschool children that showed the Experimental group was better than the Control group. However, in the paired samples t-test of their study, the p value for both Control and Experimental groups were also significant ($p<.000$).

Moreover, the strength of both studies (Zakiah Mohd Ashari et al., 2013; Chin & Effandi Zakaria, 2015) was the sample size and method used were suitable. The module developed by the researchers regarding play or games activities was also suitable for the children in their learning process. However, the content in both studies

were not clearly elaborated to show what kind of plays or games were conducted for the Experimental group. Besides, both studies did not clearly elaborate for how many weeks the studies were conducted and the problems faced by the teachers who taught the module.

Apart from that, some used the case study method which used clinical interview to conduct the early mathematics researches (Chan & Sharifah Norul Akmar Syed Zamri, 2007; Sharifah Norul Akmar Syed Zamri, 2007). In both studies the research sample was similar that involved 5 children of six-year-old. However, both studies did not mention whether the pre-schoolers belonged to the government or private preschools. On top of that, the constructivist theory that combines Piaget's and Vygotsky's cognitive development have been used in the studies (Chan & Sharifah Norul Akmar Syed Zamri, 2007; Zakiah Mohd Ashari et al., 2013; Chin & Effandi Zakaria, 2015). However, the study by Chan and Sharifah Norul Akmar Syed Zamri (2007) did not mention the theory involved and the conceptual frameworks were also not clearly explained. Besides that, the scope of the studies focus on number operations that were in the range of numbers 1-10 (Chan & Sharifah Norul Akmar Syed Zamri, 2007; Sharifah Norul Akmar Syed Zamri, 2007; Chin & Effandi Zakaria, 2015) and the scope of the studies focused on number concepts (Zakiah Mohd Ashari et al., 2013; Chin & Effandi Zakaria, 2015).

The findings of the research conducted by Chan and Sharifah Norul Akmar Syed Zamri (2007) showed that preschool children were able to identify addition operations better than subtractions in a picture that consisted of a sequence rather than in a single format. The preschool children were not able to identify addition and subtraction operations in a single picture. From the findings we know that it is not easy to help children master addition and subtraction skills. Therefore, early preschool

mathematics education requires strong curriculum, competent teachers and an appropriate approach to meet the development and learning needs of children (Zakiah Mohd Ashari et al., 2013).

Apart from review of the past studies in Malaysia, in the area of early mathematics there are researchers in others countries like Takeuchi, Towers and Plosz (2016) who have conducted research on the early years of students' relationship with mathematics. The research conducted in Alberta which engaged 39 students of which 25 were boys and 14 were girls from a kindergarten. The instruments involved were autobiographical interviews and the own drawings of children. In addition, the scope of the study included the feelings of children toward mathematics and where and how children encountered mathematics. Through the study, the findings showed that the majority of the children in the early years had positive relationship with mathematics which revealed 70.5% of them were enthusiastic and happy with mathematics, 20.5% of the children had negative feelings such as tiring or boring and 8.8% had mixed feelings like being happy and not happy. Moreover, the finding also showed that some early years students dislike challenges and complex mathematics problems.

On the other hand, the study which was conducted by Yaftian (2015) emphasized on the outlook of the creative processes of mathematicians. The theory of the study was based on Model Wallas (1926). This model included 4 stage of the creative process which are preparation, incubation, illumination and verification. However, the sample, location, method and instruments were not mention in the study. The finding of the study showed that mathematical creativity is a dynamic property of the human brain that could be enhanced and should be valued. On the other hand, the finding also showed that mathematics educators needed to emphasize the development of mathematical creativity which emphasized aesthetics and provided plenty of

opportunities to let the students think like a beginner mathematician in the math classes. Moreover, the finding showed that aesthetic played a vital role in the creative work of mathematicians and students had feeling of aesthetics towards a mathematical problems which gave them the feeling of security and success.

Besides, the study of effectiveness of play method for teaching mathematics which was conducted by Sharma (2013) focused on the baseline pattern of teaching mathematics in schools, to develop educative and instructional tools for teachers, mothers and children based on the play method of teaching and the effect of intervention on mathematics performance of children. In addition, the study conducted in Agra City involved 4-6 year-old children, teachers and mothers. It employed purposive sampling and it was an Experimental study. However, the study didn't mention the sample size and the findings of the study were not discussed too.

Furthermore, the study in support of pupil's creative thinking in mathematical education which conducted by Svecova, Rumanova and Pavlovicova (2013) emphasized on the area of geometry. The study engaged 13 and 14 years old teenage students and the instruments included photographs that represented the base for the creation of mathematical problems. On top of that, the main theory was Van Hiele Theory which included visualization, analysis, abstraction, deduction and rigor. The findings showed that the environment of the park was a rich collection of information that can be applied to different age of pupils and in all areas of mathematics. At any level schools should encourage pupils to think creatively, logically and be able to solve problems. To support mathematical creativity, teachers can provide a combination of knowledge and real life situations and solving mathematical problems can make pupils to be active and creative. However, the total sample size and the methodology were not mentioned in the study.

In Summary, the literature review in the area of early mathematics supports the present study in which preschool education needs to integrate various types of play in mathematics teaching and learning activities. Besides, many previous studies provided the findings of addition and subtraction in the range of number between 0 and 10 which showed the improvement in addition and subtraction skills in the presence of play activities. However, the revision of the content standard of mathematics in the NPSC 2017 Revision has changed the range of number from 0 to 10 to the range of 0 to 18 for addition and subtraction operations (Curriculum Development Division, Ministry of Education, 2017). Hence, the present study can contribute new findings particularly in the range between 0 and 18 for addition and subtraction operations which is crucial in ECCE. Moreover, previous studies showed the module developed by the researchers regarding play or games activities were lack of creative play activities in early mathematics lessons as a guideline for preschool teachers. Thus, the literature review in present study integrated creative play activities in addition and subtraction as a guideline for preschool teachers to explore further in depth.

2.14 Summary

Children love to play and playing is the work of the children. The play method consists of the activities that provide fun and give joy to children. Learning is not just limited to cognitive development and but also for the holistic development of the child (Sharma, 2013). When children play, they operate at their highest possible level in the "zone of proximal development (ZPD)". The human species is innately adaptable and the creativity of children, playfully exercise this human capacity through their own imagination (Vygotsky, 1978).

In this study, the Parten's Cooperative Play Theory, Jerome Bruner's Theory of Mathematics that includes the enactive mode, iconic mode and symbolic mode, Singapore Math Model Method that includes the part-whole model and the change concept, theory of Torrance's creative process which includes originality and fluency and the Theory of Lev Vygotsky which emphasizes on Zone of Proximal Development (ZPD) are integrated into 10 lessons of creative play activities in early mathematics. This is to let the children learn addition and subtraction skills through creative games. Moreover, Leggett (2017) pointed out that integrating imaginative and creative thinking into the early educational experience of children provides rich foundations for them to build a future world. Therefore, creative play in early mathematics has a vital role in the 21st century to enhance the creativity, imagination, problem solving and HOTs of children through fun learning and indirectly enhance their addition and subtraction skills. Creativity often takes place with the collaborative nature of sharing and solving problems together (Carlile & Jordan, as cited in Leggett, 2017). Chapter 3 presented the research design, location selection, sample and sampling, instruments, justification, measurement, reliability, validity, pilot study, overall comments of the experts. procedure of the study, data collection and statistical analysis.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The goal of this "Research Methodology" chapter is to describe the design, location selection, sample and sampling, justification of research sample, instruments of the previous and revised pre-test and post-test questions, measurement of performance standard for pre-test and post-test questions based on National Preschool Standard-Based Curriculum 2017 Revision and reliability of the pre-test and post-test questions. Lesson plans of creative activities in early mathematics, overall comments of the experts, curriculum vitae of the experts, lessons of previous and revised creative activities in early mathematics were discussed. In addition, the validity of the instruments, threats to validity, pilot study, procedure of the study and data collection are also discussed in this chapter.

3.2 Research Design

The methodology in this study is a quantitative approach which is experimental research. Fraenkel, Wallen and Hyun (2012) have stated that experimental research is the best way to reveal the influences of the relationship between cause and effect among variables. On top of that, the experimental research design can be used to reveal the effectiveness of a programme or a treatment on performance, where the changes are made to the independent variable and observing the effects of these changes on the dependent variable (Chua, 2016). Therefore, experimental research was chosen in this study to evaluate the effects of creative play activities on early mathematics performance among preschool children's number operations in addition and

subtraction skills. The research design in this study is quasi-experimental with non-equivalent group pre-test and post-test design.

3.2.1 Quasi-experimental with Non-equivalent Group Pre-test and Post-test Design

Chua (2016) has pointed out that the quasi-experimental research design is used to evaluate the effectiveness of a programme where respondents cannot be randomly assigned into equivalent groups which are the treatment and control groups. Apart from that, quasi-experimental design does not include the use of random assignment (Fraenkel, Wallen & Hyun, 2012). Quasi-experimental non-equivalent group pre-test and post-test design is the most often used and it consists of two groups of respondents which are the treatment and the control groups (Chua, 2016).

In this study, the 30 respondents for both the Experimental and Control groups are not randomly assigned as the Experimental and Control groups are from different *Sekolah Kebangsaan* preschools. Thus, the respondents are not suitable to be randomly assigned to the Experimental and Control groups.

Quasi-experimental with non-equivalent group pre-test and post-test design in this study was used to examine how creative play activities affect early mathematics performance among preschool children's number operations in addition and subtraction skills. It is to determine the significant differences between Experimental and Control groups among preschool children's number operations in addition and subtraction skills.

Table 3.1

Pre-test and Post-test Design Using Non-equivalent Groups (Adapted from Chua, 2016)

Treatment group	NE	M1	**X**	M3
Control group	NE	M2		M4

Key:

NE = respondent groups which are not equivalent

X = treatment

M = measurement

3.3 Location Selection

Past research in the area of early mathematics and play method in Malaysia showed a lack of research in Selangor as a research location. For instance, Lu and Effandi (2015) conducted their research in the rural areas while Hafsah Jantan et al. (2015) had chosen Malaysia as their location. The research conducted by Zakiah, Azlina and Yeo (2013) was located in Johor Bahru whereas Tarzimah Tambychik and Thamby Subahan Mohd Meerah (2010) conducted their research in the Negeri Sembilan and Perak was chosen as the location by Subadrah Madhawa Nair, Najeemah Mohd Yusof and Arumugam (2014). Therefore, Selangor has been chosen as the location for this study. The researcher selected Selangor as a location in this study to examine whether creative play activities in early mathematics can affect preschool children in number operations of addition and subtraction skills based on the 3 Levels of performance standard in the Experimental group compared to the Control group. Two *Sekolah Kebangsaan* preschools were selected - one preschool for the Experimental group and another preschool for the Control group.

3.4 Research Sample & Sampling

Fraenkel, Wallen and Hyun (2012) stated that one of the most important steps in the research process is the selection of the sample of participants (be it observed or questioned). On top of that, sampling refers to the process of selecting these individuals. Chua (2016) has highlighted that sampling is an important aspect of research because the selection of unsuitable samples will reduce the validity and reliability.

Purposive sampling was used in this study. Purposive sampling is based on previous knowledge of a population and the specific purpose of the research. Moreover, purposive sampling is also known as non-probability sampling method and it occurs when the sample are selected based on the judgement of researcher. He or she believes that a representative sample may prove to be more effective in limited numbers of people (Fraenkel, Wallen & Hyun, 2012).

For this research, 60 six-years-old children from *Sekolah Kebangsaan* preschools which is Preschool A and Preschool B were selected as sample to participate in this study. From the total number of children, 30 children from Preschool A were placed in the Experimental group and the other 30 children from Preschool B were placed in the Control group. Both the Experimental and Control groups are from different *Sekolah Kebangsaan* preschools.

In order to enahnce the validity and reliability, the researcher selected both the Experimental and Control groups samples that had the same characteristics which included children of six-years-old and both preschools are under the Ministry of Education (*Kementerian Pendidikan Malaysia).* Thus, 60 six-years-old children were selected from the two different *Sekolah Kebangsaan* preschools for this study. Another characteristics is also both preschools are located in the *Klang* district and the culture

of both of them are similar. As mentioned by Chua (2016), purposive sampling is a process whereby a group of subjects are chosen as respondents because they have certain characteristics and those without them are not selected. Thus, purposive sampling was used as a specific purpose in this quasi-experimental study to see whether creative play activities in early mathematics of Experimental group or normal teaching method of Control group is more effective on the children's number operations in additional and subtraction skills.

3.4.1 Justification of the Research Sample

The researcher took the proper procedure in approaching the preschool authorities and the preschool teachers to ensure the characteristic of the Experimental group are similar to the Control group. Finding a good match of participants in both Experimental and Control group is important.

3.4.1.1 Approaching the SK Preschools

In approaching two SK preschools in this study, the first criteria was both preschools were government SK preschools with at least two classes and had 30 preschool children aged 6-years-old. Similar culture and characteristics for both preschools was preferable. Thus, Preschool A and Preschool B were selected in this study because both are government SK preschools. Both preschools had 2 classess with 30 children each aged 6-years-old. Moreover, both preschools were from Selangor and under the *Klang* district. The preschools are culturally similar which also include physical structure of the preschool classroom. Furthermore, these preschools participants have similar charateristic, all of them started their learning in the preschool

at the age of 5 years old and they also have similar scores for early mathematics. The demographic of the participants' family background are from the low income group.

3.4.1.2 Characteristics of the Preschools Teachers

The preschool teachers were expected to have similar qualification either a diploma or a degree in early childhood education. The teachers were also expected to have a minimum of 5 years of teaching experience in SK preschool and must have passion and willingness in teaching early mathematics in the classroom. In this study, one preschool teacher from the Experimental group and one preschool teacher from the Control group were selected. Both teachers have the same characteristics which are similar qualification and teaching experiences. They have bachelors degrees and have a minimum of 7 years of teaching experience. Both teachers are female and have a strong passion and willingness to teach early mathematics.

3.4.1.3 Briefing Procedures of the Study

Both preschool teachers who were involved in the study were invited to attend the briefing regarding the study. The objectives and procedures of the study were well explained in details and clear on how the study was carried out to make the study progress smoothly and ensure validity of the data collected. Both preschool teachers had to follow the schedule given. On the other hand, the researcher would also clearly guide and explain the instrument that consisted of 10 lessons content and the steps of each lesson to the preschool teacher in the Experimental group before the actual study was conducted.

3.4.1.4 Observation of both Experimental and Control groups

Preschools A and B were observed by the researcher to ensure the validity of the data of research finding. Observation needs to be done by researcher during the study for both Control and Experimental groups to avoid any instrument change during the teaching and learning process. It also helps to address any problems occurs when applying the instruments during creative play activities which was conducted for Experimental group. On top of that, during these 10 weeks, the period of time for the lessons of both groups were the same which consisted of 5 lessons for addition and 5 lessons for subtraction. Both groups were not allowed to add more lessons for addition and subtraction when the actual study conducted or apply any other method that used in the study.

3.5 Expert Witness for Curriculum Vitae

3.5.1 Curriculum Vitae of Expert 1

She is an Assistant Director of the preschool sector in the Curriculum Development Division, Ministry of Education. She has 10 years of teaching experience in the early childhood education and 16 years of teaching experience in primary schools. Then, she started working in the preschool sector, Ministry of Education in 2016. Apart from that, she is one of the panel members who wrote the National Preschool Standard-Based Curriculum 2017 Revision (NPSC 2017 Revision). Moreover, she was the speaker who presented the NPSC 2017 Revision to the New Era University College, an inspectorate of schools (*Jemaah Nazir dan Jaminan Kualiti*) and Early Childhood Care and Education Council. She was also a National and Selangor state master trainer in the ECCE field.

3.5.2 Curriculum Vitae of Expert 2

She is a Vice Principal cum Curriculum Department Chief with twenty-five years of working experience in Early Childhood Education. She excelled in the field of early childhood education starting from the establishment stage of *Tadika Seri Soka*, a kindergarten built from the fund contributed by the members of *Soka Gakkai* Malaysia (SGM) which is a community project that practises humanistic education. On the other hand, she is one of the panel members who wrote the NPSC 2017 Revision. Moreover, she joined the Early Childhood Education exchange with kindergartens from other countries such as China, Japan, Singapore, Hong Kong and Taiwan. She was also a speaker for Workshop Presentation on "Teaching and Learning Multiple Languages in Malaysia Preschools" at the 1st Asia Chinese Early Childhood Education Conference (Refer Appendix III of Curriculum Vitae of Expert 2).

3.5.3 Curriculum Vitae of Expert 3

She is a government *Sekolah Kebangsaan* preschool teacher who has 10 years of teaching experience in early childhood education. Besides, she was also a tutor in the Open University of Malaysia for early childhood and IT subjects between 2009 and 2010. In addition, she was a facilitator for the preschool course of "*Pembelajaran Abad ke 21"* in *Klang* District and facilitator of Preschool English Language (CEFR) for private preschool teachers. Moreover, she was also a master trainer for *Klang* Preschool District that was started in 2015, master trainer of Selangor National Preschool Standard-Based Curriculum 2017 Revision in 2016 and master trainer of Malaysia for Common European Framework of Reference (CEFR) for preschool teachers in 2017.

3.5.4 Curriculum Vitae of Expert 4

He was Professor and Dean of the Faculty of Education at University of *Malaya* (UM) and Professor of Education at Sultan Idris University. He is a Senior Research Fellow at the UM. Besides, he had served as consultant to World Book Encyclopedia International Chicago, the Ministry of Education in Malaysia and Brunei. Moreover, he also led the team for the report on English as the medium of instruction for Science and Mathematics. That study had a decisive impact on the review of the PPSMI (the teaching of mathematics and science in English) policy in 2010.

Table 3.2

Academic Qualification of Expert 1, 2, 3 and 4

Academic Qualification	Expert 1	Expert 2	Expert 3	Expert 4
Doctor of Philosophy (PhD)				PhD in Education (University of Chicago)
Master	Master's in Early Childhood Education (University of Malaya)	Master's in Education (Open University Malaysia)	Master's in Education Instructional Technology (University Utara Malaysia)	Master's in Education (University of Sydney)
Degree	Bachelor's degree in Early Childhood Education (University of Malaya)		Bachelor's degree in Information Technology (University Utara Malaysia)	Bachelor's degree in Arts (University of Malaya)

Table 3.2 (Continued)

Academic Qualification	Expert 1	Expert 2	Expert 3	Expert 4
Diploma	Certificate of Teaching Pengajian Cina (Maktab Perguruan Tengku Ampuan Afzan)	Diploma in Early Childhood Education (University of Malaya Centre of Continuing Education)	Diploma Pendidikan Prasekolah (Institut Perguruan Sultan Abdul Halim, Kedah)	
Teaching Experience	26 years	25 years	10 years	30 years

3.6 Research Instruments

The research instrument in the quasi-experimental with non-equivalent group pre-test and post-test design was used in this study. It included 10 lessons of creative play activities in early mathematics of addition and subtraction games for the Experimental group. Besides, pre-test and post-test in addition and subtraction questions were also developed to measure the children's number operations in addition and subtraction skills based on the 3 levels of performance standard that are referred in the National Preschool Standard-Based Curriculum 2017 Revision for both the Experimental and Control groups.

3.6.1 Pre-test & Post-test Questions

The purpose of the pre-test and post-test questions were administered to examine the level of early mathematics performance. It was also to determine the

significant differences between Experimental and Control groups among preschool children's number operation skills after the treatment to the Experimental group. A researcher should devise own instrument (Ghazali Darusalam & Sufean Hussin, 2016). On the other hand, both the pre-test and post-test questions were proposed to be equivalent (Lim, as cited in Zakiah Mohd Ashari et al., 2013). Besides that, the quasi-experiment research using the same test can pose a threat to the internal validity of the study (Zakiah Mohd Ashari et al., 2013). Therefore, pre-test and post-test questions are the same equivalent test set in this study. Apart from that, number operations are the focus in this study. Hence, the content standard of MA 3.1 - Solve operation of addition within 18 and MA 3.2 - Solve operation of subtraction within 18 that follows the National Preschool Standard-Based Curriculum 2017 Revision (NPSC 2017 Revision) were used.

In this study, the researcher developed the pre-test and post-test that consisted of 20 questions in addition and subtraction. Besides, in order to measure whether the children could master the number operations in addition and subtraction skills, the researcher developed different types of questions. The pre-test and post-test questions were divided into 8 parts (Part A to Part H) that followed the 8 learning standard (Refer Table 3.3) in the NPSC 2017 Revision.

In order to enhance the validity of the pre-test and post-test instrument, the researcher sought the comments and suggestions of Expert 1. She is an Assistant Director of the preschool sector in the Curriculum Development Division, Ministry of Education and one of the panel members who wrote the NPSC 2017 Revision. According to Expert 1, the addition and subtraction questions were mixed together in one test and were complicated. As such it difficult to measure whether the children had mastered the skills that referred to the 3 levels of performance standard in the

NPSC 2017 Revision. Subsequently, the researcher developed the pre-test and post-test questions based on the suggestions and comments from the Expert 1 (Refer Appendix I). The revised pre-test and post-test questions consist of two tests which included 15 questions for addition and 15 questions for subtraction. Each test was divided into 3 parts (Parts A, B and C – Refer Table 3.5) which referred to the 3 levels of performance standard in the National Preschool Standard-Based Curriculum 2017 Revision page 144 (Curriculum Development Division, Ministry of Education, 2017).

Then, two different experts (Experts 2 & 3) were selected to review the contents of the revised pre-test and post-test questions. Expert 2 commented the revised pre-test and post-test questions were clearly planned and systematically organised according to the performance standard stated in the NPSC 2017 Revision. She also agreed that in the learning process of children, understanding and mastery of mathematics concepts can be developed from concrete to abstract in which the children do counting with manipulation of concrete objects first as shown in addition and subtraction questions in Part A (Add the two groups objects together and subtract by taking out the objects). Then, with the basic knowledge, the children can solve addition and subtraction problem in the Part B and Part C questions. Moreover, the revised pre-test and post-test questions could identify the mastery level of addition and subtraction of children.

Apart from that, Expert 3 commented that the 2 tests involving addition and subtraction questions separately in the pre-test and post-test were suitable as the assessment of the preschool children could provide the preschool teachers solution to determine and test the level in mastering addition and subtraction of the children. Overall comments of experts for previous and revised pre-test and post-test questions (Refer Table 3.4). Besides, the pre-test and post-test questions conformed to the

performance standard in the NPSC 2017 Revision. Thus, the two tests involving addition and subtraction separately in the pre-test and post-test were conducted with the preschool children. Cronbach's Alpha Reliability Method were used to check the reliability of the test before the actual study.

Table 3.3

Pre-test and Post-test Questions before Revision

Part	Learning Standard	Total
Part A & B	MA 3.1.1 State the sum of two sets of objects	4 questions
Part C & D	MA 3.2.1 Remove objects from a group of objects and count the balance	4 questions
Part E	MA 3.1.4 Write and state mathematical expressions using symbols; addition (+) and equal (=)	2 questions
	MA 3.2.3 Write and state mathematical expressions using symbols; subtraction (-) and equal (=)	2 questions
Part F & G	MA 3.1.5 Add in the range of basic facts	3 questions
	MA 3.2.4 Subtract in the range of basic facts	3 questions
Part H	MA 3.1.6 Solve problems involving addition	1 question
	MA 3.2.5 Solve problems involving subtraction	1 question
Total		**20 questions**

According to the Table 3.3, the pre-test and post-test consisted of 20 different questions on addition and subtraction before revision. The pre-test and post-test questions were divided into 8 parts (Part A to Part H) which followed the 8 learning standard in the NPSC 2017 Revision.

Table 3.4

Overall Comments of Experts for Previous and Revised Pre-test and Post-test Questions

Comments and Suggestions of the Previous Pre-test and Post-test Questions	**Review and Comments of the Revised Contents in Pre-test and Post-test Questions**	
Expert 1	**Expert 2**	**Expert 3**
Comments 1) The addition and subtraction questions were mixed together in one test were complicated 2) Difficult to measure whether the children can master the skills. **Suggestions** Should consist of two tests which include 15 questions on addition and 15 questions on subtraction. Each test is divided into 3 parts which refer to the 3 levels according to the performance standard in the NPSC 2017 Revision.	**Comments** 1) Clearly planned and systematically organised according to the performance standard as stated in the NPSC 2017 Revision. 2) Agreed that the children's mastery of mathematics concepts can be developed from concrete to abstract. 3) Can identify the mastery level in addition and subtraction abilities of children.	**Comments** 1) Suitable as assessment for preschool children. 2) Can provide preschool teacher solution to determine and test the children's level in mastering addition and subtraction. 3) Aligned with the performance standard in the NPSC 2017 Revision.

According to the Table 3.4, Expert 1 commented and gave suggestions to the pre-test and post-test developed by the researcher. Then, the researcher corrected the pre-test and post-test questions based on the suggestions and comments from the Expert 1. Two different experts (Experts 2 & 3) were selected to review the contents after

corrections of the pre-test and post-test questions had been made. Both experts agreed with the revised pre-test and post-test questions.

Table 3.5

Revised Pre-test and Post-test Questions

Part	Based on the Performance Standard		Questions
	Addition	**Subtraction**	
Part A	**Level 1** Can state sum of two groups of objects.	**Level 1** Can state the balance when objects are removed from a group.	Each test has 5 questions with counting objects.
Part B	**Level 2** Can solve problems of addition within 18 using concrete objects.	**Level 2** Can solve problems of subtraction within 18 using concrete objects.	Each test has 5 questions (Children answer using objects such as ice-cream sticks or toy blocks).
Part C	**Level 3** Can solve problems of addition within 18.	**Level 3** Can solve problems of subtraction within 18.	Each test has 5 questions (Children answer without using objects).

According to the Table 3.5, the revised pre-test and post-test questions consist of two tests which contained 15 questions on addition and 15 questions on subtraction. Each test is divided into 3 parts which refer to the 3 levels of performance standard in the National Preschool Standard-Based Curriculum 2017 Revision.

Table 3.6

Measurement of Performance Standard for Pre-test and Post-test Questions based on National Preschool Standard-Based Curriculum 2017 Revision (Curriculum Development Division, Ministry of Education, 2017)

		Level 1	**Level 2**	**Level 3**
Content Standard	MA3.1 Solve operation of addition within 18	Can state sum of two groups of objects.	Can solve problems of addition within 18 using concrete objects.	Can solve problems of addition within 18.
Content Standard	MA3.2 Solve operation of subtraction within 18	Can state the balance when objects are removed from a group.	Can solve problems of subtraction within 18 using concrete objects	Can solve problems of subtraction within 18.
Total of questions	15	0-5 Correct answers	6-10 Correct answers	11 – 15 Correct answers

According to the Table 3.6, the content standard in the NPSC 2017 Revision - MA3.1 Solve operation of addition within 18 and MA3.2 - Solve operation of subtraction within 18 were used in this study. The performance standard for Level 1 is that children can state sum of two groups of objects for addition and children can state the balance when the objects are removed from a group for subtraction. The performance standard for Level 2 is that children can solve problems of addition within 18 using concrete objects for addition and they can solve problems of subtraction within 18 using concrete objects for subtraction. The performance standard for Level 3 is that children can solve problems of addition within 18 for addition and children can solve problems of subtraction within 18. Measurement of Performance Standard for Pre-test and Post-

test Questions for the Level 1 is between 0-5 correct answers, Level 2 is between 6-10 correct answers and Level 3 is between 11-15 correct answers.

3.6.2 Reliability for the Revised Pre-test Questions

In a quantitative research, reliability refers to the capability of all the items in the research instruments to measure consistently the concept. This capability is called internal consistency reliability and high correlation among the items means high internal consistency reliability (Chua, 2016). In this study, the researcher used the Cronbach's Alpha Reliability Method to check the reliability of the pre-test questions. The test was carried out in an SK preschool which involved 30 children. Thus, the scores of 30 children were collected and analysed using the Statistical Package for Social Sciences (SPSS) software. The Cronbach's Alpha Reliability Method involves finding the correlation and the Cronbach's Alpha value between the score of every item. In this method, items having a high correlation value with the index score of the test will have high reliability, whereas items with a low correlation value will have low reliability and will be removed from the test (Chua, 2016).

Table 3.7

Reliability Statistic for the Revised Pre-test Questions

	Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**
Addition	.749	.753	3
Subtraction	.612	.630	3

Based on Table 3.7, the Cronbach's Alpha value for the revised addition pre-test questions is α = .749 (74.9%) and subtraction is α = .612 (61.2%) Cronbach's Alpha value that can be accepted is more than α = .60 and the value in the level of α = .71 - .99 is the best level (Majid Konting, as cited in Ghazali Darusalam & Sufean Hussin, 2016). Therefore, the value for reliability (α = .612) for the pre-test questions in addition can be accepted and value for pre-test questions in subtraction can be considered of good level. Thus, the revised pre-test questions will be used in the actual study.

3.6.3 Lesson Plans for Creative Play Activities in Early Mathematics

The researcher adapted and modified addition and subtraction activities from the Module of Early Mathematics published by the Curriculum Development Division, Ministry of Education, 2011. Ten lessons of activities were adapted and modified from the module which included 5 lessons of games for addition and 5 lessons of games for subtraction. On the other hand, the content of the lessons and learning standard follow the National Preschool Standard-Based Curriculum 2017 Revision (NPSC 2017 Revision) which included content standard of MA 3.1 - Solve operation of addition within 18 and MA 3.2 - Solve operation of subtraction within 18. Moreover, the activities also integrated other learning standard to enhance indirectly the development of the children.

According to Sharma (2013), play method can develop interest and motivation in a mathematics class as it becomes easier through this learning method. Thus, the lessons on the creative play activities were emphasized in the addition and subtraction games in creative play which included thinking, role play, group activities, sharing, and discussion among children.

Besides, in order to enhance the validity of the instruments, three experts were selected (Experts 2, 3 and 4) in this study to review the content of the creative play activities in early mathematics before the actual study was conducted. According to Expert 2, systematic planning in the lesson that integrates different types of creative play activities such as those that arouse critical thinking during the process of learning. They focus on hands-on experiences, related or connected to daily life situations; and those that adopt appropriate developmental practice or accomodate to the individual needs, interests and fun. They are important to the young children to learn and master early mathematics concepts or skills effectively.

Thus, Expert 2 suggested to add set up a role play corner, ourdoor play and pysical play in the addition and subtraction activities. Expert 3 agreed with all the 10 activties but suggested to add free play, mathematics rountine activties, set up role play corner and outdoor activities to provide the oppoturnities to expand the children creativity in learning mathematics. Expert 4 emphasized the lesson plans be rewritten according to sequential development and lesson plans should be clearly written as advised which allow the activities to be conducted easily and clearly by the preschool teacher for the Experimental group.

Therefore, 7 activities were retained but the steps of some activities step were modified based on the comments of the experts. However, 3 activities were eliminated that included Activity 1 - Ice-cream stick addition game to role play corner set up, Activity 2 - Counting on blocks addition game to addition physical play with sport equipment and Activity 6 - Ice-cream sticks subtraction game to outdoor play of subtraction bowling game.

Table 3.8

Overall Comments of Experts for the 10 Lessons of Creative Play Activities in Early Mathematics

	Expert 2	Expert 3	Expert 4
Activity 1 Ice-cream Sticks Addition Game	1. For the first introductory lesson, please consider to arouse the interest by creating a conducive environment for children. 2. The first lesson may connect to their daily life situations such as set up a role play corner like shop or market. 3. When the children are motivated by their own initiatives and interests, effective learning outcomes can be attained in the subsequent lessons.	1. The activities include teacher modelling, interactive modelling and children independent working time. 2. Good lesson activity by using simple teaching aids (ice-cream sticks) that can easily make the children understand and be interested.	Overall comments for 10 activities 1. Rewrite the lesson plans according to sequence. 2. Lesson plans should be clearly written as advised.
Activity 2 Counting on Blocks Addition Game	1. Continue to enhance the mastery of addition skills through physical play activities. 2. It will be fun to integrate cognitive skills with the physical and aesthetical aspects which emphasize in NPSC 2017 Revision. 3. Mathematics can be fun when it is integrated with physical play activities. It is truly great to learn addition effectively through physical play.	1. Good in choosing the manipulative teaching aids to make activity interesting and can enhance prior knowledge of addition among children.	Agreed

Table 3.8 (Continued)

	Expert 2	Expert 3	Expert 4
Activity 3 Addition Dice Game	1. For the set induction, the teacher can guide the children to visualise the addition process clearly in the series of adding pictures with numbers and symbols of "+" and "=". 2. Picture series can inspire critical thinking skills among young children. 3. Steps 3 and 4 are good and can continue with the learning activities as planned.	1. Good in choosing manipulative teaching aids in the activities. 2. The objective was focused on writing the symbols of "+" and "=". Counting on skills also should be focused.	Agreed
Activity 4 Addition Role Play	1. For the set induction, please use different questions or situations to inspire critical thinking. Teacher can also ask the children to suggest different addition situations or problems. 2. Steps 3 and 4 are good and continue with the learning activities as planned.	1. To make the role play more interesting and meaningful, teacher can provide props that enable children to engage in the real character such as hat and wigs.	Agreed

Table 3.8 (Continued)

	Expert 2	Expert 3	Expert 4
Activity 5 Addition Task Card	1. The children learn more effectively when they discover the knowledge, concepts and skills by their own. 2. Steps 2, 3 and 4 are good and continue with the learning activities as planned.	1. The activities are not instructive but it is easy to understand if the sequence of instruction can be seen clearly when applied in the classroom.	Agreed
Activity 6 Ice-cream Sticks subtraction Game	1. Play activities connected to daily life situations in conducive environment to learn subtraction. Please guide the children to set up simple role play corners and they can do wonders through such role play corners such as bank and bakery. 2. Children can continue to play and practice the addition concepts during free play or learning centre sessions. The children can learn effectively through play.	1. Smart usage of teaching aids to provide more understanding of basic subtraction concept. 2. The word ‘take / taken out” can be replaced with “take away”.	Agreed

Table 3.8 (Continued)

	Expert 2	Expert 3	Expert 4
Activity 7 Subtraction Dice Game	1. Let's continue to enhance the mastery of subtraction skills through physical play such as bowling games. It will be fun to integrate cognitive skills with physical activities which are emphasized in NPSC 2017 Revision.	1. The dice as a teaching aids in the activities is interesting. It's also economical and reliable. 2. The dice with Velcro surface enables teacher to replace them with any number (1-18) they want according to the activities of the situations.	Agreed
Activity 8 Subtraction Blocks Play	1. Can continue with your learning activities by demonstrating various methods / ways of subtraction. 2. Please encourage the children to share their discovery in doing subtraction.	1. Good method to further enhance children arithmetic ability that requires a lot of practices. Children should try a few times before they continue in a group.	Agreed
Activity 9 Subtraction Role Play	1. Please encourage and guide the children to create and come out with their own story sums or problem daily situations related to subtraction for role play activities. 2. Steps 3 and 4 are good and continue with the learning activities as planned.	1. The role play activities can let the children create a situation and act as different characters according to the situation. 2. Teacher can make the role play situation more realistic by providing the props such as basket, hat and stall to the children to act and engage them in the real character.	Agreed

Table 3.8 (Continued)

	Expert 2	Expert 3	Expert 4
Activity 10 Subtraction Task Card	1. Let the children discuss, decide and explain why it is appropriate to use "+" or "-" in resolving the problems. 2. Challenge the children with story sums. Request the children to identify if it is a problem on addition or subtraction. Ask the children to provide an explanation for their identification. (Why? The total is more / less) 3. Encourage the children to discover the best way to solve the problems.	1. Using the same teaching aids (ice-cream stick, blocks and fingers) provide familiarity and the children can easily understand the concept.	Agreed

Table 3.9

10 Lessons of Previous and Revised Creative Play Activities in Early Mathematics

Activity	Previous	Revised	Elements of Creative Play
Activity 1	Ice-cream Sticks Addition Game	Role Play Corner Set Up	**Create and Set Up the Role Play Corner** Children can enhance their interest by creating a conducive environment such as set up fruits stall and toys stall by themselves. They can relate to their daily lives through engaging in playing of selling and buying in the corner.
Activity 2	Counting on Blocks Addition Game	Outdoor Physical Play with sport equipment	**Connect with the Natural Environment and Play with Concrete Objects** Children can learn counting on skills by counting how many trees, cars and flowers in the environment. Besides, they enhance their addition concept through playing with sport equipment such as bean sacks and small balls. Interesting materials can stimulate discussions and elicit children's investigations.
Activity 3	Addition Dice Game	Retained	**Think, Give Instructions and Cooperate** In the dice activity using small groups, the children can learn to think how to give instructions and cooperate among friends in the group to complete the game such as who will play first, throw the dice and place the number cards, fruits cards, plus sign, equal sign on the board and record the addition sentence in the task card. It helps the children to express their thoughts and feeling when learning in problem solving situation through dice game.

Table 3.9 (Continued)

Activity	Previous	Revised	Elements of Creative Play
Activity 4	Addition Role Play	Retained	**Create the Role Play Stories** Children can enhance their creativity and addition skills through creating the addition role play stories themselves when engaged in the role play. They can also learn to think how to take on a role and pretend to be someone else such as seller, buyer, father and mother. They can also use real or fake objects to play out the role to make them think abstractly to create mental pictures of the math problem whether to add or subtract.
Activity 5	Addition Task Card	Retained	**Find Answers in the Small Group Discussion** This activity allows children to think, discuss and find solutions by themselves to answer addition questions in the task card given. It provides children opportunities to explore by themselves such as sharing what they know and express their ideas and opinions.
Activity 6	Ice-cream Sticks subtraction Game	Bowling game	**Outdoor Environment with Materials** The children interact with the outdoor environment with materials like bowling pins toys set and empty mineral water bottles when engaged in the bowling game. This is the way to make the children to have more complex way of thinking and gain the subtraction skills of less or take away through play with materials such as count and record how many pins were knocked down and how many pins were left. It can reflect, build interest, experiences and understanding of subtraction concepts in children.

Table 3.9 (Continued)

Activity	Previous	Revised	Elements of Creative Play
Activity 7	Subtraction Dice Game	Retained	**Think, Give Instructions and Cooperate** In the dice activity of small groups, the children learn to think how to give instructions and cooperate among their group friends to complete the game such as who will play first, throw the dice and place the number cards, fruits cards, plus sign, equal sign on the board and record the subtraction sentence in the task card. It helps the children to express their thoughts and feelings when learning problem solving situation through dice game.
Activity 8	Subtraction Blocks Play	Retained	**First Hand Experience** Children can explore, manipulate and organize concrete objects materials (blocks) before they are expected to use abstract objects. Through blocks play, children can begin to question, analyse and discuss their discoveries and see how mathematics is part of everyday life when solving the subtraction questions for the number more than 10.
Activity 9	Subtraction Role Play	Retained	**Create the Role Play Stories** Children can enhance their creativity and subtraction skills through creating the subtraction role play stories themselves when engage in the role play. They can also learn to think how to take on a role and pretend to be someone else such as seller, buyer, father and mother. They can also use real or fake objects to play out the role to make them think abstractly to

Table 3.9 (Continued)

Activity	Previous	Revised	Elements of Creative Play
Activity 9			create mental pictures of the math problem whether to add or subtract.
Activity 10	Subtraction Task Card	Remained	**Find Answers in the Small Group Discussion** This activity allows children to think, discuss and find answers themselves to answer subtraction questions when the task card is given. It provides the children opportunities to explore by themselves such as sharing what they know and expressing their ideas and opinions.

3.7 The Validity of the Instruments

Validity is the most important idea to consider when preparing or selecting an instrument for use. Fraenkel, Wallen and Hyun (2012) have pointed out that validity refers to the appropriateness, meaningfulness, correctness and usefulness of the inferences a researcher makes. Chua (2016) has stated that validity refers to the capability of a measurement or a research instrument to measure the true value of a concept in a hypothesis. In other words, validity is defined as the correlation value between measurement and the true value of a variable.

In this study, the researcher has obtained a panel of three experts (Experts 1, 2 and 3) who are experienced to validate the pre-test and post-test questions. The researcher has also managed to have an expert who is an Assistant Director of the preschool sector in the Curriculum Development Division, Ministry of Education to validate the measurement performance standard of Levels 1, 2 and 3 for pre-test and post-test based on National Preschool Standard-Based Curriculum 2017 Revision.

Apart from that, a panel of three experts (Experts 2, 3 and 4) were invited to validate and review the 10 lesson plans of creative play activities in early mathematics. Moreover, to enhance the validity of the instrument for the creative play activities on early mathematics, a pilot study was conducted in *Sekolah Kebangsaan* preschool located in the *Kuala Langat* District in Selangor. This preschool consisted of 30 six-year-old children who would be engage in the creative play activities in early mathematics of addition and subtractions games. The conversation between researcher and the preschool teacher was about the comments of the strengths and weaknesses of the activities after the pilot study was conducted. It was written out in the form of an interview as a supporting document (Refer Appendix II of Pilot Study) to enhance the validity of the instruments.

3.7.1 Threats to Validity

There are several threats to validity that will raise potential issues regarding the researcher's ability to conclude that the intervention affects an outcome (Creswell, 2003).

Internal validity

3.7.1.1 Inadequate Procedures

First threat to validity is inadequate procedures that can change the instrument during the experiment or aspects or problems in applying the treatments (Creswell, 2003). To avoid this threat, the researcher clearly guided and explained the instrument that consisted of 10 lessons the content and steps of each lesson to the preschool teacher in the Experimental group before the actual study was conducted.

Besides, during these 10 weeks, Preschools A and B were observe by the researcher to ensure the validity of the data.

3.7.1.2 Characteristics of the Participants

Second threat to validity is the characteristics of the participants in which participants mature and change their views or become wiser or more experienced during an experiment (Creswell, 2003). To avoid this threat, the researcher designated a period of time in which the implementation of the creative play activities was conducted in the Experimental group and the normal teaching method was conducted in the Control group within 10 weeks. This was due to time constraint and avoid influences or interference by external factors such as the participants becoming more mature and wiser in the Experimental and Control group. This would ensure the validity of the data of the research findings.

3.7.1.3 Problems in Applying Treatments

The third threat of validity is problems in applying treatments which is diffusion effect. This is when members of the Experimental and Control groups talk to each other. To avoid this threat, both Experimental and Control groups are from different *Sekolah Kebangsaan* preschools. During these 10 weeks, the period of time for the lessons of both groups were the same which consisted of 5 lessons for addition and 5 lessons for subtraction. Both groups cannot add more lessons for addition and subtraction during the actual study.

3.7.2 Validity of the Pilot Study

Chua (2016) has stated that researchers are encouraged to conduct a pilot study before the research items are used in the actual research. The pilot test is conducted by using a small group of individuals (usually 20 to 40 people) with similar demographic backgrounds as the research respondents. To enhance the validity of the instrument for the creative play activities in early mathematics, a pilot study was conducted in *Sekolah Kebangsaan* government preschool located in *Kuala Langat* District in Selangor which consisted 30 six-years-old children. They were engaged in the creative play activities in early mathematics in addition and subtractions games. The comments of the preschool teacher on the strengths and weaknesses of the activities after the pilot study had been conducted through the conversation between researcher and the preschool teacher is include as Appendix II. (Refer Appendix II of Pilot Study).

Table 3.10

Strengths and Weaknesses of the Pilot Study (Reflection of each lesson after implemented)

Activity	Strengths	Weaknesses
Activity 1 Role Play Corner Set Up	1. Enhances communication and thinking skills of children through role play by adding the objects of 2 groups. 2. Children enjoy and were happy when engaged in the "buying and selling" role play.	

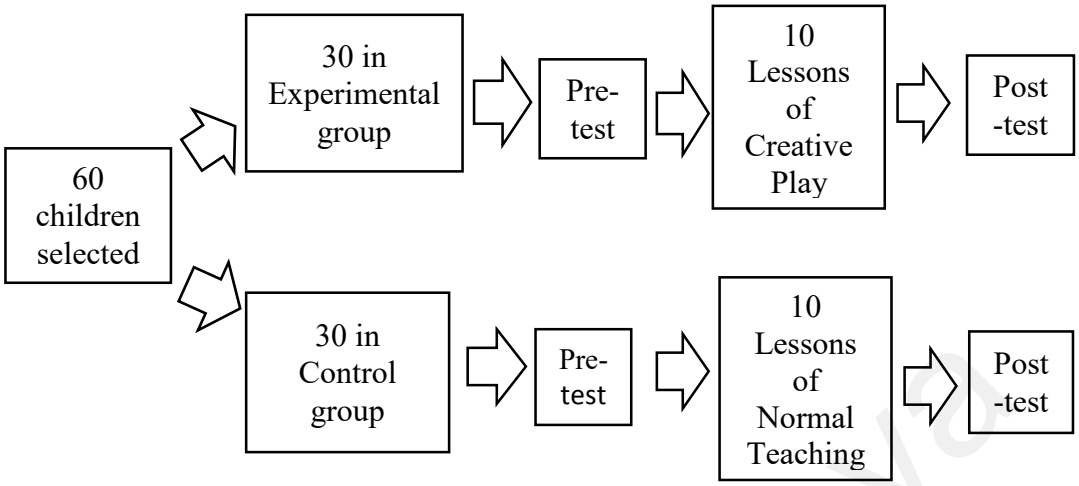
Table 3.10 (Continued)

Activity	Strengths	Weaknesses
Activity 2 Addition Physical Play with sport equipment	1. The children could master the skills of "counting on" after repeating the game several times. 2. Children were able to cooperate with each other in the group.	1. Children confused regarding the concept of "counting on" start from beginning. To master the skills need to play few times.
Activity 3 Addition Dice Game	1. Can enhance the interest in competition among children. 2. Majority of the children were be able to master the addition skills.	1. Some of the children who are weak face problems in writing the sentence in mathematics. (Slowly)
Activity 4 Addition Role Play	1. Children could engage in the role play to act the character according to the situation. 2. Role play enhances interest in learning mathematics among children. 3. Majority of the children could solve questions in the addition problems.	
Activity 5 Addition Task Card	1. Children share and talk with each other in the group discussion.	

Table 3.10 (Continued)

Activity	Strengths	Weaknesses
Activity 6 Outdoor Play of Subtraction bowling game	1. Children enjoy and happy when playing bowling game outdoor. 2. Children enhance their fine motor skills in the bowling games when they used hands to arrange the bottles or pins after playing the games a few times.	1. Time not enough when engage in the outdoor play due to bowling game; need to arrange the pins line by line.
Activity 7 Subtraction Dice Game	1. Children enhance their communication skills in the group when they need to communicate with their team members such as arrange who will play first.	
Activity 8 Subtraction Blocks Play	1. Children enhance the subtraction skills through blocks play activities. 2. Children enjoy and have fun when learning mathematics through creative play.	1. Arguments happen when they saw the blocks that they cannot control themselves.
Activity 9 Subtraction Role Play	1. Children enhance their thinking, imagination and creativity when they create the story according to the daily situations.	1. Need control and guidance from the teacher when they engage in the role play. They make noise or arguments happen
Activity 10 Subtraction Task Card	1. Enhance their creativity on drawing when they solve subtraction problems in the task card.	

3.8 Procedure of the Study



3.9 Data Collection

Pre-test was conducted for the Experimental and Control groups to examine the level of the number operations performance of the 60 children from the *Sekolah Kebangsaan* preschools in addition and subtraction skills before the treatment is started for the Experimental group and normal teaching for the Control group on the same day of the first week. The time allocated for pre-test is 40 minutes and the children are required to answer 15 questions on addition and 15 questions on subtraction. On the other hand, the 10 lessons of creative play activities in early mathematics on addition and subtraction games were conducted by the preschool teacher for the Experimental group for 10 weeks. This is to examine the effects of the creative play activities on the performance of early mathematics among preschool children in addition and subtraction skills. During these 10 weeks, the preschool teacher of the Control group conducted normal teaching to the preschool children in early mathematics without using the creative play in early mathematics instrument. The duration for each lesson is 40 minutes. Lastly, post-test was conducted in both groups on the 10^{th} week to examine the differences of the 3 levels of performance standard before and after the 10 lessons of creative play activities in addition and subtraction games that was given

to the Experimental group and normal teaching to the Control group.

Table 3.11

Procedure of Data Collection

Week	Activity	Games / Test	Group
Week 1	Pre-test	15 questions on addition 15 questions on subtraction	**Experimental group** **Control group**
	Activity 1	Role Play Corner Set Up	Experimental group
Week 2	Activity 2	Addition Physical Play with sport equipment	Experimental group
Week 3	Activity 3	Addition Dice Game	Experimental group
Week 4	Activity 4	Addition Role Play	Experimental group
Week 5	Activity 5	Addition Task Card	Experimental group
Week 6	Activity 6	Outdoor Play of Subtraction bowling game	Experimental group
Week 7	Activity 7	Subtraction Dice Game	Experimental group
Week 8	Activity 8	Subtraction Blocks Play	Experimental group
Week 9	Activity 9	Subtraction Role Play	Experimental group
Week 10	Activity 10	Subtraction Task Card	Experimental group
	Post-test	15 questions on addition 15 questions on subtraction	**Experimental group** **Control group**

3.10 Statistical Analysis

Statistical Package for Social Sciences (SPSS) was used to analyse the data. SPSS enabled the researcher to summarize the results of the pre-test and post-test and interpret the results of the findings of Experimental and Control groups in this study. To fulfill the research purpose, descriptive data was obtained to answer research

question 1, what is the level of early mathematics performance among preschool children? Pre-test of addition and subtraction questions was administered to examine the level of early mathematics performance for Control and Experimental groups before the creative play activities were conducted for the Experimental group and normal teaching for the Control group.

For research question 2, to what extent does creative play activities affect early mathematics performance among preschool children? the paired-samples t-test and effect size were conducted for statistical analysis to examine whether the creative play activities affect the performance of the children in addition and subtraction skills in the Experimental group. Paired-samples t-test was used in the research questions to determine if there was a difference between the means of both sets of data which were from pre-test and post-test (Chua, 2013). It is intended to examine the improvements of the children before and after the treatments. Moreover, effect size was also calculated in this research question to determine how the independent variable affected the dependent variable (Ghazali Darusalam & Sufean Hussin, 2016).

For research question 3, is there any difference between the Experimental group and Control group in preschool children's number operation skills? The paired-samples t-test, effect size and SPANOVA (Split Plot ANOVA Test) were conducted for statistical analysis to find out the difference before and after the 10 lessons of creative play activities in early mathematics in addition and subtraction games on the Experimental group and normal teaching to the Control group. SPANOVA (Split Plot ANOVA Test) was used to analyze the effect and differences before and after the treatment (repeated measures) on the dependent variable by making comparison and identify the differences between the Experimental and Control groups among the preschool children's in their number operation skills.

3.11 Summary

This chapter has discussed in detail the research design. The experimental research design was specially created to evaluate the effectiveness of the treatment on performance and focused on the comparison among the data sets (Chua, 2016). Besides, the quasi-experimental with non-equivalent group pre-test and post-test design was used in this study because the respondents cannot be randomly assigned to the Experimental and Control groups. It is to examine how creative play activities in early mathematics affect preschool children's number operations in the Experimental group. Furthermore, 10 lessons on creative play activities in early mathematics in addition and subtraction and the pre-test and post-test questions were reviewed by experts to ensure content validity and relevance of the questions that were to be answered by the children. In order to ensure the validity of the instruments, a pilot study was conducted in *Sekolah Kebangsaan* (SK) Preschool in *Kuala Langat* before the actual research was conducted. Moreover, the researcher carried out the test in an SK preschool to ensure the reliability of the pre-test and post-test questions. The Cronbach's Alpha Reliability Method was used to check the reliability of the pre-test and post-test questions. Chapter 4 summarized the results of the pre-test and post-test and interpret the results of the findings of Experimental and Control groups in this study through SPSS.

CHAPTER 4

DATA ANALYSIS

4.1 Introduction

Statistical Package for Social Sciences (SPSS) was used to analyse the data. Scores of the pre-test and post-test were recorded and from the scores of these tests conclusions were drawn. Statistical software like the SPSS enabled the researcher to summarize the results of the pre-test and post-test and interpret the results of the findings of Experimental and Control groups in this study. 60 six years old children from *Sekolah Kebangsaan* preschools were selected as sample to participate in this study. 30 children from one preschool were placed in the Experimental group and another 30 children from another preschool were placed in the Control group.

The research instruments in this study included pre-test and post-test addition and subtraction questions for both Experimental and Control groups. Besides, 10 lessons of creative play activities in early mathematics of addition and subtraction games for the Experimental group were also developed to be conducted to get the answers for the 3 research questions.

The 3 research questions are:

1) What is the level of early mathematics performance among preschool children?
2) To what extent does creative play activities affect early mathematics performance among preschool children?
3) Is there any difference between the Experimental group and Control group in preschool children's number operation skills?

4.2 Data Cleaning

The problem of missing data cannot be avoided and there are many reasons that can cause missing data such as entering numerical wrongly or long questionnaires (Field, 2009). Thus, multiple imputation in SPSS can generate possible values for missing values and help researchers to create the complete sets of data. In this research study, data cleaning through multiple imputation was used to ensure any missing values and all the participants answered all the pre-test and post-test addition and subtraction questions.

4.2.1 Data Cleaning for Addition Pre-test and Post-test of Control and Experimental Groups

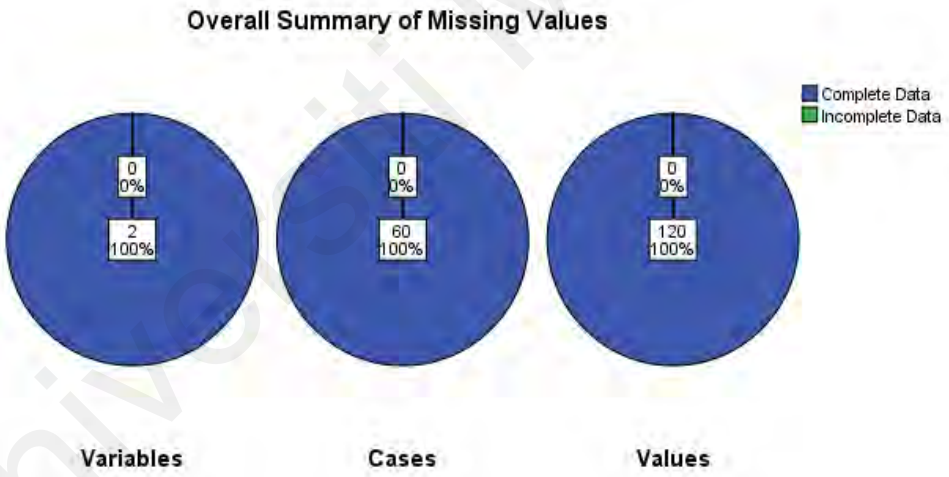


Figure 4.1 Data Cleaning Results for Addition

Based on figure 4.1, the data cleaning results show that two variables of addition pre-test and post-test were clean (100%) and missing values were 0%. On top of that, cases representing the 30 participants for the Control group and 30 participants for the Experimental group had answered all the addition pre-test and post-test questions.

4.2.2 Data Cleaning for Subtraction Pre-test and Post-test of Control and Experimental Groups

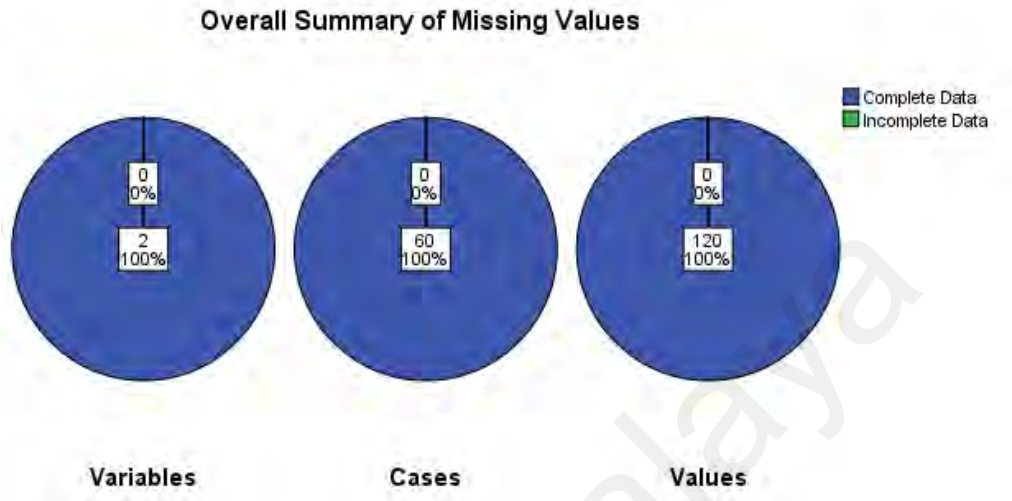


Figure 4.2 Data Cleaning Results for Subtraction

Based on Figure 4.2, the data cleaning results show that two variables of subtraction pre-test and post-test were clean (100%) and missing values were 0%. On top of that, cases representing the 30 participants for the Control group and 30 participants for the Experimental group had answered all the subtraction pre-test and post-test questions.

4.3 Normality Test

Statistics of normality test is used to determine whether a data set collected from participants has normal distribution (Chua, 2013; Klima, 2017). Parametric test is used for the normal distribution and non-parametric test is used for the non-normal distribution. There are graphical and statistical methods for evaluating normality.

There were two types of normality tests administered in the study. First was by using the scores of the mean, median and mode. Ghazali Darusalam and Sufean Hussin

(2016) stated that for a data to be normally distributed or considered as normal data, the values of the variables should be almost the same for the mean, median and mode.

Other than that, skewness and kurtosis were also used to test for the normality of the data in this research. Skewness is a measure of the asymmetry of the probability distribution of a random variable about its means and it can also be either positive or negative undefined. In addition, kurtosis is based on the shape of a bell curve and it depends on the height and sharpness of the peak at the centre (Klima, 2017). A positive value shows a positively skewed graph, whereas a negative kurtosis value shows a low distribution curve. If the data is normally distributed, the skewness and kurtosis values is between ±1.96 (Chua, 2013). Besides, Tabachnick and Fidell (2007) have explained that data is normally distributed when values of skewness and kurtosis are in the range of ±1.7 or ±2.0.

Table 4.1

Mean, Median, Mode, Skewness and Kurtosis in Addition for the Control and Experimental Groups

Addition	**Control Group**		**Experimental Group**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
N	30	30	30	30
Mean	2.50	2.66	2.40	2.83
Median	3.00	3.00	2.50	3.00
Mode	3.00	3.00	3.00	3.00
Skewness	-1.047	-1.820	-.693	-2.931
Kurtosis	-.034	2.048	-.517	8.637

Table 4.1 shows mean, median, mode, skewness and kurtosis in addition for the Control and Experimental groups. According to Ghazali Darusalam and Sufean Hussin

(2016), for a data to be considered as normal, the values of the variables should be almost the same between mean, median and mode. In this study, the pre-test and post-test in addition for Control and Experimental groups were considered to be normal in distribution because the values of the mean, median and mode for both were almost the same which were in the range of 2.40 to 3.00. Besides, skewness and kurtosis should not succeed an absolute value of 3 and 10 respectively (Kline, 2005) and the values should be in the range of -1.96 to +1.96 (Chua, 2013). The value of pre-test and post-test of both groups were in the normal probability range of skewness (-.693 to -2.931) and kurtosis (-.034 to 8.637). Thus, parametric test was used in this study.

Table 4.2

Mean, Median, Mode, Skewness and Kurtosis in Subtraction for the Control and Experimental Groups

Subtraction	**Control Group**		**Experimental Group**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
N	30	30	30	30
Mean	2.50	2.60	2.40	2.80
Median	3.00	3.00	3.00	3.00
Mode	3.00	3.00	3.00	3.00
Skewness	-1.135	-1.473	-.854	- 2.499
Kurtosis	-.089	.957	-.731	6.057

Table 4.2 shows mean, median, mode, skewness and kurtosis in subtraction for the Control and Experimental groups. For a data to be normally distributed, the values of the variables should be almost the same between mean, median and mode (Ghazali Darusalam & Sufean Hussin, 2016). In this study, the subtraction scores of the pre-test and post-test for Control and Experimental groups were considered to be normally

distributed because the values of mean, median and mode for both groups were almost the same which were in the range of 2.40 to 3.00. Besides, the skewness and kurtosis should not succeed an absolute value of 3 and 10 respectively (Kline, 2005) and the values should in the range of -1.96 to +1.96 (Chua, 2013). The values of the pre-test and post-test for both groups were in the normal probability range of skewness (-.854 to - 2.499) and kurtosis (-.089 to 6.057). Thus, parametric test was used in this study.

4.4 Homogeneity

Homogeneity of the sample is when all the members possess a certain trait or characteristics (Fraenkel, Wallen & Hyun, 2012). Levene's Test of Equality of Error Variances for pre-test was conducted to assess the preschool children's early mathematics in addition and subtraction before continuing with further analysis. This is because the assumption of homogeneity of variance requires the variance within each of the population to be equal. To meet the statistical assumption of homogeneity of variance, p-value for Levene's Test should be above 0.05 (p>.05). The factor of preschool was considered as covariate if p-value is more than 0.05. If the Levene's Test yields a p-value below 0.05, then the assumption of homogeneity of variance has been violated.

Table 4.3

Levene's Test of Equality of Error Variances for Pre-test

	F	**df1**	**df2**	**Sig.**
Addition	.000	1	58	1.000
Subtraction	.279	1	58	.599

Table 4.3 shows Levene's Test of Equality of Error Variances for pre-test. The pre-test results show they are not significant for addition ($F_{(1, 58)} = .000$, $p>.1.000$) and subtraction ($F_{(1, 58)} = .279$, $p>.599$). Thus, the error variance of the dependent variable is equal across groups. The results indicated that participants in Control and Experimental groups were equal at the same level in early mathematics for addition and subtraction before the actual study was conducted. Levene's Test showed the results were not significant and also indicated that both SK preschools children had the same characteristics which include physical structure of the preschool classroom. Furthermore, both SK preschools participants have similar charateristic, all of them started their learning in the preschool at the age of 5 years old and they also have similar scores for early mathematics. The demographic of the participants' family background are from the low income group.

4.5 Pre-test and Post-test Results

The purpose of administering the pre-test on the addition and subtraction questions was to examine the level of early mathematics performance for Experimental and Control groups before the study was carried out. Besides, post-test results was administered to determine the significant differences between Experimental and Control groups in the preschool children's number operation skills especially after the treatments to the Experimental group. The pre-test and post-test questions include 15 questions for addition and 15 questions for subtraction which was based on the content standard of MA 3.1 - Solve operation of addition within 18 and MA 3.2 - Solve operation of subtraction within 18 according to the Revised National Preschool Standard-Based Curriculum 2017 (NPSC 2017 Revision).

Research Question 1: What is the level of early mathematics performance among preschool children?

Pre-test of addition and subtraction questions was administered to examine the level of early mathematics performance for Control and Experimental groups. The test was before the creative play activities were conducted for the Experimental group and normal teaching for the Control group. Measurement of Performance Standard for Pre-test questions based on Revised NPSC 2017 which were represented by 3 Levels which are Level 1 (0-5 correct answers), Level 2 (6-10 correct answers) and Level 3 (11-15 correct answers).

The performance standard for Level 1 refers to children who can state the sum of two groups of objects for addition and children who can state the balance when objects are removed from a group for subtraction. The performance standard for Level 2 refers to children who can solve problems of addition within 18 using concrete objects for addition and children who can solve problems of subtraction within 18 using concrete objects for subtraction. The performance standard for Level 3 refers to children who can solve problems of addition within 18 for addition and children who can solve problems of subtraction within 18 for subtraction. The level of addition and subtraction pre-test results are shown in Tables 4.4 and 4.5.

Table 4.4

Pre-test in Addition by 3 Levels for the Control and Experimental Groups

Level	Score	Control Group		Experiment Group	
		Frequency	Percent	Frequency	Percent
Level 1	0-5	3	10	3	10
Level 2	6-10	9	30	12	40
Level 3	11-15	18	60	15	50
Total		30	100	30	100

Table 4.4 shows pre-test in addition by 3 Levels for the Control and Experimental groups. Out of the 30 participants in both groups, there were 18 participants (60%) in the Control group compared to 15 participants (50%) in the Experimental group for Level 3 that showed they were able to score between 11-15 correct answers. On the other hand, 9 participants (30%) of Control group and 12 participants (40%) of Experimental group were categorized in the Level 2 that showed they were able to score 6 – 10 correct answers. Besides, 3 participants (10%) in both the Experimental and Control groups were found to be at Level 1 that showed they only were able to score 0-5 correct answers. Therefore, the results of the pre-test in addition showed that participants from the Control group did better than the Experimental group before creative play activities conducted in the Experimental group and normal teaching conducted in the Control group.

Table 4.5

Pre-test in Subtraction by 3 Levels for the Control and Experimental Groups

Level	**Score**	**Control Group**		**Experiment Group**	
		Frequency	**%**	**Frequency**	**%**
Level 1	0-5	4	13.3	5	16.7
Level 2	6-10	7	23.3	8	26.7
Level 3	11-15	19	63.3	17	56.7
Total		30	100	30	100

Table 4.5 shows pre-test in subtraction by 3 Levels for Control and Experimental groups. Out of the 30 participants in both groups, there were 19 participants (63.3%) in the Control group compared to 17 participants (56.7%) in the Experimental group for Level 3 that showed they were able to score between 11-15 correct answers.

Besides, 7 participants (23.3%) of Control group and 8 participants (26.7%) of Experimental group were categorized in the Level 2 that showed they were able to score 6 – 10 correct answers. Moreover, 4 participants (13.3%) of the Control group and 5 participants (16.7%) of the Experimental and Control group were found at Level 1 that showed they were only able to score 0-5 correct answers. Therefore, the results of the pre-test in subtraction showed that the participants from the Control group did better than the Experimental group before creative play activities conducted in the Experimental group and normal teaching conducted in the Control group.

Research Question 2

To what extent does creative play activities affect early mathematics performance among preschool children?

The preschool teacher conducted 10 lessons of creative play activities in early mathematics which included 5 addition and 5 subtraction games in the Experimental group for 10 weeks. After the 10 lessons had been implemented, post-test was conducted to examine the effects of the creative play activities in the performance of early mathematics among preschool children in addition and subtraction skills. The researcher wanted to examine whether the creative play activities affect the performance of the children in addition and subtraction skills in the Experimental group. This was reflected in the post-test results. The study also intended to examine the improvements of the children before and after the treatments.

Paired-samples t-test was used in the research questions to determine if there was a difference between the means of both sets of data which were from pre-test and post-test (Chua, 2013). Moreover, effect size was also calculated in this research

question to determine how the independent variable affected the dependent variable (Ghazali Darusalam & Sufean Hussin, 2016).

Table 4.6

Pre-test and Post-test in Addition by 3 Levels for the Experimental Group

Level	**Score**	**Experiment Group**			
		Pre-test		**Post-test**	
		Frequency	**%**	**Frequency**	**%**
Level 1	0-5	3	10	1	3.3
Level 2	6-10	12	40	3	10
Level 3	11-15	15	50	26	86.7
Total		30	100	30	100

Table 4.6 shows pre-test and post-test in addition by 3 Levels for the Experimental group. After 5 treatment lessons of creative play activities of addition games had been conducted, out of the 30 participants in both groups, the results showed there was an improvement from 15 participants (50%) to 26 participants (86.7%) in the post-test results for Level 3. This showed that they were able to score between 11-15 correct answers. This was an increase of 11 participants after the treatment of creative play activities. Moreover, participants who were in Level 2 decreased from 12 participants (40%) to 3 participants (10%). In Level 1, there was a decreased from 3 participants (10%) to 1 participant (3.3%). Meanwhile, the 2 participants who scored between 0 – 5 correct answers during the pre-test in the Level 1 improved and went up to Level 2 in the post-test results. The improvement revealed by the participants in the post-test results showed that creative play activities had affected positively the performance among preschool children's addition skills in early mathematics.

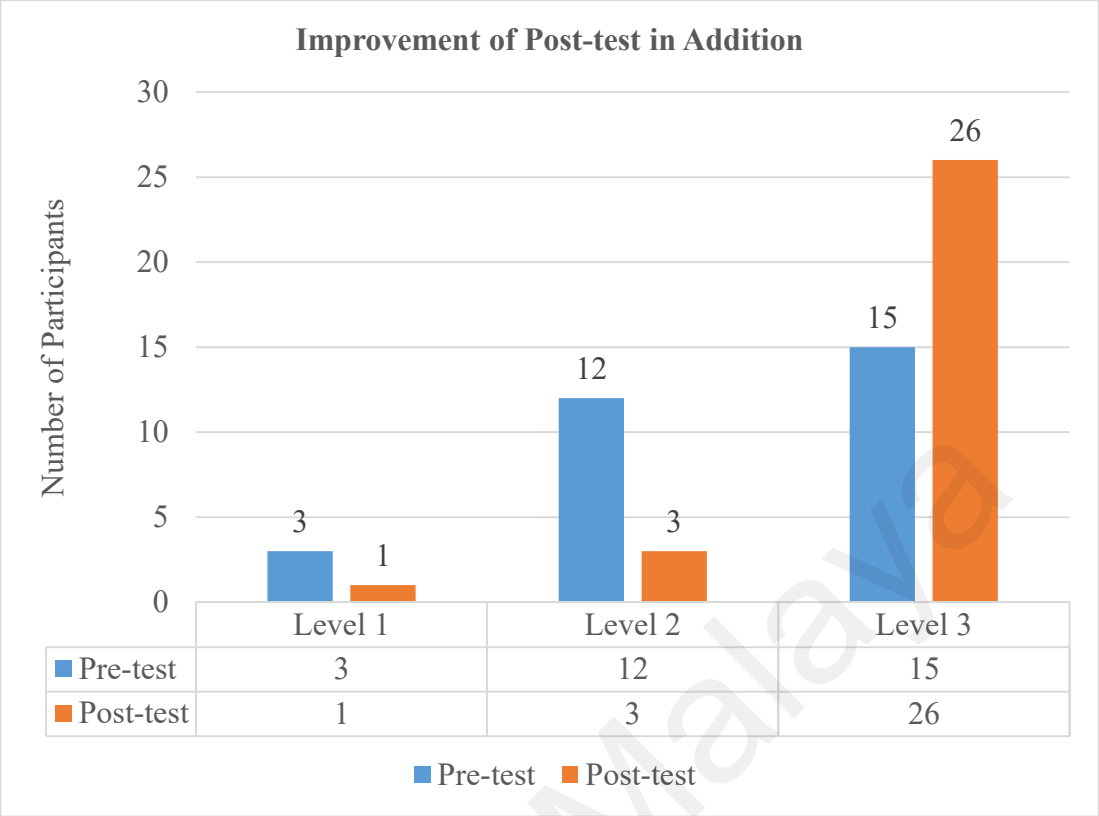


Figure 4.3 Improvement of Post-test in Addition by 3 Levels for the Experimental Group

Based on figure 4.3, the graph shows the participants of the Experimental group decreased from 3 to 1 in Level 1. Participants in Level 2 decreased from 12 to 3 and participants in Level 3 increased from 15 to 26. The summary of the graph shows that the improvement revealed by the participants of the Experimental group in the post-test results. In other words, creative play in addition activities were able to help and increase the performance of the children after intervention conducted in the Experimental Group.

Table 4.7

Pre-test and Post-test in Subtraction by 3 Levels for the Experimental Group

Level	Score	Experimental Group			
		Pre-test		Post-test	
		Frequency	%	Frequency	%
Level 1	0-5	5	16.7	1	3.3
Level 2	6-10	8	26.7	4	13.3
Level 3	11-15	17	56.7	25	83.3
Total		30	100	30	100

Table 4.7 shows pre-test and post-test in subtraction by 3 Levels for the Experimental group. There were 5 treatment lessons of creative play activities in the subtraction games conducted. Out of 30 participants for both groups, the results showed that there was an increased from 17 participants (56.7%) to 25 participants (83.3%) in the post-test results for Level 3. This showed there was an increase of 8 participants who had scored between 11-15 with correct answers. The results indicated that all the 8 participants who scored between 6-10 correct answers in the Level 2 during pre-test had moved up to Level 3 in the post-test result. Moreover, participants who were in Level 2 decreased from 8 participants (26.7%) to 4 participants (13.3%). In Level 1 there was a decreased from 5 participants (16.7%) to 1 participant (3.3%). Meanwhile, the 4 participants who scored between 0 – 5 correct answers in the Level 1 during the pre-test moved up to the Level 2 during post-test results. The improvement in the post-test results showed that creative play activities did affect early mathematics performance among preschool children in their subtraction skills.

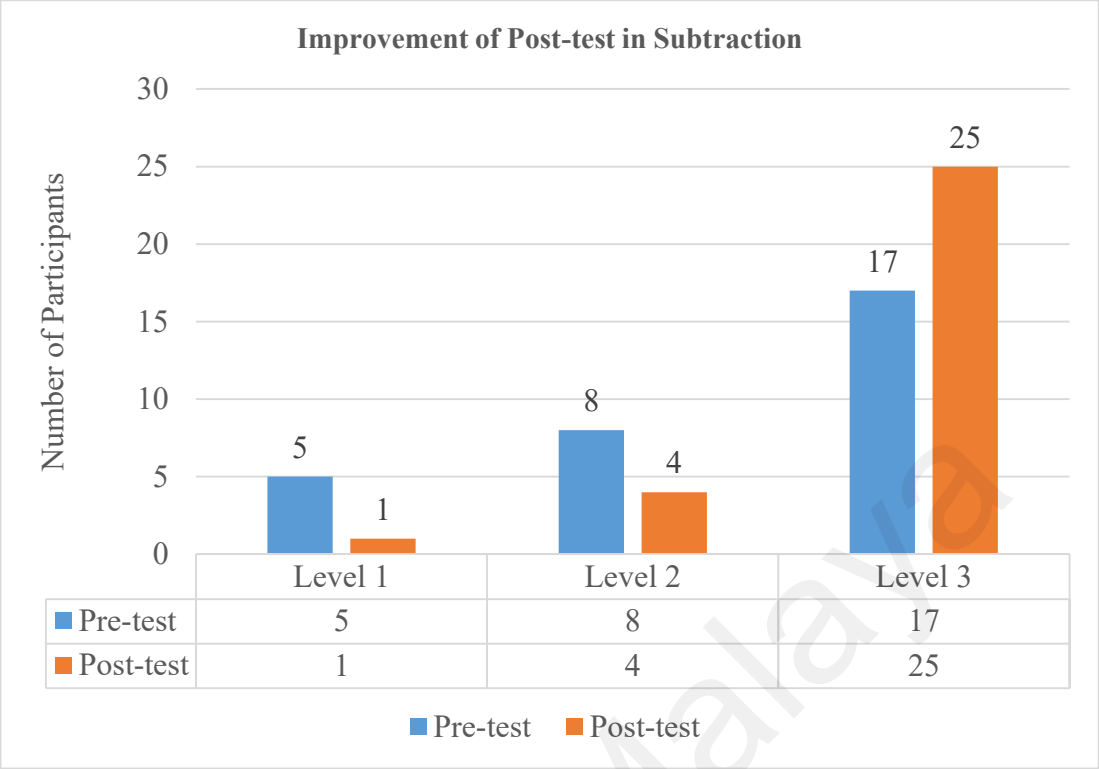


Figure 4.4 Improvement of Post-test in Subtraction by 3 Levels for the Experimental Group

Based on figure 4.4, the graph shows the participants of the Experimental group decreased from 5 to 1 in the Level 1, participants in Level 2 decreased from 8 to 4 and participants in Level 3 increased from 17 to 25. The summary of the graph shows that the improvement revealed by the participants of the Experimental group in the post-test results. In other words, creative play in subtraction activities were able to help and increase the performance of the children after intervention conducted in the Experimental Group. The paired-samples t-test was conducted to determine if there was a difference between the means of both sets of data for the pre-test and post-test (Chua, 2013).

Table 4.8

Paired-Samples T-Test in Addition for the Experimental Group

Mean		Mean Difference	Std. Deviation		Procedure Paired-Samples T-Test		
Pre-test	**Post-test**		**Pre-test**	**Post-test**	**t**	**df**	**P**
2.40	2.83	0.43	.67466	.46113	-4.709	29	.000

Table 4.8 shows paired-samples t-test in addition for the Experimental group. The paired-samples t-test result is significant (t (29) = -4.709, p<.000) in addition between the pre-test and post-test. Hence, the creative play activities affect early mathematics performance among preschool children in addition skills. Thus, the null hypothesis H_o is rejected. Besides, the mean score value in the post-test is higher than pre-test results after implementing the 5 lessons of creative play addition activities, the pre-test mean score is 2.40 compared to the post-test that is at 2.83. The higher mean score in the post-test showed that creative play in the addition activities were able to increase the performance of the children.

Table 4.9

Paired-Samples T-Test in Subtraction for the Experimental Group

Mean		Mean Difference	Std. Deviation		Procedure Paired-Samples T-Test		
Pre-test	**Post-test**		**Pre-test**	**Post-test**	**t**	**df**	**P**
2.40	2.80	0.40	.77013	.48423	-3.525	29	.001

Table 4.9 shows paired-samples t-test in subtraction for the Experimental group. The paired-samples t-test result is significant (t (29) = -3.525, p<.001) in subtraction between the pre-test and post-test. Hence, the creative play activities affect early mathematics performance among preschool children in their subtraction skills. Thus, the null hypothesis H_o is rejected. Besides, the mean score value in the post-test is higher than the pre-test results after the implementation of the 5 lessons of creative play in subtraction activities. The pre-test mean score is 2.40 compared to the post-test that is 2.80. The mean score that was higher in the post test showed that the creative play in subtraction activities were able to increase the performance of the children.

4.6 Effect Size

Effect size can be used to determine how much the independent variable affects the dependent variable. Besides that, the effect size can also be used to compare the means of the two scores in the paired-samples t-test. Cohen's *d* was used to measure the effect size in this study. Cohen (1988) stated that when $d = 0.2$ it constitutes a small effect size, when $d = 0.5$ it represents a medium effect size and when $d = 0.8$ it is considered as large effect size (Ghazali Darusalam & Sufean Hussin, 2016). The interpretation of effect size are shown in the Table 4.10.

Table 4.10

Interpretation of Effect Size (Cohen's d)

Effect Size (Cohen's *d*)	**Interpretation of Effect Size**
$0.2 < d < 0.5$	Small
$0.5 < d < 0.8$	Medium
$d >= 0.8$	Big

4.6.1 Effect Size in Addition for the Experimental Group

$$d = \frac{Mean_1 - Mean_2}{\sqrt{\frac{sd_1 + sd_2}{2}}}$$

$$= \frac{2.83 - 2.40}{\sqrt{\frac{0.46113^2 + 0.67466^2}{2}}}$$

$$= 0.74414$$

$$= 74\% \ (0.74 \times 100\%)$$

The effect size of addition for the Experimental group between pre-test and post-test is d = 0.74 (74%) which considered a medium effect size. The medium effect size shows an improvement in the post-test results and indicated that creative play in early mathematics were able to enhance the performance of children in addition after they engaged in the 5 lessons of creative play addition games.

4.6.2 Effect Size in Subtraction for the Experimental Group

$$d = \frac{Mean_1 - Mean_2}{\sqrt{\frac{sd_1 + sd_2}{2}}}$$

$$= \frac{2.80 - 2.40}{\sqrt{\frac{0.48423^2 + 0.77013^2}{2}}}$$

$$= 0.621828$$

$$= 62\% \ (0.62 \times 100\%)$$

The effect size of subtraction for the Experimental group between pre-test and post-test is d = 0.62 (62%) which considered a medium effect size. The medium effect size shows an improvement in the performance of the children in the post-test results. This result indicated that creative play activities were able to enhance the performance of children in subtraction after they engaged in the 5 lessons of creative play subtraction games.

Research Question 3: Is there any differences between Experimental group and Control group in preschool children's number operation skills?

There were 10 lessons of creative play activities in early mathematics in addition and subtraction games conducted by the preschool teacher in the Experimental group for 10 weeks. The duration for each lesson was 40 minutes. During these 10 weeks, the preschool teacher of the Control group conducted normal teaching to the preschool children in early mathematics without using the creative play activities instrument in early mathematics. Lastly, post-test was conducted to both the Control and Experimental groups on the 10^{th} week to examine the differences of the 3 levels of performance standard. This was to find out the difference before and after the 10 lessons of creative play activities in early mathematics in addition and subtraction games on the Experimental group and normal teaching to the Control group.

Paired-samples t-test was used to determine if there was a difference between the means score of both sets of data from the pre-test and post-test for both the Control and Experimental groups. Moreover, effect size was also used in this research to determine how the independent variable affected the dependent variable for both the Control and Experimental groups. Furthermore, SPANOVA (Split Plot ANOVA Test) was used to analyze the effect and differences before and after the treatment (repeated measures) on the dependent variable by making comparison and identify the differences between the Experimental and Control groups among the preschool children's in their number operation skills.

Table 4.11

Pre-test and Post-test in Addition for the Control and Experimental Groups

Level	Score	Control Group				Experimental Group			
		Pre-test		Post-test		Pre-test		Post-test	
		n	%	n	%	n	%	n	%
Level 1	0-5	3	10	3	10	3	10	1	3.3
Level 2	6-10	9	30	4	13.3	12	40	3	10
Level 3	11-15	18	60	23	76.7	15	50	26	86.7
Total		30	100	30	100	30	100	30	100

Table 4.11 shows pre-test and post-test in addition for the Control and Experimental groups. There was an increase in the post-test results for Level 3 after the 5 treatment lessons of creative play activities in early mathematics of addition games for the participants of the Experimental group. There was an increase of 11 participants from 15 (50%) to 26 (86.7%). The results also showed the Control group in Level 3 moved up from 18 participants (60%) to 23 participants (76.7%) after normal teaching conducted. This was an increase of 5 participants. This results indicated that Experimental group did better than Control group by looking at Level 3 where there were 26 participants compared to 23 participants. Besides that, there were 3 participants (10%) from Control group who were in Level 1 score from 0-5 correct answers showed there was no change in the pre-test and post-test addition results after normal teaching was conducted. However, in the Experimental group the number of participants decreased from 3 participants (10%) to 1 participant (3.3%) in the Level 1 that showed that the two children moved up to Level 2 after treatment. The results

indicated the Experimental group did better than the Control group in the post-test results.

Table 4.12

Pre-test and Post-test in Subtraction for the Control and Experimental Groups

Level	Score	Control Group				Experimental Group			
		Pre-test		Post-test		Pre-test		Post-test	
		n	%	n	%	n	%	n	%
Level 1	0-5	4	13.3	3	10	5	16.7	1	3.3
Level 2	6-10	7	23.3	6	20	8	26.7	4	13.3
Level 3	11-15	19	63.3	21	70	17	56.7	25	83.3
Total		30	100	30	100	30	100	30	100

Table 4.12 shows pre-test and post-test in subtraction for the Control and Experimental groups. The results showed there was a difference in the post-test of Experimental group in Level 3 after 5 treatment lessons of creative play activities of subtraction games which increased from 17 participants (56.7%) to 23 participants (83.3%). There was an increase of 8 participants in the Experimental group. There was also an increase of 3 participants in the Control group in Level 3 that improved from 19 participants (63.3%) to 21 participants (70%). The results indicated the post-test results showed the Experimental group did better than the Control group in Level 3 where there were 25 participants compared to 21 participants. Moreover, the participants from the Experimental group in Level 1 showed more improvement than the Control group which had 4 participants compared to 1 participant and moved from Level 1 to Level

2 after treatment. From the findings, the Experimental group did better than Control group in the post-test results.

Table 4.13

Paired-Samples T-Test in Addition for the Control and Experimental Groups

Group	Mean		Mean Difference	Std. Deviation		Procedure Paired-Samples T-Test		
	Pre-test	Post-test		Pre-test	Post-test	t	df	P
Control Group	2.50	2.66	0.16	.68229	.66089	-2.408	29	.023
Experimental Group	2.40	2.83	0.43	.67466	.46113	-4.709	29	.000

Table 4.13 shows the paired-samples t-test in addition for the Control and Experimental groups. The paired-samples t-test result is significant for both groups, (t (29) = -2.408, p<.023) for the Control group and (t (29) = -4.709, p<.000) for the Experimental group in addition between the pre-test and post-test. However, children in the Experimental group did better than the Control group in which p<.000 compared to p<.023. Besides, the mean score value difference in the post-test for the Experimental group is higher than the Control group which is 0.43 compared to 0.16. The result shows that creative play in addition activities as a teaching strategy is better than the normal teaching that helps and to increase the performance of the children in their addition skills.

Table 4.14

Paired-Samples T-Test in Subtraction for the Control and Experimental Groups

Group	Mean		Mean Difference	Std. Deviation		Procedure Paired – Samples T-Test		
	Pre-test	Post-test		Pre-test	Post-test	t	df	P
Control Group	2.50	2.60	0.10	.73108	.67466	-1.140	29	.264
Experimental Group	2.40	2.80	0.40	.77013	.48423	-3.525	29	.001

Table 4.14 shows the paired-samples t-test in subtraction for the Control and Experimental groups. For the Control group, the paired-samples t-test result is not significant (t (29) = -1.140, p>.264) in subtraction between the pre-test and post-test. Hence, the normal teaching method did not bring significant effect on early mathematics performance among preschool children in the subtraction skills for the Control group children. On top of that, the paired-samples t-test result is significant (t (29) = -3.525, p<.001) in subtraction between the pre-test and post-test for the Experimental group. Therefore, the creative play activities did bring a significant change in the early mathematics performance among preschool children in subtraction skills. Thus, the null hypothesis H_o is rejected. Besides, the mean score difference value of the Experimental group in the post-test results is higher than Control group which is 0.40 compared to 0.10. The mean score which is higher in the Experimental group shows that creative play in subtraction activities has been able to help and increase the performance of the children subtraction skills.

Table 4.15

Effect Size in Addition for the Control and Experimental Groups

Group	Mean		Std. Deviation		Procedure Paired-Samples T-Test			Effect Size
	Pre-test	Post-test	Pre-test	Post-test	t	df	P	
Control Group	2.50	2.66	.68229	.66089	-2.408	29	.023	0.24 (24%)
Experimental Group	2.40	2.83	.67466	.46113	-4.709	29	.000	0.74 (74%)

Table 4.15 shows effect size (Cohen's d) in addition for the Control and Experimental groups. The effect size for the Control group is d = 0.24 (24%) which represents a small effect size and Experimental group is d = 0.74 (74%) which showed a medium effect size. The results show that the effect size of the Experimental group is higher than the Control group. From the analysis, the results indicated that there is an increase in the performance as shown in the post-test results of the Experimental group that is higher than Control group. Thus, lessons of creative play activities in early mathematics of addition games have been more effective than normal teaching in enhancing the children's performance in addition skill.

Effect Size in Addition for the Control Group

$$d = \frac{Mean_1 - Mean_2}{\sqrt{\frac{sd_1 + sd_2}{2}}}$$

$$= \frac{2.66 - 2.50}{\sqrt{\frac{0.68229^2 + 0.66089^2}{2}}}$$

= 0.238210

= 24% (0.24 x 100%)

Effect Size in Addition for the Experimental Group

$$d = \frac{Mean_1 - Mean_2}{\sqrt{\frac{sd_1 + sd_2}{2}}}$$

$$= \frac{2.83 - 2.40}{\sqrt{\frac{0.46113^2 + 0.67466^2}{2}}}$$

= 0.74414

= 74% (0.74 x 100%)

The effect size for the Control group is *d* = 0.24 (24%) which represents a small effect size and Experimental group is *d* = 0.74 (74%) which showed a medium effect size. The results indicated that the effect size of the Experimental group is higher than the Control group. Thus, lessons of creative play activities in early mathematics of addition games have been more effective than normal teaching in enhancing the children's performance in addition skill.

Table 4.16

Effect Size in Subtraction for the Control and Experimental Groups

Group	Mean		Std. Deviation		Procedure Paired – Samples T-Test			Effect Size
	Pre-test	Post-test	Pre -test	Post-test	t	df	P	
Control Group	2.50	2.60	.73108	.67466	-1.140	29	.264	0.14 (14%)
Experimental Group	2.40	2.80	.77013	.48423	-3.525	29	.001	0.62 (62%)

Table 4.16 shows the effect size (Cohen's d) in subtraction for the Control and Experimental groups. The effect size for the Control group is d = 0.14 (14%) which represents a very small effect size and Experimental group is d = 0.62 (62%) which showed a medium effect size. The results show that effect size of the Experimental group is higher than the Control group. From the analysis, the results indicated that there is an increase in the performance in the post-test results of the Experimental group which is higher than those in the Control group. Therefore, lessons of creative play activities in early mathematics in subtraction games have been more effective than normal teaching in enhancing the children's performance in subtraction skill.

Effect Size in Subtraction for the Control Group

$$d = \frac{Mean_1 - Mean_2}{\sqrt{\frac{sd_1 + sd_2}{2}}}$$

$$= \frac{2.60 - 2.50}{\sqrt{\frac{0.73108^2 + 0.67466^2}{2}}}$$

= 0.142159

= 14% (0.14 x 100%)

Effect Size in Subtraction for the Experimental group

$$d = \frac{Mean_1 - Mean_2}{\sqrt{\frac{sd_1 + sd_2}{2}}}$$

$$= \frac{2.80 - 2.40}{\sqrt{\frac{0.48423^2 + 0.77013^2}{2}}}$$

= 0.621828

= 62% (0.62 x 100%)

The effect size for the Control group is *d* = 0.14 (14%) which represents a very small effect size and Experimental group is *d* = 0.62 (62%) which showed a medium effect size. The results indicated that the effect size of the Experimental group is higher than the Control group. Therefore, lessons of creative play activities in early mathematics in subtraction games have been more effective than normal teaching in enhancing the children's performance in subtraction skill.

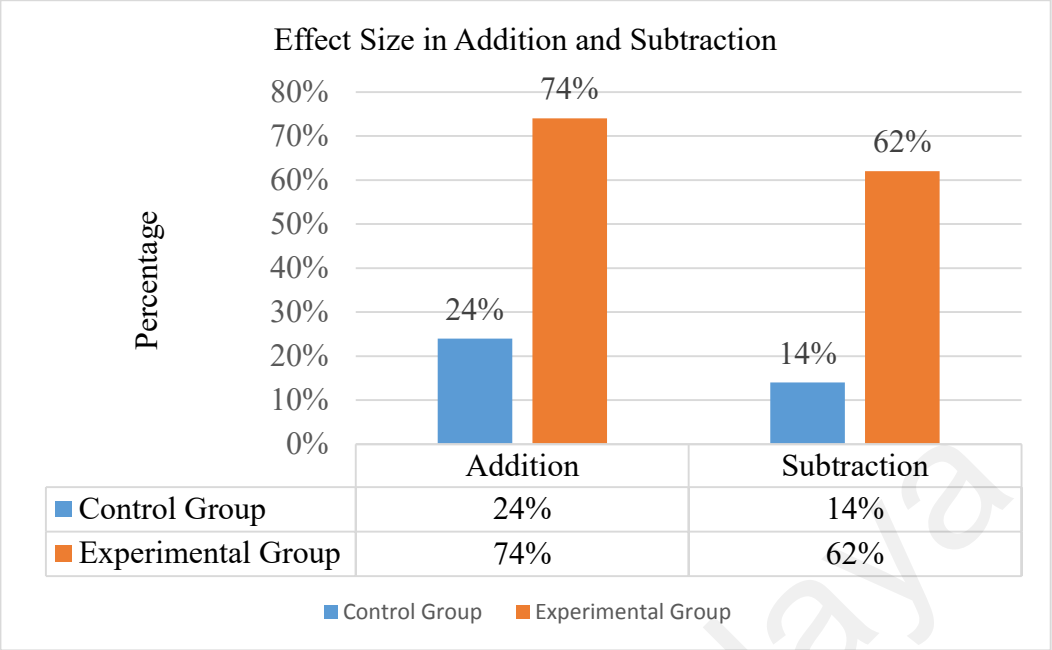


Figure 4.5 Effect size (Cohen's d) in Addition and Subtraction for the Control and Experimental Groups

Based on figure 4.5, the effect size (Cohen's d) for addition is $d = 0.24$ (24%) for the Control group that represents a small effect size and $d = 0.74$ (74%) for the Experimental group which showed a medium effect size. For subtraction, the effect size for the Control group is $d = 0.14$ (14%) which represents very small effect size and for the Experimental group is $d = 0.62$ (62%) which showed a medium effect size. The results show that the effect size for both the addition and subtraction for the Experimental group is higher than the Control group. Thus, it can be concluded that lessons of creative play activities in early mathematics have been more effective than normal teaching in enhancing the children's performance in addition and subtraction skill.

4.7 SPANOVA (Split-plot ANOVA)

Mixed design ANOVA is also known as SPANOVA (Split-plot ANOVA) and it is a combination of groups and repeated-measures variables (Field, 2009). SPANOVA (Split Plot ANOVA Test) is used in this study to examine the effects and differences before and after the treatment (repeated measures) on the dependent variable by making comparison and identify the differences between the Experimental group and Control group (Chua, 2014). According to the Cohen (1988), the effect size is small if $\eta^2 = 0.01$, medium if $\eta^2 = 0.06$ and large if the $\eta^2 = 0.14$.

Table 4.17

SPANOVA Multivariate Test (Interaction Effect) in Addition for the Control and Experimental Groups

Effect		Value	F	Hypothesis df	Error df	Sig.
Test	Pillai's Trace	.319	27.156	1.000	58.000	.000
Test* Group	Pillai's Trace	.085	5.364	1.000	58.000	.024

Table 4.17 shows SPANOVA multivariate test (interaction effect) in addition for the Control and Experimental Groups. The findings of the Test (pre-test and post-test) were statistically significant ($F_{(1, 58)} = 27.156$, $p < .000$, $\eta^2 = 0.319$). For the interaction between the Test (pre-test and post-test) and the Group (Control and Experimental) was also statistically significant ($F_{(1, 58)} = 5.364$, $p < .024$, $\eta^2 = 0.85$). The results indicated that there is a significant difference between the Experimental and Control groups in preschool children in their number operation skills. Therefore, the null hypothesis H_o is rejected. In other words, children in the Experimental group improved in their performance of addition after the treatment.

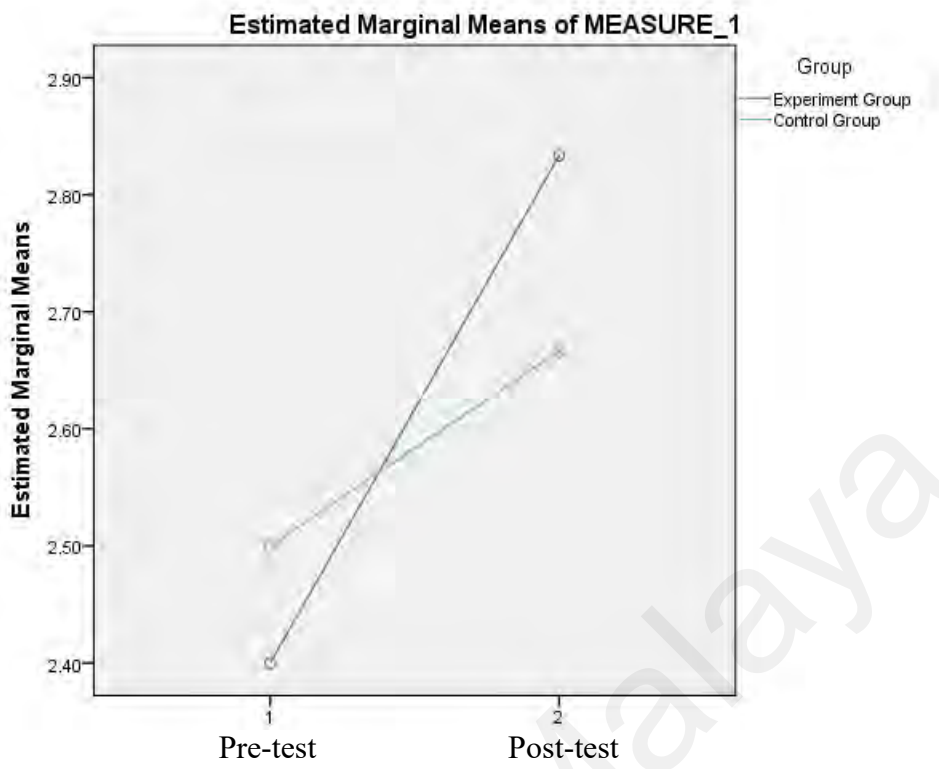


Figure 4.6 Estimated Marginal Means of Pre-test and Post-test in Addition

Based on Figure 4.6, the Control group (green line) started at a higher point, while the Experimental group started at a lower point during pre-test. The mean score for addition increased at the post-test level for both groups. However, the increase of the mean score for the Experimental group was more than Control group. There is a significant interaction effect for both groups in the middle during the post-test ($p = < .024$, $\eta^2 = 0.85$) which suggested a high significance. The effect size was large as $\eta^2 = 0.14$ according to the Cohen (1988). The results shows that lessons of creative play activities in early mathematics of addition games have been more effective than normal teaching in enhancing the children's performance in addition skill.

Table 4.18

SPANOVA Multivariate Test (Interaction Effect) in Subtraction for the Control and Experimental Groups

Effect		Value	F	Hypothesis df	Error df	Sig.
Test	Pillai's Trace	.173	12.151	1.000	58.000	.001
Test* Group	Pillai's Trace	.070	4.374	1.000	58.000	.041

Table 4.18 shows SPANOVA multivariate test (interaction effect) in subtraction for the Control and Experimental Groups. The findings of the Test (pre-test and post-test) were statistically significant ($F_{(1, 58)} = 12.151$, $p = < .001$, $\eta^2 = 0.173$). For the interaction between the Test (pre-test and post-test) and the Group (Control and Experimental) was also statistically significant ($F_{(1, 58)} = 4.374$, $p = < .041$, $\eta^2 = 0.070$). Hence, there is a significant difference between the Experimental and Control groups in preschool children in their number operation skills. Thus, the null hypothesis H_o is rejected. In other words, children in the Experimental group have improved their performance of subtraction after the treatment.

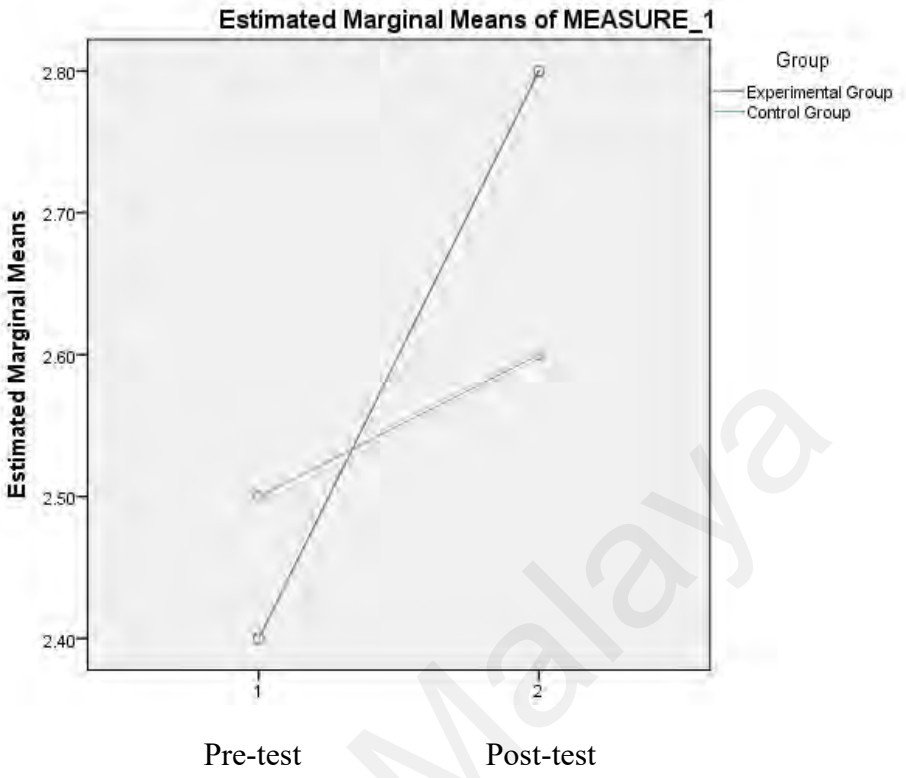


Figure 4.7 Estimated Marginal Means of Pre-test and Post-test in Subtraction

Based on Figure 4.7, the Control group (green line) started at a higher point, while the Experimental group (blue line) started at a lower point during pre-test. The mean score for subtraction increased as shown in the post-test for both groups. However, the increase of the mean score for the Experimental group was more than the Control group. There is a significant interaction effect for both groups in the middle during the post-test ($p = < .041$, $\eta^2 = 0.070$) which suggested a medium significance. The effect size showed medium as $\eta^2 = 0.06$ according to the Cohen (1988). The results shows that lessons of creative play activities in early mathematics of subtraction games have been more effective than normal teaching in enhancing the children's performance in subtraction skill.

4.8 Summary

The analysis of the data revealed that the 10 lessons of creative play activities in early mathematics in addition and subtraction games have been more effective than the normal teaching methods in enhancing the performance of the children in their addition and subtraction skills. On the other hand, the paired-samples t-test for addition and subtraction have also shown a significant change in the Experimental group between pre-test and post-test scores. The results have indicated that the creative play activities affect the early performance in mathematics among preschool children. Besides that, the difference in the mean score values of the Experimental group in the post-test in addition and subtraction are also higher compared to the Control group. Moreover, the effect size in addition and subtraction for the Experimental group is considered as medium and is higher than the Control group. Furthermore, the findings of SPANOVA multivariate test show there is a significant interaction effect for both the Control and Experimental groups in addition and subtraction. In other words, creative play which was present in the addition and subtraction activities were able to help and increase the performance of the children in the Experimental group in their addition and subtraction skills. The following chapter 5 discussed the summary of the findings, discussion of research questions, implications of the study, recommendations from the study and recommendations for future research.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

Based on the findings in the Chapter 4, this chapter discusses the results of the statistical analysis for all three research questions. Apart from that, summary of the findings, implications of the study, recommendations from the study and recommendations for future research will also be discussed. Lastly, the conclusion of this research study is also included.

5.2 Summary of Findings

The analysis provides a useful insight into the teaching of addition and subtraction for preschool children using the creative play approach. From the results of the analysis, it can be concluded that the pre-test addition and subtraction scores of the Control group were better before the treatment was provided to the Experimental group. The pre-test findings showed that participants from the Control group in the Level 3 answered between 11-15 questions correctly more than the Experimental group. However, after the treatment was given to the Experimental group, the post-test scores indicated that the 10 lessons of creative play activities in early mathematics in addition and subtraction games were more effective than the normal teaching in enhancing the performance of children in addition and subtraction skills. The paired-samples t-test in addition between pre-test and post-test scores for both the Control and the Experimental groups is significant ($p<.023$; $P<.000$). However, the children in Experimental group showed more improvement than the children in the Control group for the post-test addition results, whereby the significant value is $p<.000$. On the other

hand, the Cohen's effect size for the Control group is 0.24 (24%) which considered to be small effect size whereas the effect size for Experimental group is 0.74 (74%) which indicated a medium effect size.

Paired-samples t-test of subtraction between pre-test and post-test scores for Control group is not significant ($p>.264$) while Experimental group is significant ($p<.001$). The results indicated that creative play activities in subtraction games improved children's performance in subtraction skill. It was better than the normal teaching that was conducted for the Control group. Apart from that, the Cohen's effect size for the Control group is 0.14 (14%) which considered as very small effect size. However, the effect size for the Experimental group is 0.62 (62%) which indicated a medium effect size. The results indicated that creative play activities affected the performance of early mathematics among preschool children. Hence, the null hypothesis H_o is rejected.

Furthermore, the findings of the SPANOVA multivariate test showed there is a significant interaction effect for both the Control and Experimental groups in addition ($p = < .024$, $\eta^2 = 0.85$) and subtraction ($p = < .041$, $\eta^2 = 0.070$). Hence, the results indicated that there is a significant difference between the Experimental and Control groups in the number operation skills among preschool children. Thus, the null hypothesis H_o is rejected. In other words, creative play in addition and subtraction activities were able to help and increase the performance of the children.

5.3 Discussion of Research Questions

5.3.1 Research Question 1

What is the level of early mathematics performance among preschool children?

To answer Research Question 1, descriptive analysis using frequency and percentage from the pre-test in addition and subtraction questions were used to examine the level of performance in early mathematics for the Control and the Experimental groups before the creative play activities took place for the Experimental group and normal teaching for the Control group.

The participants who were categorized as Level 1 were also considered as lower level children. They were only able to answer between 0-5 questions correctly out of 15 addition and subtraction questions. The performance standard for Level 1 referred to children who were able to state the sum of two groups of objects for addition and were able to state the balance in subtraction when objects were removed from a group. These children were weak in the understanding of concepts in addition and subtraction. They were also not able to solve problems in addition and subtraction.

From the results, it was found there were 3 participants from both the Control and the Experimental groups who had similar scores for Level 1 in the pre-test for addition. This indicated some children just memorized a procedure and they did not have an understanding of addition and do not have any idea of combining numbers to make other numbers (Gifford, as cited in Thompson, 2010). Moreover, they were also not able to relate the plus and equal signs to other problem. For subtraction, the participants of both Control and Experimental groups were more than the participants in addition at Level 1. The results showed that there were 4 participants in the Control group and 5 participants in the Experimental group who belonged to Level 1. Kamii,

Lewis and Kirkland (2001) have pointed out that many teachers had observed that addition seemed to be easier and more natural than subtraction. Subtraction was harder than addition because children deduce differences from their knowledge of sums.

Apart from that, Level 2 was considered as moderate level and the children were able to answer 6 – 10 questions correctly out of the 15 questions. The performance standard for Level 2 referred to children who could solve addition and subtraction problems within 18 using concrete objects. One third of the children of both Control and Experimental groups were grouped in Level 2. The results indicated that they had not mastered the addition and subtraction problem solving skills and they could not solve problem without using objects. Moreover, the pre-test results involving addition and subtraction questions for Level 3 showed that the Control group scored better than the Experimental group. Level 3 is considered as high level in which the children were able to answer between 11-15 questions correctly out of 15 questions. The performance standard for Level 3 referred to children who could solve problems in addition and subtraction within 18 without using concrete objects.

The pre-test results showed that minority of the children were able to answer between 11-15 questions correctly out of 15 questions before creative play activities conducted in the Experimental group and normal teaching conducted in the Control group. However, the pre-test results could not explain whether or not the children mastered the problem solving skill. According to the Kullberg et al. (2020), counting may help the children solve the task at hand, but does not promote their full potentials for mathematics problem solving.

From the overall analysis of the pre-test results, it can be concluded that before the treatment took place to the Experimental group, the pre-test scores for addition and subtraction of the Control group was better than the Experimental group. Furthermore,

the pre-test results in addition and subtraction showed that there were 27 children (Control = 12, Experimental = 15) for addition and 24 children (Control = 11, Experiment = 13) who were either in Level 1 or 2. The children had not fully mastered the addition and subtraction skills for Level 3. In order to enhance the number operations skills of children from Level 1 to Level 2 or Level 2 to Level 3, it is crucial for different teaching methods to be conducted in preschool classroom. Abdolreza Lessani, Kamariah Abu Bakar and Aida Suraya (2017) have pointed out that different teaching methods in early mathematics are essential because of the variations of beliefs and values in learning mathematics that provide different performance and development outcome in children.

5.3.2 Research Question 2

To what extent does creative play activities affect early mathematics performance among preschool children?

To answers Research Question 2, paired-samples t-test and effect size were used to determine how the independent variable affected the dependent variable and see whether the creative play activities affected the performance in number operation skills for the Experimental children in post-test results.

The finding from the post-test results in addition and subtraction showed that the children in the Experimental group were better when compared to the pre-test result. Paired-samples t-test for both addition ($p<.000$) and subtraction ($p<.001$) showed a significant between the pre-test and post-test. The results indicated that various creative games were included in the addition and subtraction activities affected the performance of the children and these were able to enhance their addition and subtraction skills. Hence, the null hypothesis H_o is rejected. This finding is supported

by Chin and Effandi Zakaria (2015) that revealed the games approach were able to increase the achievement of the number operations of children in the Experimental group. According to Mirawati (2017), creative mathematics games are attractive thematic learning activities which include different kinds of plays and games that can enhance and develop number sense of children. However, although play activities can attract children' interest in learning mathematics concepts and skills but not many teachers emphasize play in the children learning (Christie & Roskos, 2009).

Apart from that, the pre-test results showed that there were 3 children for addition and 5 children for subtraction who were under the Level 1 category. They were weak and faced difficulties in understanding addition and subtraction concepts and solving the mathematics problem. However, through the 10 lessons of creative play activities, the post-test results showed improvement whereby 6 children improved and moved from Level 1 (low level) to Level 2 (moderate level). This finding is supported by Sharma (2013) study that revealed teaching through play can improve the early numeracy skills among children after they have experienced a lot of activities in mathematics games. In order to develop mental strategies to solve addition and subtraction problems, children should be encouraged to be more actively involved in games and solving a greater variety of problems, real and imaginary (Gifford, as cited in Thompson, 2010). Besides enhancing the performance of children through creative play, children can explore, learn how to express their feeling and work together, adapt to different situations, experiments, begin to learn what they like and develop a positive self-concept during creative play (Thiessen, Gluth & Corso, 2013).

In creative play activities, some children face problems that cannot be accomplished independently. In order to complete the tasks they need to create a conducive environment such as setting up fruits and toys stalls by themselves. In this

situation, the assistance from helpful peers enables children to solve problems that they cannot solve independently. This is the optimum time for teachers to assist children in their learning. This learning situation was supported by the Vygotsky theory of "zone of proximal development". Vygotsky (1978) has stated that play is a critical scaffold that enables children to move to a higher level of thinking ability in all developing areas. However, teachers must avoid personal emotions during their interactions with young children because conducted variety of play activities are challenging (Roslinda Rosli & Teo, 2018).

On the other hand, the Cohen's effect size for the Experimental group between pre-test and post-test scores was 0.74 (74%) for addition and 0.62 (62%) for subtraction respectively. The results indicated that creative play activities were effective and were able to enhance the performance of children in addition and subtraction skills. The result is supported by the research findings of Chin and Effandi Zakaria (2015) that indicated various games in addition and subtraction activities can help children in the Experimental group in the post-test achievement and can help to develop the addition and subtraction skills of children.

In this study, other than improving the performance in the number operations skills, the development, creativity, imagination, problem solving and high thinking skills of children were indirectly enhanced through fun learning in the creative play activities such as addition and subtraction role play games. The children in the Experimental group enhanced their creativity and number operations skills by creating the addition and subtraction role play stories themselves, learning to think how to take on a role and use real objects to play out the role. All these can help to make them think abstractly to create mental pictures of the math problem whether to add or subtract. Pretend play and creativity are interlinked because pretend play constitutes

an open-ended event and serves as a tool that are used by children for a variety of creative purposes such as to manipulate objects, representations, mental images and compose stories to explore the imaginary world (Russ & Wallace, 2013). However, some of the weaker children in the Experimental group faced problems in creating the addition and subtraction role play stories themselves and also could not comply with the rules during role play game. Reikeras (2020) has stated that for the young children, the goal of the game is to have fun rather than to follow the rules. Thus, the activities rules need to be reviewed so that the rules will not to be too complicated at the expense of this group of children.

Additionally, the value of cooperative play also helps in promoting mathematics exploration (Zippert, Eason, Marshall & Ramani, 2019). The small group discussion activity in this study allowed children to think, discuss and find answers by themselves to answer the addition and subtraction questions in the task card that was given to them. It provided children opportunities to explore by themselves such as sharing what they knew and express their ideas and opinions. It has been proven that children with the same cognitive ability and age group can help one another and learn cooperatively to find solutions that lead to new understanding and ideas (Piaget, as cited in Zippert, et al., 2019).

5.3.3 Research Question 3

Is there any differences between the Experimental group and Control group in preschool children's number operation skills?

To answer Research Question 3, paired-samples t-test and effect size were used in the analysis to compare which method was more effective. To test the differences between both groups, SPANOVA (Split Plot ANOVA Test) was used to analyze this

question and examine the effects and differences before and after the treatment (repeated measures) on the dependent variable by making comparison and identify the differences between the Experimental and Control groups.

Post-test scores indicated that the 10 lessons of creative play activities in early mathematics in addition and subtraction games conducted were more effective than the normal teaching in enhancing the performance of the children in addition and subtraction skills. This can be seen in the post-test results by look at Level 3 (High Level) where the participants of the Experimental group were better than the Control group for addition and subtraction. The children were able to solve problem in addition and subtraction without using concrete objects. According to the results of the study by Fernandez-Oliveras and Oliveras (2014), the children could learn, enjoy and develop mathematical thinking through play. Thus, creative play activities in early mathematics not only can increases the performance of the children, it also can help to develop their creative thinking. Thus, all the activities planned should support creativity (Dere, 2019). Torrance (1972) found the most effective training for stimulating creativity involves both cognitive and affective attributes. It is believed that the mood of play could have its face value that facilitates creativity.

The paired-samples t-test in addition between pre-test and post-test scores for both the Control and the Experimental groups is significant ($p<.023$; $P<.000$). The post-test results showed that Experimental and Control groups children improved their addition skills. However, the children in Experimental group showed more improvement than the children in the Control group for the post-test addition results, whereby the significant value is $p<.000$. Moreover, the mean score value difference in the post-test of the Experimental group was higher than the Control group for addition which is 0.43 compared to 0.16.

For subtraction, the paired-samples t-test results showed the Control group was not significant ($p>.264$) but the Experimental group showed it was significant ($p<.001$). Hence, the findings indicated that normal teaching does not affect early mathematics performance for the Control group children. Teachers should raise the expectations of what young children can do and believe they can deal with abstract number symbols and mental problem and stop thinking in terms of readiness or worksheets (Gifford, as cited in Thompson, 2010). Moreover, mastery mathematics concepts do not come from assignments and workbooks (Ojose, 2008). However, it is a difficult task for preschool teachers to provide high quality mathematical education as it is requires many types of competencies (Cross et al., as cited in Oppermann, Anders & Hachfeld, 2016).

In order to create interest among children in early mathematic learning, play-based and embedded in life situations are useful for them (Ginsburg; McCray & Chen; as cited in Oppermann, et al., 2016). Without play, the children get bored and are less interested in the learning. Traditional method is teacher-centered which is based on homework and demonstrated a low level of problem solving (Stonewater, as cited in Abdolreza Lessani, et al., 2017). The results showed that 3 participants (10%) from the Control group who were in Level 1 (lower level) were able to score between 0-5 correct answers. It was also shown there was no change in the pre-test and post-test results in addition after normal teaching was conducted. The results showed that the children did not improve in their skills in addition which remained in Level 1 in the post-test results.

On the other hand, the Cohen's effect size for addition and subtraction between pre-test and post-test scores for the Experimental group was higher than the Control group. The results indicated that creative play in addition and subtraction activities in teaching strategies is better than normal teaching and can increase the performance of

the children in the addition and subtraction skills. The result is supported by the research findings of Kullberg et al. (2020) which showed that the intervention group was taught to use their fingers to structure part-part-whole relations of numbers has improved their performance in addition and subtractions skills better than Control group. By getting involved in different activities children gain knowledge without realising they are learning (Clegg, as cited in Sharma, 2013).

Furthermore, the findings of the SPANOVA multivariate test showed there is a significant interaction effect for both the Control and Experimental groups in addition ($p = < .024$, $\eta^2 = 0.85$) and subtraction ($p = < .041$, $\eta^2 = 0.070$). Hence, the results indicated there is a significant difference between the Experimental and Control groups in the number operation skills among preschool children. Therefore, the null hypothesis H_o is rejected. In other words, creative play in addition and subtraction activities were able to help and increase the performance of the children in addition and subtraction skills. This finding confirm the research by Wang and Hung (2010), in which the results showed that the children in the Experimental group did better than the Control group in the post-test results in the test for addition and subtraction. Besides, this finding is also supported by the study conducted by Chin and Effandi Zakaria (2015) which showed that the games based learning module significantly influenced learning of number operations of the Experimental group children compared to the normal teaching of the Control group. In the study by Zakiah Mohd Ashari et al. (2013), they explained that children who were taught using the play module understood the number concepts better than those who learnt through the normal teaching method.

Apart from enhancing the performance of children, coordinating behaviour with peers through creative play activities could also lead children to solve problem

more effectively. Kandemir and Gur (2009) has stated that application of new teaching techniques in mathematics education will contribute to problem solving. According to the Zippert et al. (2019), the interaction among friends when playing could also elicit important discussion of mathematical concepts. For example, in the study, the dice activity of a small group can make the children learn to think how to give instructions and cooperate among the members of the group to complete the game. It helps the children to express their thoughts and feeling when they learn in a problem solving situation through the dice game. Parten (1932) has explained that preschool children should engage in cooperative play within a team that has a common goal, interest and purpose.

It can be concluded in the 21st century, creative play activities are crucial in teaching early mathematics. However, many teachers rarely have sufficient time to organize play activities in the classes although they agreed the importance of integrating play in the curriculum (Chervenak, 2011). Thus, teachers are the most important person to ensure the effectiveness of learning mathematics to the children. Oppermann, Anders and Hachfeld (2016) have pointed out that the professional competencies of preschool teachers are essential for their ability to conduct mathematical concepts in children's play to ensure the quality of early mathematics education. This is because play is associated with the development of creative skills.

5.4 Implications of the Study

5.4.1 Theoretical Implication

Parten's cooperative play theory, theory of Lev Vygotsky which emphasizes on the Zone of Proximal Development (ZPD), Jerome Bruner's Theory of Mathematics which includes the enactive mode, iconic mode and symbolic mode, Torrance Theory of Torrance's creative process which includes the originality and fluency and Singapore math model method are integrated into the 10 lessons of creative play activities in early mathematics. The theoretical combinations had contributed a systematic and effective manner creative play lesson plans and steps of learning activities as guideline to the preschool teachers. Systematic with various of creative play activities are important in the mathematics learning. One of the basic principles for preschool education is the creativity and imagination to the children (Dere, 2019).

Thus, 10 lessons of creative play activities used by the preschool teacher when conducting the lessons enhanced the performance of Experimental children in addition and subtraction skills as revealed by the post-test findings results. Besides, creativity, imagination, problem solving, higher order thinking skills and other development skills such as social skills among preschool children were also developed through creative play activities. Bruner's theory indicated that the intellectual development is an enactive stage followed by an iconic stage and final by the symbolic stage. The symbolic stage for children are mostly at the abstract level and it can be connected to other knowledge and ideas (Bruner, as cited in Mahoney, 2012). Besides, Singapore math model method has been used to enhance the understanding among children in problem solving situation (Mahoney, 2012). Moreover, theory of Lev Vygotsky which emphasizes on the Zone of Proximal Development (ZPD) could let the children

experience learning with peers. Their interaction during the collaboration with peers offers opportunities for the development of creativity. Therefore, provide a creative environment for the children by adults is crucial (Vygotsky, 1978).

Apart from that, the various creative games in addition and subtraction can also be used for future implementation in teaching and learning. Although creative paly activities are important to integrate in the mathematics learning but some of the preschool teachers carried out addition and subtraction in mathematics learning by using worksheets due to limited knowledge and teaching skills in creative play. Through this study, the preschool teacher was able to develop her understanding of creative play and was able to improve her teaching skills to conduct the addition and subtraction lessons in creative ways. Besides, the findings are also an evidence to help and support the preschool teachers to conduct creative play in the teaching and learning of early mathematics instead of using the traditional teaching method for the children. They can teach in a systematic and effective manner related to the number operations of early mathematics through the lesson plans and steps of learning activities as guideline.

The theoretical combinations that provided the quality of creative play activities influenced and support the field of creative domain in early mathematics in ECCE after the revision of the content standard of mathematics in NPSC 2017 Revision that has been changed from the range of number 0-10 to the range of 0-18 in addition and subtraction operations.

5.4.2 Pedagogical Implication

Creative play activities in addition and subtraction games enhanced the performance of children in addition and subtraction skills as revealed by the post-test findings results. The findings showed that the children in the Experimental group has mastered the addition and subtraction skills than previously pre-test results. The children learnt mathematic skills through various of creative play activities such as creative dice and block games during the lessons in this study. A game using blocks could educates the children the important of solving a problem and various mathematics concepts such as addition, subtraction, multiplication and division can be developed (Roslinda & Teo, 2018).

Besides enhancing the performance of number operations, creativity, imagination, problem solving and higher order thinking skills of the children in the Experimental group were also indirectly enhanced through the 10 lessons of fun learning in the creative play activities. During creative play addition and subtraction activities, the children created the addition and subtraction role play stories by themselves, learned to take on a role and acted according to the character. They used real objects to role play and then think abstractly to create mental pictures of the mathematical problem whether to add or subtract. Stories can cultivate children creativity by prompting their curiosity, sensitivity and interest (Kim et al., 2019). Thiessen, Gluth and Corso (2013) have pointed out that creative activities such as exploration, curiosity, independence, risk taking, dare to try out and make mistakes can enhance the creative development of children.

Apart from that, the children played the bowling outdoor game and this allowed them to interact with the environment as they engaged with the bowling pins toy sets and empty mineral water bottles. This is the way to ensure children have a more

complex way of thinking and gain skills in subtraction through play with materials and it can reflect and build on the learning interest of children. Thus, learning through play activity in mathematics for nurturing young children's interest and attitude should be the focus of the preschool curriculum (Roslinda Rosli & Teo, 2018).

Creative play activities in addition and subtraction also enhanced children social skills. During the creative play games, the children learned to discuss among themselves and cooperate among the group members to complete the game. It allowed children to express their thoughts and feelings when learning to solve problem. Cooperative learning can provide chance and space in which to develop concepts within the learners and to use the communication with others as negotiation of knowledge and experience to change thinking with new or improved ideas (Kim et al., 2019).

5.5 Recommendations from the Study

Though this study, the 10 lessons of creative play activities with lesson plans and steps of learning activities can serve as a guideline for the preschool teacher. It helped her to teach in a systematic and effective manner the number operations of early mathematics in the Experimental group. With this guideline, the stress and difficulty to conduct creative play activities in the classroom can be reduced and at the same time children would benefit from them. Both number operations skills and development of other constructs such as creativity, social skills and problem solving would be improved. Thiessen, Gluth and Corso (2013) have stated that teachers are under stress to maintain control and manage behaviour when conducting the play activities. Teachers face pressure from both parents and government who emphasis on the traditional learning strategy to measure academic results. Thus, this study could

help the teacher to enhance her knowledge about the creative play and teaching skills such as classroom management.

However, additional time should be allocated for outdoor play and role play activities in order to make creative play activities more effective in the future. Teacher has commented that outdoor play or role play activities need more time for explanation about the rules of games so as to ensure the children by abide them and are able to cooperate with their team members to avoid any untoward incidences. In addition, the children also require more time to explore the activities such as to think and create role play stories.

Moreover, children's number operations skills developed and this can be seen from the post-test results. Also, children's learning interest was ignited as they engaged in a fun and conducive learning environment such as set up fruit stalls and toy stalls by themselves through the role play corner. They could relate to their daily lives by engaging the play of selling and buying in the play corner. Besides, they gain better understanding of the addition and subtraction concepts and problem solving through creative play. On the other hand, creative play activities allow children to think, create, discuss and find answers by themselves. It provides children opportunities to explore such as sharing what they know and expressing their ideas and opinions. By playing in a group, children learn how to tolerate and cooperate with their friends. Moreover, children can explore, manipulate and organize concrete objects materials (blocks) to stimulate discussions that elicit the imagination of children.

However, there were arguments that occurred among the children during these activities. Due to excitement, some children did not comply with the rules and they grabbed the blocks and toy animals from other friends. In order to make creative play more effective and run smoothly, additional materials such as toy fruits, vegetables

and animals need to be added. A bigger and more stable bowling toy set needs to be replaced to combat the weather factor so that it won't fall when it is windy.

For parents, they would benefit by knowing more about the importance and integration of creative play to ECCE field in early mathematics. Based on this study, parents who were focused in academic learning can change their prejudice about play in early childhood education system.

In ECCE, there are a few of researches in the domain of creative play in early mathematics and a few studies in the number operations within the range of number 0-18 in Malaysia. Thus, this study has contributed to the creative domain in the early mathematics field especially in the range of number 0-18. Moreover, this study has also contributed its valuable findings after the revision of the content standard of mathematics in NPSC 2017 Revision which has changed the range of number from 0-10 to the range of 0-18 in addition and subtraction operations. The valuable findings can support preschool teachers in their teaching skills and ensure the quality of mathematics education in early childhood in the future.

5.6 Recommendations for Future Research

One of the recommendations for future research would be using mixed methods which include quantitative and qualitative approaches instead of a single approach. In this study, the quantitative approach was used. However, numerical data such as mean score, frequencies and percentages are not able to explain the various types of phenomena such as the attitudes, emotions and motivations of children. It requires qualitative data obtained from observations, interviews and questionnaires to ensure triangulation.

Apart from that, the sample in this study was limited to 60 six-year-old children and the results of the research were only restricted to children from the government preschool. Besides, only 30 children were involved in the 10 lessons of creative play activities for addition and subtraction games. The findings of the present study might not be generalizable to other population. Hence, future research study should involve a larger sample in the creative play activities in early mathematics. This is because the results can yield different findings when compared to a small sample. Moreover, more research can be done with different age groups to see the different results.

Furthermore, this study was only conducted in the state of Selangor and only two preschools were selected. Thus, the findings of the study are also restricted to selected government preschools. More future research can be done with government preschools in other states, private or international kindergartens to examine the effects of the creative play activities in early mathematics.

Apart from the children's performance in early mathematics, the effects of creative play activities on the holistic development of children can be further explored. In addition, further research can also be conducted using different types of play to investigate creativity and creative process such as unstructured play among children. Unstructured play is thought to be a crucial part of how children develop their creativity as they have more freedom to explore their abilities. In order to develop 21st century skills among preschool children further research on the various types of creative play study should be conducted in their early years to improve the quality of early childhood education in Malaysia. These findings can be used as a guideline and new ideas to support preschool teachers to help them incorporate creative thinking and HOTS through play that can enable them to cultivate a risk-free learning environment by using their teaching skills.

5.7 Conclusion

Creative play is the natural way in which children learn, explore and recreate. The use of creative play activities had significantly affected the performance in early mathematics among preschool children in addition and subtraction skills as revealed in the post-test results. These creative play activities had also indirectly enhanced the development of creativity, imagination, HOTS and problem solving skills of children. Thus, creative play is crucial in the future to guarantee a high quality of achievement in early mathematics education. Kuan (2012) suggested that children should not be pressured by teachers as they should adopt a playful situation to enable children to explore their creativity. Hence, in order to cultivate the 21st century learning skills in children, preschool teachers need a different domain of knowledge and skills to guarantee successful learning in the preschool like creating a risk-free learning environment, engage children in challenging activities or tasks that can cultivate their creativity, imagination, thinking out of the box, HOTS and problem solving skills using different materials and different approaches.

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