A Comparison of the Effectiveness between Free and Structured Play in Enhancing Students' Problem Solving Skills in Mathematics

Saroja Dhanapal[1], Ravi Kanapathy[2], Evelyn Wan Zi Shan[3]

[1]Taylor's University, Malaysia
Corresponding author email: saroja.dhanapal {at}taylors.edu.my

[2]Taylor's University, Malaysia

[3]Fairview International School, Malaysai

ABSTRACT---- The increasing awareness among educators around the world on the role of free play and structured play in enhancing students' academic performance and development of skills as well as attitudes influenced the purpose and background of this research study. This study employed a mixed method, a combination of qualitative and quantitative research to compare the effectiveness of free play and structured play in enhancing students' problem solving skills in Mathematics among twenty-six Grade 3 students in an international school. Three major focuses stand out in this study: teachers' perceptions towards free play and structured play, students' perceptions towards free play and structured play as well as a comparison of the effectiveness between free play and structured play in enhancing students' problem solving skills in Mathematics. Every teacher and every student has his/her own opinion towards free play and structured play. Generally, both free play and structured play approaches enhance students' problem solving skills in Mathematics. Nevertheless, findings indicate that students show a better progress in their problem solving skills in Mathematics, in structured play lessons compared to free play. Further, the findings have proven that free play and structured play complement each other in improving students' academic performance in Mathematics. In addition, findings also showed positive responses among the students in choosing structured play over free play for learning Mathematics. Lastly, recommendation for future research was given. Since researches on play are usually carried out with students at primary levels; thus, recommendation would be for further study to be carried out to investigate the effectiveness of play on secondary school students.

***Keywords*---** free play, structured play, Mathematics

---

1. INTRODUCTION

Many of our daily routines involve the application of Mathematical skills. For instance, buying items from supermarkets, weighing the heaviness of flour, calculating taxes and many other activities require a person to apply his/her Mathematical skills. Thus, it is crucial for every person regardless of age and gender to learn and understand the seven strands of Mathematics: using and applying Mathematics, counting and understanding number, knowing and using number facts, calculating, understanding shape, measuring as well as handling data (DfES, 2006). According to Naval Education and Training Program Development Center, 'our modern way of life would hardly have been possible without mathematics' (2002: 286). In summary, learning Mathematics enriches our understanding about the world, allowing us to widen our ideas and apply them in our lives (Carruthers and Worthington, 2011).

Pronin and Bergen's study mention that 'play offers the opportunity for children to learn mathematical concepts more effectively and also to demonstrate what they know more powerfully' (1998: 59). Based on Frobel's theory of play, there are three types of play: free play, semi-structured play and structured play (Synodi, 2010). Nevertheless, according to Tucker (2010), children can develop their mathematical skills mostly through free play and structured play; thus, this study will only be focusing on free play and structured play. Free play, known as child-initiated play is a situation where children have the opportunity to make choices on the aspects, duration and methods of play (Wood and Attfield, 2005; Tassoni and Hucker, 2005; Synodi, 2010). On the other hand, structured play, known as adult-led play is an activity that is planned and guided by teachers or parents for children to grow (Tassoni and Hucker, 2005).

As we are aware, manipulatives such as blocks, beans and others are concrete and visible objects that are designed and are usually used for learners to grasp and understand abstract concepts especially in Mathematics (Martin, 2007). Based on Hawkins' studies, 'the use of manipulatives in elementary classroom has been widely viewed as beneficial and useful

in enhancing students' development and understanding of mathematical concepts' (2007: 90). On the contrary, Clements (1999) mentions that there is no guarantee that the use of manipulatives during play enhances students' Mathematical skills. In his study, classes which did not employ manipulatives performed better than classes employing manipulatives because the teachers highlight learning with understanding (Clements, 1999). Christie (1991) supports Clements' study as she acknowledges the possibility of no guarantee on the use of manipulative during play in enhancing students' Mathematical skills due to several factors such as the teacher's capability, behaviour and teaching strategies employed, resulting in an unexpected outcome.

On the other hand, many studies have proven that playing board games is an effective approach in developing children's Mathematical problem solving skills and their interests in learning Mathematics (Hinebaugh, 2009). In addition, the research mentioned by Tipps et al (2011) recommends the use of digital game-based learning, known as computer games seeing that it can help children with a range of mathematical skills and content. The majority of research has shown positive outcomes in the development of children's mathematical skills with the use of different types of play as an approach; however, there is lack of strong evidence of research found in comparing the effectiveness of free play and structured play.

Kay (2005) suggests that it is vital for children to experience a balance of both free play and structured play to ensure children learn new things with understanding and enjoyment whilst they are able to apply their knowledge in real life situation. As Tassoni and Hucker (2000) mention, children who were not exposed to adult-led activities, structured play, were unable to play on their own. On the contrary, Hughes (2009) mentions that the National Association for the Education of Young Children (NAEYC) agrees more on free play compared to structured play as the NAEYC believes that there are more positive outcomes when children are engaged with a task that they have identified for themselves. Similarly, Tassoni and Hucker (2005) assume that children are less involved in structured play compared to free play. Due to insufficient research on the effectiveness of free play and structured play, the researchers have developed an interest in conducting this research. The contradicting suggestions made by different researches mentioned above have led the researchers to extend the research by comparing the effectiveness of free play and structured play in the development of Grade 3 students' Mathematical problem solving skills. Although researchers conducted studies focusing on the different types of play, they did not specifically make explicit the comparison of effectiveness between free play and structured play. These researches have provoked the researchers to conduct a study to compare the effectiveness of free play and structured play in the development of Grade 3 students' Mathematical problem solving skills. Three research objectives have been designed and they are as follows:

To understand teachers' perceptions of free play and structured play in improving students' problem solving skills in Mathematics.

To understand students' perceptions of free play and structured play in improving students' problem solving skills in Mathematics.

To identify which type of play (free play or structured play) is more effective in enhancing students' problem solving skills in Mathematics.

As this research is conducted to find out whether free play or structure play is a more effective approach in enhancing students' Mathematical skills, the outcomes will develop the awareness of society and teachers to employ the most effective approach. As a result, it will increase the teachers' interest in teaching Mathematics as well as learners' interest in learning Mathematics and subsequently raise students' level of achievement in Mathematics. Therefore, this study is important as it focuses on preparing learners to be efficient problem solvers in the future. As the world is changing at a fast pace, it is vital to prepare the younger generations to solve problems that do not exist at present but which they may face in the future.

2. LITERATURE REVIEW

According to Sandberg and Heden (2011), many researchers mention that play has become a norm and is important for the development of individuals regardless of age. There are various types of play such as physical play, constructive play, imaginative play and creative play incorporating play with natural materials that take place during free play, semi-structured play and structured play (Tassoni and Hucker, 2000). Physical play is a type of play which involves movements and physical activities and it usually takes place indoor and in outdoor areas near the classroom (Saracho and Spodek, 2003). However, Saracho and Spodek (2003) mention that teachers usually do not promote physical play to reduce the chances of children getting injured.

Constructive play is when children utilize tangible materials that can be found around them to create an object that represents their own reality, for example, when a child uses blocks to build towers and cities (Wellhousen and Kieff, 2001; Nisha, 2006). Imaginative play which is also known as fantasy play usually takes place spontaneously when children take on a role of a person or a character and pretend to be that particular person by acting it out (Tassoni et al., 2007). Creative play is when children are exploring, wondering and developing their understanding of the natural things in the surroundings, for example, twigs, leaves, flowers, butterflies and others (Wilson, 2012).

2.1 Development of Children through Play

Each type of play contributes to the development of a child in various ways such as physical, social, emotional, language and cognitive aspects (Tassoni and Hucker, 2000). Many researchers have shown evidence that play develops children's cognitive skills and literacy skills (Christie, 1991; Morrow, 2007). For instance, during symbolic play, children may create symbols through drawing, painting or modeling clay at the beginning. These symbols are later changed into linguistic expressions which will subsequently form the foundation of oral literacy (Burke, 2010).

Besides that, in Smilansky's research on dramatic play shows that children become more sociable, including having high ability to cooperate, negotiate, share, solve problems and appreciate others' efforts as they grow older (1968 cited in Mayesky, 2011). During dramatic play, children initiate play based on their surrounding observations, experiences, imagination and creativity by acting to be a character such as father, mother, doctor or others (Hereford and Schall, 1991; Machado, 2010). Therefore, teachers can facilitate them by providing props that will extend the children's creativity during play (Mayesky, 2011). During play, they usually have the opportunity to imagine who they want to become and where they are; consequently, it allows them to build and master their emotions by acting out as well as to experience different situations (Greg, 1958 cited in Veale, 2001; Sandberg and Heden, 2011). On the other hand, Hereford and Schall (1991) acknowledge that dramatic play is less likely to be seen in a child's play routine if that particular child has visual impairments.

2.2 Children and Mathematics

Pound (2008) mentions that every child born is naturally mathematical, however, there is a need to raise the students' achievements in Mathematics as reported in The Every Child a Chance Trust (2009) in order to reduce unfavorable effects on future employability. Many studies mention that the lack of interest found in a majority of students including educators' interest in teaching Mathematics is one of the reasons for the poor mathematical attainment (Welsh, 2012; Barbarin and Wasik, 2009). Pound (2008) also acknowledges that a majority of population have a lack of confidence in Mathematics despite being born with a natural inclination to it.

Each individual learns not only in various ways but also at different rates (Liebeck, 1984). Gates' (2001) studies show a decline in students' interest in Mathematics due to the difficulties faced in coping with Mathematics. Gates' studies (2001) point out that students faced difficulties in learning Mathematics mainly because of the pace of the lessons and the pressure from teachers, parents and even peers to master the Mathematical skill. Consequently, they rely on memorizing the rules and procedures of Mathematics to solve Mathematical problems instead of understanding and enjoying them (Haylock and Thangata, 2007). Subsequently, when they have difficulty solving a Mathematical problem, they get overwhelmed and eventually give up (Welsh, 2012). As for Hughes' (2009) research, the outcomes note the perception of a group of learners was negative towards their Mathematical skills. The reasons given were due to negative statements made by their teacher and failure in achieving high scores for Mathematics tests (Hughes, 2009). There is belief that 'it is in their earliest educational experiences of mathematics that children develop their personal attitudes and beliefs about the subject and about themselves as young mathematicians' (Carruthers and Worthington, 2011: 9). Therefore, it is necessary that every child has the opportunity to learn and develop Mathematical skills at their own pace during play through child-initiated and adult-led experiences (Fox and Surtees, 2010). This is because according to Liebeck (1984), a child develops their understanding of abstract thought through a sequence. The sequence is as follows:

> E – experience with physical objects
> L – spoken language that describes the experience
> P – pictures that represent the experience
> S – symbols that generalize the experience (Liebeck, 1984: 16)

Oakley (2004) agrees with Liebeck's (1984) statement and mentions that play allow children to build their basic understanding of abstract thought on Mathematics concepts and subsequently enhance their Mathematical skills in solving problems.

2.3 Play in Mathematics

Several researches have proven that play enhances children's Mathematical problem solving skills (Kay, 2005; Hinebaugh, 2009). According to Hinebaugh (2009), a study conducted in New York City's Harlem School District found that students who are exposed to chess during play time improved their critical thinking and problem solving skills through an increase in test scores of 17.3 percent. Kay (2005), Hinebaugh (2009) and McAteer (2012) also agree that, besides chess, board games such as Chutes and Ladders, Stratego, Risk, Ludo, Battleship, checkers and others are an effective way to develop a person's Mathematical skills. Kay (2005) also adds that role plays can develop children's Mathematical skills as they demonstrate their Mathematics knowledge and practice using the concepts and skills during the act.

According to Tipps et al. (2011), mathematical computer games can not only help students to enhance their Mathematical skills in a various areas, but also engage and excite them. In addition to that, in a study mentioned by Gunter (1998), the perceptions of parents and children were found similar; both parents and children were having a positive impression on the usage of video games as a tool for learning in enhancing children's Mathematical skills. However, in Creasey's and Myers' (1986) study, it is proven that playing video games have little or no difference in the children's school grades in Mathematics whereas children who do not play video games scored better grades in Mathematics. It is mentioned by Gunter (1998) that parental control may be the possible reason that was causing the results to be different from the perceptions of parents and children.

3. METHODOLOGY

A mixed method was employed in this study to compare the effectiveness between free play and structured play in developing students' problem solving skills in Mathematics. A combination of qualitative and quantitative methods was used to expand '…the scope and range of the study' (Greene, 2007: 103). Qualitative method was chosen as it provided the study with '…detailed descriptions of situations, events, people, interactions, observed behaviours, direct quotations from people about their experiences, attitudes, beliefs and thoughts' (Patton, 1990: 22). Observation forms, video recording and open-ended questions in survey questionnaires were utilized to obtain detailed qualitative data for this study. At the same time, quantitative method was employed in this research to provide numerical results (Aliaga and Gunderson, 2000). Results gathered from the analysis of data collected using the survey questionnaires (Likert Scale) and tests helped the researchers to identify the difference in effectiveness between free play and structured play in enhancing children's Mathematical problem solving skills.

Purposive sampling was employed in this research whereby two out of four Grade 3 classes were chosen. Both classes were renamed as Class A and Class B in this study for confidential purposes. These two Grade 3 classes were chosen for this research because the teachers have applied free play and structured play during Mathematics lessons; therefore, they will provide strong evidences in comparing the effectiveness between free play and structured play in developing students' Mathematical skills. Both classes consist of thirteen diverse learners from different backgrounds and capabilities who are studying at an international school identified as School X. A total of 26 Grade 3 students from Class A and Class B participated in this research. The children's age ranged from 6 to 10 years old. In addition, 11 teachers, a teacher from each grade levels at primary level including all four of Grade 3 teachers were informed about this study and they agreed to cooperate and participate in this research to identify the views of the teachers on free play and structured play.

The researcher conducted a classroom observation as it provided detailed and descriptive information on what happened in the classrooms. For instance, teachers' teaching strategies and teaching behaviour as well as changes in children's behaviour and response throughout the lesson can be observed and recorded (Nunan, 1992; Chaudron, 1998; Waxman et al., 2004). The classroom observations were carried out by using two methods: observation form and video-recording. Classroom observation form was filled through a discussion between the researchers and the teachers in Class A and Class B before and after each lesson for the researchers to understand the content of the lesson before observing and to evaluate the lesson after it was conducted. During the lesson, the researchers also took note of students' behaviour and responses towards the lesson. Besides that, the lessons were recorded 'to provide a more objective and detached picture and capture in more detail specific aspects of classroom's life as related to the research questions' (Bartolo, 2004: 18). Two different survey questionnaires were distributed to all the students and the teachers who participated in this research. The survey questionnaires given to the students and the teachers consisted of two parts: Likert scale and open-ended questions.

Two different tests were used in this research to compare the effectiveness of free play and structured play in the students' academic development in Mathematical problem solving skills. The first test was given to the students during a lesson about "Addition" whereas the second test was given to the students during a lesson about "Subtraction". Each test has a pre- and post-test which contain the same questions and were answered by students before and after each lesson to

find out whether the students have improved their Mathematical problem solving skills. Both tests consist of two sections with the same number of questions and have approximately the same level of difficulty.

The researchers began collecting the data first by having a discussion with the class teacher from Class A before the lesson on "Addition". A pre-observation form was filled as the discussion was held. Next, a pre-survey questionnaire was distributed to thirteen students in Class A. Before the lesson started, a pre-test on "Addition" was given to the students. During the lesson on "Addition", the teacher conducted free play activities and the lesson was recorded. During the lesson, the researchers took note of the teacher's teaching methods, classroom management skills and students' responses towards the lesson. A post-test was administered to the students when the lesson ended. Next, the researchers discussed with the class teacher and filled up the post observation form. The same procedure was used again the next day, but this time the lesson was on "subtraction". This time, the class teacher conducted structured play activities. The same procedures were adopted in Class B. Next, a survey questionnaire was distributed to all four of the Grade 3 teachers including each grade of primary level class teachers, from Crèche to Grade 6. This was done to identify the teachers' perceptions of free play and structured play.

In order to ensure that the research findings are valid and reliable, the researchers utilized all participants' responses by analyzing all the responses. Besides that, a triangulation approach was used in this research to further strengthen the validity and reliability of the findings. As McMurray et al. mention, 'triangulation refers to the use of several different research techniques in the same study to confirm and verify data gathered in different ways' (2004: 263). Thus, the data from the teachers' and students' survey questionnaire, classroom observation and tests were triangulated to explore whether free play or structured play is the more effective approach in enhancing students' problem solving skills in Mathematics.

4. FINDINGS AND DISCUSSION

This section discusses the findings obtained from the various methods in order to fulfil the research objectives and to respond to the research questions. It discusses students' preferences in learning Mathematics as well as the teachers' and students' point of views towards free play and structured play. Lastly, it also identifies and discusses on the type of play which is the more effective approach in enhancing students' problem solving skills in Mathematics.

4.1 Students' Preferences in Learning Mathematics

Every learner has his/her own learning styles; hence, they have different learning preferences even for Mathematics (Bastable, 2008). According to Okafor (2012), a person learns more and better when their learning preference is catered. Nevertheless, Partin (2009) mentions about a research suggesting that the teaching methods employed may enhance students' performances when their learning styles are catered. Therefore, students' preferences of learning Mathematics were identified through a pre-survey questionnaire at the beginning of the research to find out if the students' learning preferences affect the outcomes of this study. The results are tabulated in Table 1.

Table 1: Grade 3 Students' Preferences in Learning Mathematics

Learning Style	Activity	Class A	Class B
Visual	Activities involving pictures or slide shows	2	3
Audio	Activities involving listening to my teacher teaching	4	1
Read/Write	Activities involving reading books and doing lots of exercises	2	6
Kinesthetic	Activities involving moving around and finding for answers	5	3
Total number of students		13	13

Table 1 shows the preferences of students' from Class A and Class B in learning Mathematics. The choice of activities involving movements as one of the learning preferences, have the most number of responses from students in Class A. A total of 5 out of 13 Class A students have a preference for activities involving movements. Table 1 also shows that there are only 2 out of 13 students prefer activities involving pictures and slideshows as well as reading books and doing lots of exercises. On the other hand, nearly half of Class B, 6 out of 13 students prefer activities involving reading books and

doing lots of exercises. There is only one aural learner in Class B as he/she likes activities involving listening to the teacher when learning Mathematics as compared to 4 out of 13 liking this approach.

4.2 Teachers' Perceptions towards Free Play and Structured Play

From the researchers' point of view, Mathematics lessons employing free play approach is an effective method to develop students' interest and enthusiasm in learning Mathematics which can subsequently enhance students' academic achievements in Mathematics. Nevertheless, the researchers also believe that students will be able to have a better understanding of the Mathematical concepts which will also develop students' Mathematical skills. Each individual has a different point of view towards a subject matter. The researchers had tabulated the information obtained from the teachers' survey questionnaire to identify the teachers' perceptions towards free play and structured play. Based on the data obtained from the teachers' survey questionnaire, 10 out of 11 teachers who participated in this study have implemented free play approach in their classroom.

Table 2: Ways on how Teachers Implement Free Play Approach

Teacher	Class	Have you implemented free play in you class? How?
D	Grade 2	Yes. When giving them Free time with their own choice to play.
G	Grade 3	I provide them with some materials for them to play about. For example, poker cards, straws, etc.
I	Grade 4	Yes; Math board game, dices are prepared for students to improve their mental maths. Wood blocks to build any 3D shapes.
J	Grade 5	Yes, during our multiplication lesson when they played dice and did multiplication.
K	Grade 6	Nope

As shown in Table 2, Teacher K, a Grade 6 teacher has not implemented free play approach in any of his/her lessons. On the contrary, most of the teachers have implemented free play approach mainly during Mathematics lessons. For instance, Teacher G, one of the Grade 3 teachers, provided the students with poker cards, straws and other objects during free play; however, he/she did not specify where and when she employed a free play approach. Teacher D on the other hand, mentioned that he/she provides an opportunity for the students to play by having free time in between the schooling hours. Besides that, Teacher I has used wooden blocks, board games and dices during Mathematics lessons to enhance students' Mathematical skills particularly in mental maths. Teacher J also uses dices for students to play with during free play session, with the intention of enhancing students' problem solving skills on the topic of 'Multiplication'.

From the teachers' survey questionnaires, the researchers also identified that all of the teachers have implemented structured play approach in their Mathematics lessons. This is tabulated in Table 3.

Table 3: Ways on how Teachers Implement Structured Play Approach

Teacher	Class	Have you implemented structured play in your class? How?
A	Crèche	Yes. I use counters when I teach numbers.
E	Grade 3	Yes, by giving them some educational toys like lego or counting cubes to solve problems.
F	Grade 3	Yes, guided instructions for money topic-based activities.
G	Grade 3	Giving them some instructions. I will usually divide them into groups and ask them to explore at different stations.
I	Grade 4	Yes; Smarties are given out to student

Table 3 shows several ways on how the teachers who participated in this study implemented structured play in their classroom. Teacher A has used counters to teach children from Crèche on numbers during structured play lessons. Besides that, Teacher I provides students with 'Smarties' which are colour-varied sugar-coated chocolates whereas Teacher E provides the students with Lego or counting cubes in order to guide the students to solve Mathematical

problems during structured play. Subsequently, the students will develop their problem solving skills in Mathematics when they begin to understand the Mathematical concepts with the guidance of the provided materials. On top of that, Teacher F implements structured play approach by conducting activities with guided instructions on the topic of 'Money'. Teacher G on the other hand, implements structured play approach in a different way compared to the other teachers. Teacher G usually divides the students into groups and the students will work on different tasks at the same time with guided instructions provided for them to follow. This is a good structured play approach whereby the teacher provides different tasks for different students according to their capabilities and learning styles. Nevertheless, every approach that is employed has different challenges for the teacher. Therefore, the researchers also looked into the challenges teachers' faced when employing free play and structured play approaches.

Table 4: Challenges Faced when Implementing Free Play Approach

Teacher	Class	What are the challenges that you faced in implementing free play?
B	Reception	None- due to applying the IB attitudes and learner profile of cooperation, caring and balance. Students are well-mannered.
C	Grade 1	time, limited resources
E	Grade 3	The challenges faced were some students were not willing to share and cooperate with their peers.
G	Grade 3	The noise level. At times, it gets too difficult to handle/ manage the kids.
H	Grade 3	Time management, participation

Table 4 reveals the challenges faced by the teachers when free play approach was implemented. Teacher B from Reception class claimed that he/she does not face any challenges when implementing free play approach because the students are well-mannered due to the usage of twelve IB attitudes such as respect, independence, integrity, commitment, empathy, cooperation, appreciation, creativity, curiosity, enthusiasm, tolerance and confidence as well as the 10 learner profiles which are reflective, principled, risk-taker, knowledgeable, open-minded, caring, inquirer, balanced, thinker and communicator. IB attitudes and learner profiles are practiced in School X by the teachers and the students in order to build good characteristics among students.

In contrast, Teacher C mentions that there are insufficient resources to implement free play approach effectively. Both Teacher C and Teacher H believe that time is one of the challenges to implement free play session in the class. This is because sufficient time must be provided for the students for free play sessions to allow effective development in various aspects. Teacher H also stated that it is a challenge to ensure that all students are actively participating during the free play sessions. Besides that, Teacher E mentioned that students who have difficulty in sharing and cooperating with others may cause issues that can be quite difficult to handle. Noise level in class during free play sessions is also a concern raised by Teacher G and J. The same challenge in implementing free play approach was mentioned by Zachopoulou et al. (2010). During free play, students are often engrossed in playing because they develop their own play, therefore, they will not realize that they are making a lot of noise (Tassoni and Hucker, 2005) and this can become a challenge to teachers.

Table 5: Challenges Faced when Implementing Structured Play Approach

Teacher	Class	What are the challenges that you faced in implementing structured play?
A	Creche	Too many instructions which the kids not able to understand.
D	Grade 2	Maintaining their attention on the play centers on area that they are assign into.
F	Grade 3	Probably it is teacher-guided-based activity that could limit their creativity in handling things.
H	Grade 3	Engaging everyone, cooperation during teamwork
I	Grade 4	Students don't have freedom to explore.
K	Grade 6	Students need to get used to systems, activities need to be both accessible and differentiated.

There are also challenges faced by teachers when implementing structured play in class. For example, Teacher A pointed out that he/she has difficulty in giving instructions for a particular activity to the students because they are too young so it is hard for them to understand the instructions. Teacher D also mentioned that sustaining students' attention on a particular task is also one of the challenges that he/she faced when implementing structured play. It is also a challenge faced by many teachers especially teachers who are teaching students at primary levels because usually, they are only able to pay attention for 10 to 20 minutes before they lose their concentration in learning (Wright, 1998; Bruff, 2009). Therefore, Bruff (2009) recommends teachers to organize different activities with the same objective of the lesson for the students to participate in the activities and move on to a different activity when they lose their attention. However, teachers will face challenges if they employ Bruff's suggestion and this was confirmed in this study where teacher K mentioned that he/she has difficulty to provide activities that are accessible and at the same time, differentiated for the students.

Furthermore, Teacher F and Teacher I stated that they faced challenges in implementing structured play effectively in their class because they believe that structured play approach limits students' freedom to explore and their ability to be creative in handling things when learning Mathematics. On top of that, Teacher H stated that several students had difficulties in cooperating and participating with their team members during group work activity, causing them to disengage themselves from the activity and from their group members. This can be an issue as it will affect that particular group of students' learning in Mathematics.

In the same teachers' survey questionnaire, the teachers also shared their perceptions towards their experience of implementing free play and structured play in Mathematics. A total of 8 teachers from different grade levels perceived that structured play is an easier approach whereas the other 3 teachers perceived that free play is an easier approach to employ in Mathematics lessons. Table 6 shows several teachers' perceptions on a type of play which is easier to employ in Mathematics lessons.

Table 6: Teachers' Perceptions on the Type of Play which Is Easier to Employ

Teacher	Grade	Which type of play (free play or structured play) do you think is easier to employ in Mathematics lessons? Why?
B	Reception	Structured play as the students need to know the concept and teachers will be able to assess student capability during play.
C	Grade 1	structured play, because you have instructions for the students to follow
I	Grade 4	Structured play. Easier to discuss on the outcome of the learning.
J	Grade 5	If we talk about the easier one, it's the free play because there is not hard or fast rules to follow.

Teacher J is one of the 11 teachers who believe that free play is an easier approach to employ because it does not require the students to follow any rules. The students have their freedom to explore and create their own rules that are simple for them to understand. Teacher C's view contradicts Teacher J's opinion. He/she believes that structured play is an easier approach to employ in Mathematics lessons because instructions are provided for the students to follow and complete a particular activity. Teacher B and Teacher I supported Teacher C's opinion, noting that structured play is an easier approach to employ in Mathematics lessons because they find it easier to assess students' capabilities. In structured play, the outcomes of students' learning in Mathematics are more noticeable. The outcomes can be assessed in the form of students' responses in class during questioning and answering sessions, worksheets, tests and others which will be easier to discuss with the parents or the students for the students to make further progress in their Mathematical problem solving skills.

Moreover, the researchers also discovered different perceptions from the teachers on the type of play which will make Mathematics lessons more interesting for the students to learn. 7 out of 11 teachers find that free play approach makes Mathematics lessons more interesting compared to structured play approach. 2 out of 11 teachers perceived that structured play approach makes Mathematics lessons more interesting compared to free play approach. The other two teachers claimed that both free play and structured play approaches will make Mathematics lessons interesting in different ways. Table 7 shows the perceptions of teachers on the type of play which makes mathematic lessons more interesting.

Table 7: Teachers' Perceptions on the Type of Play which makes Mathematic Lessons More Interesting

Teacher	Grade	In your opinion, which type of play (free play or structured play) makes your lessons more interesting? Why?
E	Grade 3	Structured play, the students are more engaged and willing to learn.
F	Grade 3	Free play. Students are leading their learning creatively.
H	Grade 3	Free play is more interesting as the results vary and can surprise you sometime.
I	Grade 4	Free play. Open ended task
J	Grade 5	Both, it depends on the purpose & objectives.

As displayed in Table 7, Teacher F, Teacher H and Teacher I state that the application of free play approach creates more interesting Mathematics lessons. This is because free play approach is an open-ended activity whereby students are free to play in any way that they desire. This will allow the students to widen their creativity by developing a variety of activities in their own ways. As a result, the outcomes of the lessons will be interesting because they will vary from time to time. Teacher H also commented that during the activities some students have brought up interesting ideas. This research has proven that there are teachers who believe that structured play can also create interesting Mathematics lessons. Based on Teacher E's personal experiences, students were more engaged and willing to learn when structured play approach was employed in Mathematics lessons. Teacher J on the other hand, supports both free play and structured play approaches, believing that both types of play will create an interesting Mathematics lessons.

The researchers also discovered the teachers' opinions on which type of play (free play and structured play) will allow students to enjoy most when learning Mathematics. A majority of the teachers, 8 out of 11 believe that students enjoy more during free play when learning Mathematics. The other two teachers believe that students enjoy more in Mathematics lessons which employ structured play approach. Unpredictably, one of the teachers, Teacher C believes that students will enjoy Mathematics lessons to the fullest immaterial of whether free play or structured play is employed. This is because she states that children love to play whether it is structured or free play approach. Table 8 indicates the teachers' perceptions on the type of play that is most enjoyable.

Table 8: Teachers' Perceptions on the Type of Play which Students will Enjoy Most when Learning Mathematics

Teacher	Grade	Which type of play (free play or structured play) do you believe students will enjoy most? Why?
B	Reception	Free play as they are able to make own choices and decision.
C	Grade 1	Both, because children love to play whether it is structured or free play.
F	Grade 3	Free play. They will assume that they are the teachers and plan their learning as per what they desire.
J	Grade 5	Free play, they are given freedom to explore & learn their own with fun.
K	Grade 6	Some may prefer free play, but the majority would rather have an organised lesson.

One of the common reasons given by most of the teachers who perceive free play as a more enjoyable approach for the students is mentioned by Teacher J. The reason why free play is a more enjoyable approach compared to structured play is because students have the freedom and the opportunity to do what they desire. There are no rules or instructions to follow, hence, students are free to make their own choices and create their own ideas in a particular area. Teacher F also pointed out the opportunity that the students have to visualize themselves as a teacher and plan their learning according to their desires as a reason for it being more enjoyable for the students. In contrast, as displayed in Table 8, Teacher K, a Grade 6 teacher mentioned that there are some of his/her students who prefer free play approach; however, he/she perceived that most of them enjoy structured play approach because the lesson is more organized.

Lastly, teachers' perceptions on a type of play which is more effective in enhancing students' problem solving skills in Mathematics were also gathered. There is almost a balance in the number of teachers who believe that free play is more effective compared to structured play in enhancing students' problem solving skills in Mathematics. 4 out of 11 teachers perceived that free play is a more effective approach whereas 5 out of 11 teachers perceive that structured play is a more effective approach in enhancing students' Mathematical problem solving skills.

Table 9: Teachers' Perceptions on the Type of Play which is More Effective in Enhancing Students' Problem Solving Skills in Mathematics

Teacher	Grade	Which type of play (free play or structured play) do you think will enhance students' problem solving skills in Mathematics? Why?
E	Grade 3	Structured play. They can think and share opinions.
F	Grade 3	Both. Different learning and teaching approaches enhances different types of learning - VAK.
I	Grade 4	Free play. They are able to think of various ways to solve any problems/ challenges arise.
J	Grade 5	Structured play because you can create rules/ criterias which will be challenging for students.
K	Grade 6	I haven't tried free play but I do think students will get a chance to try problems on their own, independent learning.

As displayed in Table 9, Teacher I stated that free play is a more helpful approach in developing students Mathematical problem solving skills because students expand their thinking skills as they create their own activity during free play. Hence, students with high level of thinking skills can think of numerous ways to solve any problem question in Mathematics. Teacher K on the other hand, has not tried to implement free play approach, as he/she believes that every student will have the chance to develop their problem solving skills on their own.

Nonetheless, Teacher E and Teacher J oppose Teacher I's and Teacher K's views. They believe that structured play is a more helpful approach because the teacher provides challenging criteria for the students to ponder upon and find solutions for questions on a particular topic in Mathematics. On the other hand, Teacher F mentioned that both approaches will enhance students' Mathematical problem solving skills because both approaches can cater for learners with different learning style.

4.3 Students' Perceptions towards Free Play and Structured Play

Similar to adults, children also have their own opinions towards free play and structured play. The information gathered from students' post-survey is tabulated in Figure 1.

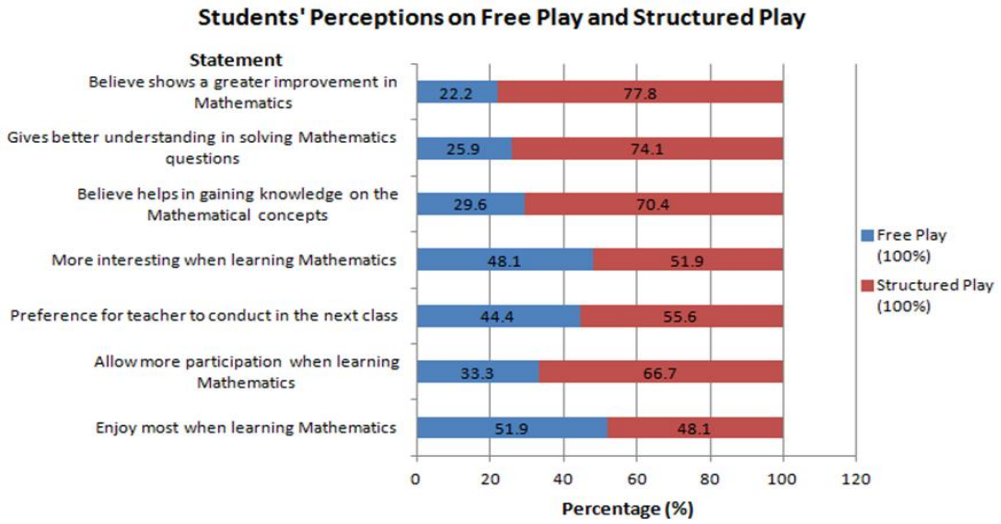

Figure 1: Students' Perceptions towards Free Play and Structured Play

As shown in Figure 1, most of the students gave positive feedbacks towards structured play approach. For instance, a high percentage of 77.8% of students believe that they will improve greatly in their Mathematical skills through structured play approach. The other 22.2% of students perceived that they will demonstrate a greater improvement in Mathematics through free play approach. As mentioned earlier, the results of students' developments are more noticeable in structured play compared to free play approach because structured play has desired outcomes for students to focus on and achieve. This is consistent with Ebbeck's and Ebbeck's (1974) findings. Besides that, 74.1% of students believe that structured play gives better understanding in solving Mathematics questions whereas 70.4% of students believe that structured play helps them to gain knowledge on the Mathematical concepts. These statements justified the researchers' opinions that structured play will help students to gain a better understanding on the Mathematical concepts. Once the students have built their understanding on the Mathematical concepts, they will eventually make progress in their problem solving skills in Mathematics.

Based on the Figure 1, it is interesting to note that the same percentage of students (3.8%) found structured play to be more interesting and free play approach to be more enjoyable. Compared with the teachers' point of views, most of the teachers believe that students enjoy and find free play approach to be more interesting, the students' responses appears to be quite different. Besides that, 66.7% of students view structured play as an approach which allows them to participate more actively and this has led 55.6% of students to show desire for structured play to be conducted in the following Mathematics lessons.

4.4 The Effectiveness of Free Play and Structured Play in Enhancing Students' Problem Solving Skills in Mathematics

As mentioned in the methodology section, two different tests were given to the students from Class A and Class B to compare the effectiveness of free play and structured play in enhancing students' problem solving skills in Mathematics. The results of students from Class A and Class B obtained from the first test consisting of a pre and post-test during free play lessons on the topic of "Addition" are recorded to compare students' test results. Figure 2 shows the test results of Class A after the lessons conducted with free play.

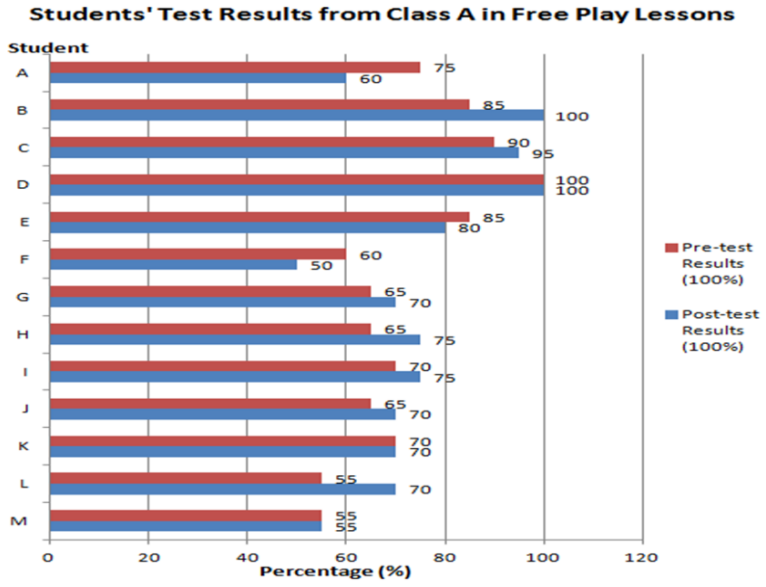

Figure 2: Students' Test Results from Class A in Free Play Lessons

Overall, the 13 students in Grade 3 Class A had shown a slight improvement of 3.2% in their problem solving skills in Mathematics through free play. Based on the Figure 2, some of the students' results had increased amazingly and some had dropped severely after free play lessons. Surprisingly, Student B and Student L who actually prefer Mathematics activities involving listening to the teacher teaching demonstrated a great improvement of 15%. This result appears to prove that these students are aural learners who are flexible and can adapt to different teaching approaches and can still perform well. The researchers also believed that both of them enjoyed free play lessons, resulting in the great improvement in their results. The results of three students, Student D, Student K and Student M remained constant.

In contrast, Student A's result had dropped from 75% to 60% and Student F's results also had dropped from 60% to 50%. Fielding (2006) and Thanasoulas (2001) mention that certain tasks may require a way of working that a learner discovers hard to handle. Therefore, the researchers concluded that Student A and Student F were limited by movements during free play, causing them to lose their interest in learning Mathematics and subsequently affect their academic performance. It must be noted that students' interest also plays an important role in enhancing their Mathematical problem solving skills. This is consistent with the findings of Partin (2009). A graph was also designed to compare students' test results from Class B to find out the effectiveness of free play.

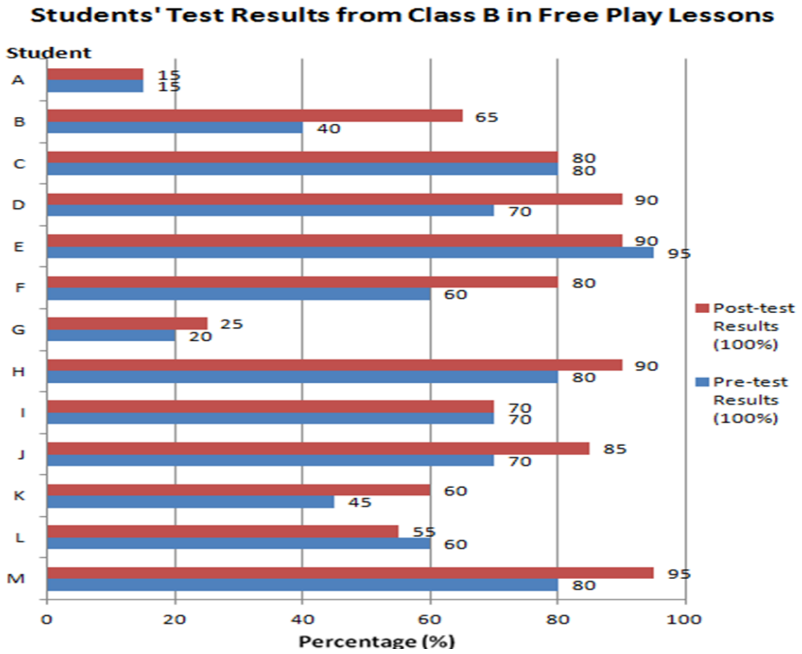

Figure 3: Students' Test Results from Class B in Free Play Lessons

As seen in Figure 3, there were more students from Class B who showed a great improvement in their results compared to students from Class A. For example, Student B had improved by 25% whereas Student D and F had improved by 20% in their Mathematical problem solving skills. Overall, the 13 students in Grade 3 Class B had shown improvement in their results by 8.8%. In addition, there are also a higher number of students from Class B who had showed a greater improvement in their Mathematical problem solving skills through free play compared to Class A. The researchers noted that students' level of confidence in Mathematics plays a role in students' academic performance. Students from Class A have a higher percentage of confidence level in Mathematics compared to students from Class B. This is consistent with the study of Pound (2008). Three students' results from class B also remained the same. There were only two students, Student E and Student L who had declined in their academic achievement by 5%.

The results of students from Class A and Class B obtained from the second test consisting of a pre and post-test during structured play lessons on the topic of "Subtraction" were also recorded. Figure compares students' test results from Class A to find out the effectiveness of structured play.

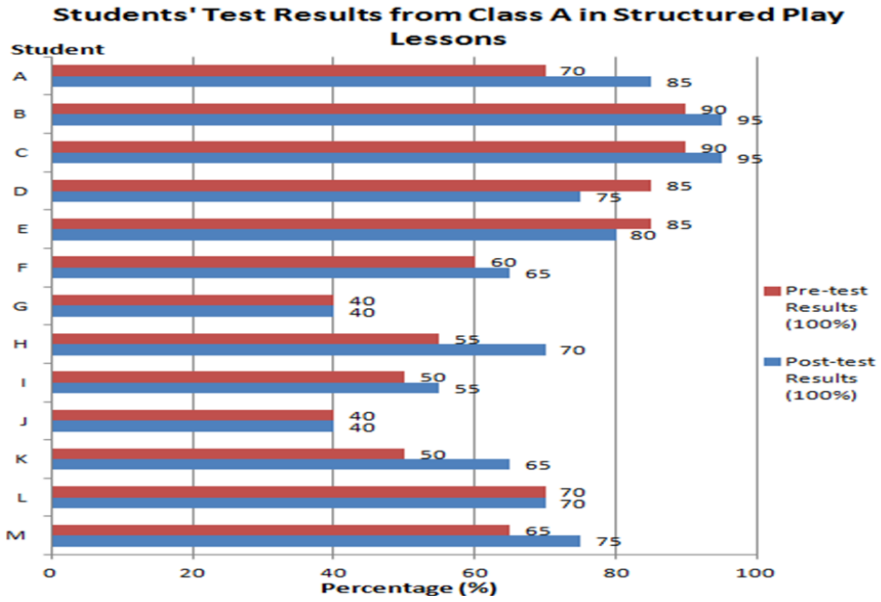

Figure 4: Students' Test Results from Class A in Structured Play Lessons

Overall, students from Class B had shown improvement in their test results by 4.6% during structured play lessons. Student A and Student H test results had improved by 15%. This had provided stronger evidence that Student A and Student H were unable to adapt to free play approach. Teacher A had conducted structured play activities in this class which allowed students to move about. The researchers believe that these students had made a progress through structured play mainly because their learning preferences were met. Similarly, Student K's results had also improved from 50% to 65%. The results obtained by Student G, Student J and Student L remained the same even after structured play was employed. Only a student, Student D did not succeed to improve in his/her problem solving skills in Mathematics through structured play. Student D's result had dropped by 10% from 85% to 75%.

Figure 5 compares students' test results from Class B to find out the effectiveness of structured play.

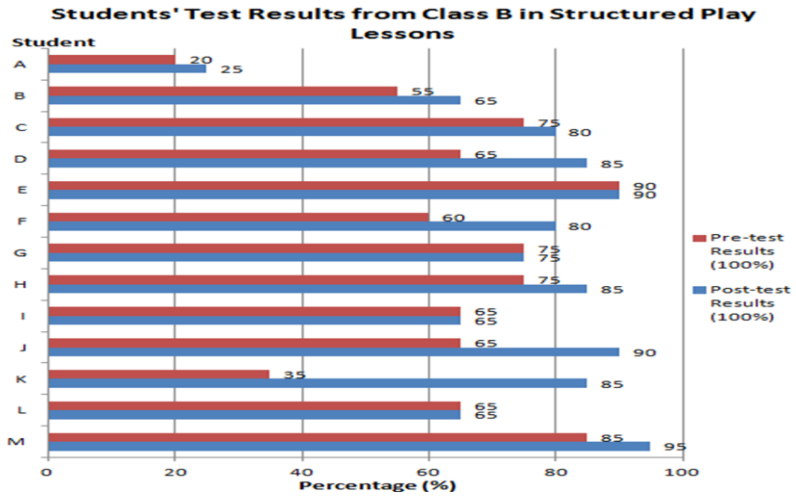

Figure 5: Students' Test Results from Class B in Structured Play Lessons

Interestingly, students from Class B had improved in their test results in structured play lesson by 11.9%. Once again, students in Class B showed a greater improvement compared to students in Class A with the difference of 8.3%. As shown in Figure 5, all of the students from Class B had either progressed in their problem solving skills or remained the same. Not even a single student had dropped in his/her results. Student K, in particular, had shown a tremendous improvement from 35% to 85% whereas the other students had improved within the range of 5% to 20%.

Next, a graph was also designed to compare the effectiveness between free play and structured play by looking at the difference in students' pre and post-test results.

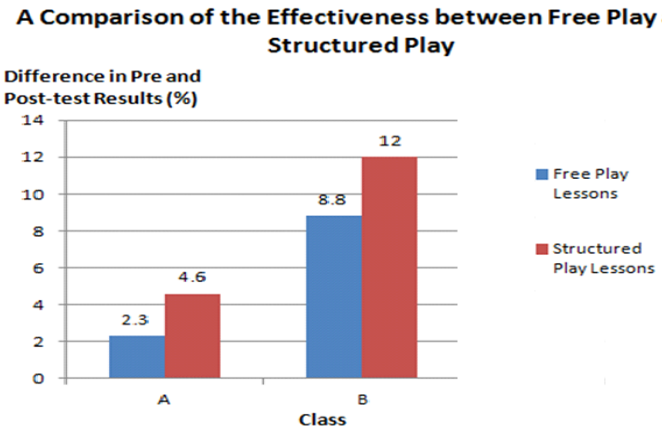

Figure 6: A Comparison of the Effectiveness between Free Play and Structured Play

Figure 6 illustrates that structured play is a more effective approach compared to free play. In Class A, students' results had improved slightly by 2.3% in free play lessons whereas in structured play lessons, the students had improved by 4.6%. Thus, the students had progressed more by 2.3% in structured play lessons. Similarly, students' test results in Class B had shown a greater improvement of 3.2% in structured play lessons compared to free play lessons.

To sum up, although both free play and structured play enhance students' problem solving skills in Mathematics; however, structured play is a more effective approach compared to free play. The researchers believe that structured play showed a greater improvement in students' test results because it had planned objectives that were needed to be achieved. Therefore, teachers who employed structured play usually focused on enhancing students' problem solving skills in Mathematics whereas free play only showed a slight improvement because it does not have a particular objective that must be fulfilled. Besides that, it focuses on an overall development of the students which can be noted through observation from time to time.

5. CONCLUSION

To sum up this research report, a comparison of the effectiveness between free play and structured play in enhancing students' problem solving skills in Mathematics were shown through the various data collected. The majority of the data collected had shown positive results in most of the areas. In general, teachers view both types of play as helpful and effective in enhancing students' problem solving skills in their own ways. Both types of play also have their own challenges faced by teachers. Besides that, many teachers perceive that structured play is an easier approach to employ in classrooms. Many teachers also perceive that free play approach will allow the class to be a more interesting place to learn and also build students' enjoyment in learning Mathematics. In contrast, a majority of the students perceive that structured play is a more effective approach compared to free play in developing their skills. Furthermore, the students' test results generally showed improvement in students' problem solving skills in Mathematics lessons employing free play and structured play approaches. When free play and structured play are compared, structured play appears to have a greater effect on the development of students' problem solving skills. Many researches have been conducted on play in primary school levels Researches on play in secondary schools can hardly be found. Therefore, the researchers recommend that further research can be carried out by looking at the effectiveness of play in secondary schools.

6. REFERENCES

Aliaga, M., & B. Gunderson, (2000) Interactive Statistics, New Jersey: PrenticeHall.

Barbarin, O., & B. Wasik, (2009) Handbook of Child Development and Early Education: Research to Practice, New York: The Guilford Press.

Bartolo, A. M., (2004) Input and Interaction: Investigating EFL Italian University classroom, Soveria Mannelli, Italy: Rubbettino Editore.

Bastable, S., (2008) Nurse as Educator: Principles of Teaching and Learning for Nursing Practice, 3rd edition, Massachusetts, United States: Jones and Bartlett Publishers, Inc (first published: 1997).

Bruff, D., (2009) Teaching with Classroom Response Systems: Creating Active Learning Environments, United Kingdom: Jossey-Bass.

Burke, A., (2010) Ready to Learn: Using Play to Build Literacy Skills in Young Learners, Canada: Pembroke Publishers.

Carruthers, E., & M., Worthington, (2011) Understanding Children's Mathematical Graphic: Beginnings in Play, England: Open University Press.

Chaudron, C., (1998) Second Language Classrooms: Research on Teaching and Learning, United Kingdom: Cambridge University Press.

Christie, J. F., (1991) Play and Early Literacy Development, Albany: State University of New York Press.

Clements, D., (1999) 'Concrete Manipulatives, Concrete ideas', Contemporary Issues in Early Childhood, 1 (1) pp. 45 – 60.

Creasey, G. L., & B. J., Myers, (1986) 'Video Games and Children: Effects on Leisure Activities, Schoolwork, and Peer Involvement', Merrill-Palmer Quarterly, 32 (3) pp. 251-262.

Creswell, J. W., (2002) Educational Research: Planning, Conducting, and Evaluating quantitative and qualitative approaches to research, Upper Saddle River, New Jersey: Merrill/Pearson Education.

Department for Education and Skills (DfES), (2006) Primary Framework for Literacy and Mathematics, Available at: http://www.educationengland.org.uk/documents/pdfs/2006-primary-national-strategy.pdf (accessed: 22/11/2012).

Ebbeck, F. N., & M. A. Ebbeck, (1974) Now We Are Four: An Introduction to Early Childhood Education, Ohio: Merrill Pub Co.

Fielding, M., (1994) 'Valuing difference in teachers and learners: Building on Kolb's learning styles to develop a language of teaching and learning' Curriculum Journal, 5(3) pp. 393-417.

Fox, S., & L. Surtees, (2010) Mathematics across the Curriculum: Problem-Solving, Reasoning and Numeracy in Primary Schools, London: Continuum International Publishing Group.

Gates, P., (2001) Issues in Math Teaching, London: RoutledgeFalmer.

Greene, J., (2007) Mixed Methods in Social Inquiry, California: Jossey-Bass.

Gunter, B., (1998) The Effects of Video Games on Children: The Myth Unmasked, England: Sheffield Academic Press Ltd.

Hawkins, V. H., (2007) The Effects of Math Manipulatives on Student Achievement in Mathematics, Dissertation, Capella University, Ann Arbor: UMI.

Haylock, D., & F. Thangata, (2007) Key Concepts in Teaching Primary Mathematics, London: Sage Publications.

Hereford, N. J., & Schall, J., (1991) Learning through Play: A Practical Guide for Teaching Young Children, New York: Scholastic Inc.

Hinebaugh, J., (2009) A Board Game Education, United States: Rowman & Littlefield Education.

Hughes, A. M., (2009) Problem Solving, Reasoning and Numeracy in the Early Years Foundation Stage, Oxon: Routledge.

Kay, J., (2005) Teaching Assistant's Handbook: Primary Edition, London: Continuum.

Kumar, R., (2011) Research Methodology: A Step-by-Step Guide for Beginners, 3rd edition, London: Sage publication (first published: 1999).

Liebeck, P., (1984) How Children Learn Mathematics: A guide for parents and teachers, London: Penguin.

Machado, J. M., (2010) Early Childhood Experiences in Language Arts: Early Literacy, 9th edition, United States of America: Cengage Learning (first published: 2009).

Martin, A. R., (2007) Are Algebra Tiles Effective for Raising High School Students' Texas Assessment of Knowledge and Skills Mathematics Scores?, Dissertation, The University of Houston – Clear Lake, Ann Arbor: UMI.

Mayesky, M., (2011) Creative Activities for Young Children, 10th edition, United States: Wadsworth Publishing.

McAteer, M., (2012) Improving Primary Mathematics Teaching and Learning, England: Open University Press.

McDaniel, C. D., & R. Gates, (1998) Marketing Research Essentials, 2nd edition, Ohio: South-Western College Publishing (first published: 1995).

McMurray A. J., R. W. Pace, & D. Scott, (2004) Research: A Common Sense Approach, Melbourne: Thomson.

Morrow, L. M., (2007) Developing Literacy in Preschool, New York: The Guilford Press.

Naval Education and Training Program Development Center, (2002) Together with Mathematics, New Delhi: Rachna Sagar Pvt. Ltd.

Nisha, M., (2006) Milestones of Child Development, India: Kalpaz Publications.

Nunan, D., (1992) Research Methods in Language Learning, New York: Cambridge University Press.

Oakley, L., (2004) Cognitive Development, New York: Routledge.

Okafor, P., (2012) Alternate Route to School Effectiveness and Student Achievement: Circumventing Socioeconomic Status, Bloomington, Indiana: iUniverse.

Partin, R. L., (2009) The Classroom Teacher's Survival Guide: Practical Strategies, Management techniques, and Reproducibles for New and Experienced Teachers, 3rd edition, United States: John Wiley & Sons, Inc (first published: 2004).

Patton, M. Q., (1990) Qualitative evaluation and research methods, 2nd edition, Newbury Park, California: Sage (first published: 1980).

Pound, L., (2008) Thinking and Learning about Mathematics in the Early Years, Oxon: Routledge.

Pronin, D., & D. Bergen, (1998) Play from Birth to Twelve and Beyond, New York: Garland Publications.

Tassoni, P., & K. Hucker, (2000) Planning Play and the Early Years, Oxford: Heinemann Educational Publishers.

Tassoni, P., & K. Hucker, (2005) Planning Play and the Early Years, 2nd edition, Oxford: Heinemann Educational Publishers (first published: 2000).

Tassoni, P., K. Beith, K. Bulman, & H. Eldridge, (2007) Child Care and Education: Cache Level 3, 4th edition, Oxford: Heinemann.

Thanasoulas, D., (2001) ' Constructivist Learning', ELT Newsletter, Article 54, Available at: http://www.eltnewsletter.com/back/April2001/art542001.htm (accessed: 22/11/2012)

The Every Child a Chance Trust, (2009) The Long Term Costs of Numeracy Difficulties, Available at: www.everychildachancetrust.org (accessed: 20/11/2012).

Tipps, S., A. Johnson, & L. M. Kennedy, (2011) Guiding Children's Learning of Mathematics, 12th edition, USA: Wadsworth, Cengage Learning.

Tucker, K., (2010) Mathematics through Play in the Early Years, 2nd edition, London: SAGE Publications Ltd (first published: 2005).

Sandberg, A., & R. Heden, (2011) 'Play's importance in school: Education 3-13', International Journal of Primary, Elementary and Early Years Education, 39 (3) pp. 317-329.

Saracho, O., & B. Spodek, (2003) Contemporary Perspectives on Play in Early Childhood Education, United States: Information Age Publishing, Inc.

Synodi, E., (2010) 'Play in the Kindergarten: the Case of Norway, Sweden,

New Zealand and Japan', International Journal of Early Years Education, 18 (3), pp. 185-200.

Veale, A., (2001) Revisiting the Landscape of Play, Early Child Development and Care, 171 (1) pp. 65 – 74.

Waxman, H. C., R. G. Tharp, & R. S. Hilberg, (2004) Observational Research in U.S. Classrooms: New Approaches for Understanding Cultural and Linguistic Diversity, United Kingdom: Cambridge University Press.

Wellhousen, K., & J. Kieff, (2001) A Constructivist Approach to Block Play in Early Childhood, New York: Delmar, Thomson Learning, Inc.

Welsh, P., (7th September, 2012) 'Why our kids hate math', USA TODAY News, http://usatoday30.usatoday.com/news/opinion/forum/story/2012-07-09/math-education-remedial-algebra/56118128/1 (accessed: 24/11/2012).

Wilson, R., (2012) Nature and Young Children: Encouraging Creative Play and Learning in Natural Environments, 2nd edition, Oxon: Routledge (first published: 2008).

Wood, E., & J. Attfield, (2005) Play, learning and the early childhood curriculum, London: PCP Limited.

Wright, D., (1998) Managing Behaviour in the Classroom, Oxford: Heinemann Educational Publishers.

Zachopoulou, E., J. Liukkonen, I. Pickup, & N. Tsangaridou, (2010) Early Steps Physical Education Curriculum: Theory and Practice for Children Under 8, United States: Human Kinetics.