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Volume No.6 Issue No.2 June 2017

www.iresearcher.org

ISSN 2227-7471

THE INTERNATIONAL RESEARCH JOURNAL "INTERNATIONAL RESEARCHERS"

www.iresearcher.org

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The Volume 6 Issue 2 was published much late due to technical problems

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EXTENT TO WHICH PRE-SCHOOL TEACHERS USE GAMES AND ACTIVITIES IN TEACHING MATHEMATICS

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ABSTRACT

Basic early childhood mathematics is broader and deeper than mere practice of counting and adding. The purpose of this study was to determine the extent to which pre-school teachers use mathematics games and activities in teaching mathematics. This study employed a descriptive survey design. Stratified sampling technique was used to ensure proper representation of the whole region. Standardized formula was used to arrive at a sample size of 29 pre-school teachers. Data was then analyzed using descriptive statistics such as frequency, percentages, means and mode. Tables were used to present the results. The findings indicated that the utilization of games by teachers in teaching mathematical concepts was below average since the overall mean for all games was below average, and also that teaching objectives in mathematics could not be achieved through selection of the right games to achieve a specified objective. The study recommended that workshops and seminars be organized for the training and of teachers in game-based teaching, so that they can be in a position to select the appropriate games for each math activity.

Key words: mathematics activities, games, teaching, pre-school

1. INTRODUCTION

i. Theoretical Framework

This study was guided by Vygotsky's (1998) Socio-Cultural Theory. Socio-Cultural Theory tries to explain learning as a gradual social journey which is the originality of human intelligence and wisdom in cultural setting. It explains culture and social interaction as the channel which enables persons to come up with knowledge and understanding gained from their own encounters with others in life and the learning process. The major theme of Vygotsky's theoretical framework is that social interaction plays a fundamental role in the development of cognition. His theory suggests that everything is learned in mainly two phases. The first phase is learned through associating with other people and then incorporated into the person's mental capacity and understanding. In view of constructivist, learning is a constructive process in which the learner builds an internal illustration of knowledge and a personal interpretation of experience. The inclusion of games as a part of mathematics instruction is supported by Vygotsky's socio-cultural theory. Mathematical games help learners to bridge the gap between concrete and abstract using manipulation of objects. The interactions between learners playing games together encourage development of language, specifically mathematics related language, which provides learners with opportunities to use new terms and create schema in order to deepen their understanding of the mathematics concepts which they are exploring.

According to Vygotsky (1997), teachers should be considered as collaborators in ensuring that children understand clearly basic mathematical concepts and objectives which govern what is taught by teachers. Vygotsky's theory emphasizes that children should acquire knowledge by participating in activities rather than getting answers from others, including teachers their colleagues. Although children may sometimes go wrong in several areas, they should be encouraged by adults to acquire knowledge through participation in the different activities and to build confidence as well as their thinking capacity.

However, in social constructivism learning, many of these values such as the basic concepts and procedures together with the basic principles can be practically simulated in real world application to solve problems. Vygotsky's social development theory argues that social interaction precedes development; consciousness and cognition, and is the end product of socialization and social behaviors. A teacher or older adults or even computers could be the child's aid in development and at the same time closing the gap of the Zone of Proximal Development (ZPD). Through a variety of games, a child's free exploration and discovery of knowledge and concepts is enhanced. The teacher or caregiver acts as a guide who encourages the learners to discover skills and principles of life for themselves and also to construct knowledge through solving real life problems. This is crucial learning experience which is enhanced mostly when children are playing different games in their learning process.

This Vygotsky's theory can therefore apply in this study in that it is geared towards the use of games to learn mathematical concepts as they interact with them and their peers. By using mathematics games, the teacher provides his/her learners with opportunities to develop their understanding of mathematics in a social context. Through the use of mathematics, specific language and positive interactions in their cultural setting with other learners, a child acquires a deeper understanding of mathematics skills and concepts.

ii. Extent of Use of Games and other Activities in Teaching Mathematics

Jacob (2001) conducted a study on the evaluation of the use of games and instructional media in the teaching of Mathematics in primary schools noted and their findings indicated that teachers' use of games as instructional approaches was very inadequate and invariably had impact on pupil's performance in their primary school final examination. Dahar and Faize (2011) also noted that there was great deficiency in the use of games and other instructional media in schools in Punjab District of Pakistan.

Kabita, et al (2013) in their study revealed a conspicuous absence of *songs/rhymes and water play* for teaching of mathematics and science in pre-schools was also revealed. They further revealed that many teachers did the activities outdoors, and nothing much was done inside the classrooms using the mathematics corners. Probably, lack of training in ECE guided them to pick up the mathematics like nature walk, visit to water sources, see physical features, go for excursions, to take children outside the classroom as suggested in the pre-primary curricular framework (Republic of Botswana, 2008). But the brighter side was, almost half of them (53%) did them every day.

The studies in the literature prove that games are frequently used in education (Becker & Jacobsen, 2005; Cheng & Su, 2012; Cherney & London, 2006; Emin-Martinez & Ney, 2013) The literature review of the studies regarding education games shows that the available studies are mostly focus on the application and use of technology-supported games (Cheng & su 2012). A study done in the year 2004 also supports the fact that using games leads to positive outcomes in teaching (Jonker & van Galen, 2004).

The study conducted by Emin-Martinez & Ney, 2013 found that games helped pre-service teachers to learn through entertainment, increased motivation, promoted active participation, aroused interest in learners, and helped them learn the concepts easily. In parallel with these results, the studies by Cheng & Su (2012), & Emin-Martines & Ney (2013), revealed that educational games promoted motivation and that students had positive attitudes toward such games.

In general the study suggests that, playing of games in schools is of great importance on how children understand different mathematical concepts and other analytical concepts learned in class. This has been supported by several previous studies which have proposed that as children use games during mathematic lesson they easily learn through social interaction. For example, they usually socialize by talking number stories, listening to others, counting and actively participating in exploring procedures and concepts with the help from their peers. However, use of small group discussions, individual assignments and mathematical games are of great importance for sprouting and promoting interactive mathematical discussion among different groups of children and between pupils and teachers. Children are usually eager to participate in different activities and mathematical games with peers due to the immediate feedback that the children get from their fellow learners.

2. METHODOLOGY

i. Research Design

Descriptive survey research design was used in this study. Descriptive survey design was appropriate for this study because it enabled the research to directly collect data on use of games in teaching mathematical concepts as they happen and without manipulation. Descriptive research design also helps to collect information on people's attitudes, opinions and habits hence it was used to establish the extent to which pre-school teachers use games as a medium for teaching mathematical concepts.

The dependent variable of the study was the status of teaching of mathematical concepts based on games. This was measured by assessing use of games in teaching mathematics and acquisition of skills through the use of questionnaires for teachers. And the independent variable measured by the frequency of using games in teaching mathematical concepts:-this was measured by assessing the number and types of games the preschool teachers used to teach mathematics.

ii. Location of the Study

The study was conducted in Kajiado County. The purposive sampling was used. Kajiado County is about 90km south west of Nairobi along Nairobi – Namanga road. Kajiado County borders Narok County to the West, Nakuru, Kiambu and Nairobi Counties to the north, Machakos, Makueni and Taita-Taveta Counties to the east and Tanzania to the south. It has a population of 406,054 and an area of 21,903 km². The main ethnic community of Kajiado County is the

Maasai who are renowned for their strong cultural heritage and exquisite jewelry. There is an increased influx of other people from various regions of the county who flock the area and boost the millions acquired from tourism sector of the County.

iii. Target Population

The target population of this study was teachers in all public pre-schools that had been in existence for the previous one year within Kajiado. There are approximately 5,000 pre-school teachers in Kajiado County. However, this study targeted 290 pre-school teachers specifically in Kajiado Central Sub-County.

iv. Sampling Techniques

Kajiado Central Sub-County is sub-divided into three zones (Enkorika, Elangata, and Kajiado Zones). Therefore the three zones formed the strata of the study. Subsequently, stratified sampling technique was used to proportionally select 13 pre-school teachers from Enkorik Zone, 9 pre-school teachers from Elangata Zone, and 7 pre-school teachers from Kajiado Zone leading to a total sample of 29 pre-school teachers.

v. Sample Size

Formula by Kothari (2004):

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

Where: n = required sample size.

t = standard normal deviation at the required confidence level.

p = proportion in the target population estimated to have the characteristics being measured.

m = the level of statistical significance set (margin of error).

The sample size was estimated within 95% confidence interval ($t=1.96$) and a significance level of 0.05 as follows;

$$n = (1.96)^2 \cdot (0.019) \cdot (0.981) / (0.05)^2 = 29 \text{ (approximate)}$$

For this research a total sample size of 29 was adequate. Stratified sampling was used to proportionately select a total of 29 pre-school teachers in three zones (Enkorika, Elangata and Kajiado Zones). This represents 10% of the total pre-school teachers in the Sub-County. This is in accordance with Best and Kahn (2006) who argue that at least 10% sample size is ideal for a bigger population and 30% for a smaller population. Table 1, presents population and sample size of pre-school teachers.

Table 1: Population and Sample Size

Zone	Population of Teachers	Sample size	Percentage
Enkorika zone	130	13	10%
Elangata zone	90	9	10%
Kajiado Central zone	70	7	10%
Total	290	29	10%

3. FINDINGS

The study sought to determine the extent to which pre-school teachers use games and activities in teaching mathematics. Teachers in pre-schools were required to provide the frequency of which they used mathematical

games and play activities in teaching Mathematics. Table 2, presents data on the frequency at which teachers used mathematical activities in teaching mathematics.

Table 2, Frequency of which Pre-School Teachers Use Mathematics Games and Play Activities in Teaching Mathematics

Games	Response				
		MF	F	R	N
Mathematics Bingo	F	3	11	3	0
	%	17.6	64.7	17.6	0
Matching game	F	1	3	2	0
	%	16.7	50	33.3	0
Guessing game	F	0	4	2	2
	%	0	50	25	25
Snake and ladders	F	0	21	5	0
	%	0	80.8	19.2	0
Cross-number puzzles	F	2	13	5	1
	%	9.5	61.9	23.8	4.8
Catching ball	F	3	4	1	1
	%	33.3	44.4	11.1	11.1
Hiding game	F	9	2	0	0
	%	81.8	18.2	0	0
Big ten	F	24	0	0	0
	%	100	0	0	0
Average Score					

Key: MF-Most Frequently F-Frequently R-Rarely N-Never.

Results in Table 2, indicates that majority 24(100%) teachers who participated in the study in pre-schools agreed that they used Big Ten game in teaching Mathematics in pre-schools. On On utilizing snakes and ladders 5(19.2%) only, reported that they rarely used it. The study findings further revealed that 9(81.8%) most frequently used hiding games while 13(61.9%) out of 21 frequently used cross-number puzzles to teach Mathematics. Interestingly, 2(25%) out of the 8 teachers who reported the use of Guessing game did not use it at all.

These findings imply that the utilization of games by teachers in teaching mathematical concepts was below average since the overall mean for all games was below average. These findings also imply that some game-based methods did not work better because some games were inappropriately used to achieve certain teaching objectives hence were not reliable. Teaching objectives in mathematics could only be achieved through selection of the right games to achieve a specified objective. For instance, a puzzle number game could be chosen to achieve the acquisition of addition and subtraction concepts among learners in the pre-schools.

These findings are similar to that of Reuben (1999) who found that participation in an activity requires the use of content by the learner thus ensuring learners are working with the ideas that are being taught and applying them. In support to this concept, Copley (2000) observes that children usually are fast to notice and eager to explore different mathematical concepts of their own world thus the use of games make learning mathematics is essential.

In relation to the socio-cultural theory of Vygotsky, children are active seekers of knowledge and not solitary agents, and their collaboration with the social environment moulds cognition in culturally adaptive ways through games and other materials. The theory provides that games provide a temporary platform or support (Scaffolding) through which

children can accomplish a range of tasks that are within their Zone and cannot yet handle alone. According to Essa (2011), games promote abstract thought that allow children to reach beyond their actual development in their cognition and self-regulation and achieve a mental representation of social roles. Children will often try to compare different quantities, discover patterns, navigate in space, and grapple with real problems such as balancing a tall block building or sharing goodies with a playmate (Essa, 2011).

It is evident in this study that all games that were used in teaching mathematical concepts were not adequately utilized as indicated by low overall mean score (mean=1.97). Similar findings were also revealed by Jotia and Matlale (2011, cited in Bose & Seetso, 2016) that teachers' use of games as instructional approaches was very inadequate and this invariably had impacted on pupil's performance in their primary school final examination. Dahar and Faize (2011) also noted that there was great deficiency in the use of games and other instructional media in schools in Punjab District of Pakistan.

4. CONCLUSIONS

This study sought to determine the extent to which pre-school teachers use games and activities in teaching mathematical concepts. The frequency at which teachers utilized games in teaching Mathematical concepts was generally low (Overall mean=1.97 and standard deviation=1.42). Most teachers appreciated their game-based activities which they implemented towards improving teaching mathematical concepts. Nevertheless, some game-based methods did not work better because some games were inappropriately used to achieve certain teaching objectives hence were not reliable. Teaching objectives in mathematical concepts could only be achieved through selection of the right games to achieve a specified objective.

5. RECOMMENDATIONS

i. Recommendation to the Teachers

Teachers should be active and creative in the use of games. When teaching mathematical concepts. This is based on the notion that the use of games as teaching strategy assists to simplify instruction, revision, summarizes concepts, capture children's attention and help to enhance retention of concepts learned.

ii. Recommendations to the Head Teachers and School Managers

- 1) School managers and head teachers should cultivate a conducive social environment that could promote and motivate teachers' behavior to embrace the use of games as a teaching strategy.
- 2) School management should have ways in place to orient inexperienced teachers with the child-centered teaching methods especially the use of games in teaching.

iii. Recommendation to the County Government

Quality training is paramount in selection and application of teaching methods related to games towards the acquisition of mathematics concepts among learners in pre-schools. Therefore, the County Government should support the training by organizing for the training and re-training of teachers on game-based teaching through workshops and seminars.

iv. Suggestions for Further Research

With regards to the findings of the current study, the following suggestion is made for further studies:

- i) A similar research could be carried out in other counties and among the primary mathematics teachers to further validate the results of this study.
- ii) The learners could be surveyed to determine the extent the teachers are utilizing the game-based learning methods in schools.

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