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Indoor Play Materials Availability for Teaching Mathematical Concepts and Skills in ECD Centers in Eldoret West Sub-County, Kenya

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ABSTRACT

The paper explored indoor play materials available for teaching mathematical concepts and skills in ECD centres in Eldoret West Sub-county. The study was guided by Jean Piaget's theory of cognitive development in children. Descriptive survey research design was adopted to assess the use of indoor play in enhancing the acquisition of Mathematical concepts and skills. The study was conducted in Eldoret West Sub-county, Kenya. The target population in this study consisted of 181 public ECDE centers with a total of 181 top class ECD teachers that are qualified to teach mathematic activities and 3620 ECDE pupils. 30% of the total number of ECD schools was sampled thus yielding a sample size of 54; that is, 54 ECDE centers out of 181. The researcher selected 362pupils who represented 10% of the target population. Simple random sampling technique was used to select the sample schools and ECDE pupils. Questionnaires and observation schedule was used to collect data. The data analysis employed the use of both qualitative and quantitative techniques. Majority of the respondents were of the opinion that block play materials are available in this school whereas a significant number of the teachers felt that clay play materials are available in this school and that water and sand play materials are available in this school. The study recommended that the school administration of ECD schools should provide adequate resources and play facilities/materials for the learners to improve on acquisition of mathematical concepts and skills.

1.0 Introduction

Globally, many states and other education agencies in the United States of America (USA) have introduced mathematics and new literacy programs for children in preschool. Educators and psychologists have created early mathematics instruction programs which are research-based (Balfanz, Greenes, & Ginsburg, 2004; Casey, 2004; Griffin, 2004; Sophian, 2004; Clements & Serama 2004; Wekeley, Klein, & Starkey, 2004). Preparing children for school is a major goal for these programs. According to the policy makers, education professionals as well as parents their main concern is mathematics performance by American children which is weaker that it should be, thus become a primary reason for their contemporary emphasis. The American children are outperformed by the East Asian children in mathematics achievement as early as Kindergarten. According to West and Denton (2002), the average academic achievement levels is lower in disadvantaged minority and low-income children as compared to those of upper and middle-income peers within the USA. Evidently, better mathematics education should be offered to the American children in general, particularly low-income children than they are offered currently. Provision of quality mathematics instruction right from preschool is one part of the solution, which can be attained through indoor play.

According to the study by Seetso, Bose and Tsamaase (2013), despite of presence of mathematics corners which are well prepared within the classrooms by the majority of preschools in Botswana, there is disparity in their usage as well as teacher uncertainty in the attempt to develop mathematics skill in children and therefore teachers are limited in scope. Also in Botswana, it is revealed that outdoor mathematics activities through play are generally preferred by preschool teachers, as the young children are curious and active; they need to discover, ask questions, explore, practice and rehearse to build ideas and concepts from their experiences. It is through play that these activities which develop a building block to learning are brought together. The opportunities for experimentation, exploration and discovery for both outdoor and indoor are planned and provided by teachers. Therefore, this calls for provision and preparation of standard national ECE curriculum for preschool teacher. However, the educator programs rendered in the country need to be reviewed urgently in order to establish the extent to which teachers are prepared for teaching mathematics Republic of Botswana, 2008).

In Kenya, teaching and curriculum methodologies are that of hominizing in an aim of easing transition of children to primary grade from kindergarten. The study by Mutero (2001), clearly shows criticism by educators on a developmentally appropriate and play-centered curriculum verses an exclusively academic curriculum in some kindergartens and preschools. In Kenya, the play relevance that may be accrued from ECDE curriculum implementation

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is mostly ignored and at risk by majority of implementers, thus leading to poor performance in later grade. Ideally, every aspect of children's learning and development is enhanced by indoor play. It nourishes every aspect of the foundation of social, intellectual, emotional and physical skills necessary for success for both in life and in school. Although indoor play forms an integral component of children's participation in indoor activities and in enhancing children's acquisition of mathematical concepts and skills, there is still some concern from Uwezo Kenya (a civil society group that monitors achievement in education). Uwezo Kenya made a sensational report about the state of affairs in Kenyan preschools, which showed that 11% of pupils in standard eight cannot solve standard two level mathematical problems; especially division. (Education News, Volume 112 of September 17th 2013- October 5th2013). Sang (2013) did a research on the effects of classroom environment on academic performance in mathematics of preschool children in Pioneer Zone, Uasin Gishu County, she also recommended on study to be carried out on the methods and techniques of teaching mathematic in pre-schools to improve pre-scholer's performance. This therefore shows that there was a gap to be studied.

2.0 Literature review

Theoretical Framework

This study was guided by Jean Piaget's theory of cognitive development in children (Piaget, 2010). In his influential theory, a series of developmental stages of play was devised that corresponded to the successive stages Ojose, 2008). The 'practice play' characterize birth to about two years old (sensor motor stage), when the focus on children is majorly on gaining mastery of external object and their own bodies, which consists of repeated patterns of sound or movement, for instance, shaking, sucking, babbling, banging, and, eventually, 'peekaboo' games in which items are made to recurrently appear and disappear. Children tend to monitor the play effects of objects on the environment through learning its properties as well as learning how to manipulate them thus, relationship with the environment gradually become systematic. Piagets theory of cognitive development is important to the study of indoor play activities since block play, clay play, sand and water play assists ECDE learners to create a view where the focus of attention is on the idea of developmentally appropriate play that assisted them in mathematical concepts and skills. This includes the availability of the environment that is the play grounds and materials that are consistent with student's mathematical concepts and skills, physical and cognitive abilities as well as their social and emotional needs.

ECE Indoor Play Materials for Enhancing Mathematical Concepts

Preschool math activities help children in developing a basic sense, and recognizing numbers of math. Thus, giving the children better understanding of ratios, measurements and other essential math concepts (Bose *et al.*, 2013). Math activities use daily examples to teach children simple calculations that aid them to remember and understand concepts better since it is used in a day to day life. Therefore, before moving children to advanced mathematical concepts, it is important to ensure they are perfectly equipped with math concepts first. Math practice should be fun for children through math activities, thus, making math practice more frequent. This could be just what is needed to raise math grades in ECE children.

Young children explore shapes and patterns, count things and compare sizes; which hold fundamental implications for their development. Six categories of contents of mathematics emerge when children are examined during free play. These are enumerating (counting, saying number words, recognizing number of objects, or writing or reading numbers), exploring, classifying magnitude (comparing and describing the size of objects), investigating dynamics (exploring motions for instance flipping, taking things apart, putting things together), exploring spatial relations (drawing or describing a direction or location), and studying shape and pattern (creating or identifying shapes or patterns, or exploring geometric properties). Therefore, the mathematics range explored throughout free play is impressive. It is evident that a rich foundation is offered during free play leading to building of interesting mathematics. Later mathematics foundation is formed with these daily experiences. Play only offers rich possibilities, but doesn't guarantee mathematical development. When teachers follow up through engaging children in representing and reflecting on the mathematical ideas that emerged from their play, there is more likelihood of significant benefits. Feuerstein (2011), explained that when children ask questions that provoke extensions, clarifications and the development of new understanding, teachers enhance their mathematical learning.

When building with blocks in block play, children tend to increase their science, math and general reasoning abilities. Children for instance show little interest in stacking. In this case, when children's spatial relationship is "on" at around one year old, they show their understanding on stacking. Children at the age of 2 place each successive block next to or on the one placed previously. Therefore, children tend to recognize that when placed in that manner, block do not fall, thus, they begin to anticipate and reflect. Children at the age of 3 to 4 years, the regularly build horizontal and vertical components within the building. Beside aiming to build a stable tower when asked to make a tall tower, they use vertically long block since their goal is to build a tall stable tower. Children at the age of four can use various spatial relations, extending to multiple directions their buildings and with several points of contact between the blocks, showing litheness in how they integrate and build parts of the structure. According to Ahmed (2010), through block play, preschoolers employ more advanced geometric concepts, at least at instinctive level, than the majority of children throughout elementary school.

Water provides an excellent environment for learning to children hence regarded as a very valuable component (Crosser, 2009). Children begin to understand how and why many things happen as they manipulate water play materials. They can experiment with concepts such as same/different, more/less, full/empty, many/few, less than/greater than, before/after, and counting (Crosser, 2009).

Seeds are also seen in ECD centers. The seeds can be used by children to do counting, sorting, ordering and matching important. These are very important concept in mathematics activities. Children can also make patterns and form shapes using seeds thus acquiring a good foundation for mathematics at an early stage. Some ECD centres have no trace of a seed in the entire outdoor play environment.

Clay is available in all the ECD centres and it is enough for children to scoop and play with it. When Children play with clay, they mould numbers and shapes. This provides a good chance for children to be exposed to mathematical experiences that they hear about during indoor mathematical activities. They can also mix the clay soil with water to make modeling clay and improve their creativity in mathematical

concepts. Children use soil symbolically in fantasy play to represent maize meal, they can measure as they cook. Fantasy play develops children's cognitive ability as they make imagination.

The availability of blocks enhances children's cognitive development in several ways. One is that they strengthen perception of space such as under below, above, inside and outside. Secondly, children develop concepts of big, little, more than, less than, equal to, longer and shorter. Thirdly, is the fact that in the process of block play children become aware of whole part relationships. Fourthly, children can classify the blocks according to shapes, sizes, colours and types. All these actions are performed by children as they manipulate blocks. These are activities that enhance mathematical concept in Early Childhood Education.

Sand is also important for ECDE centers since it enables children to be creative in measuring using small containers. Sand is also good for children to engage in filling and emptying activities. Filling and emptying will expose children to mathematical concepts namely; capacity, measurement and volume. Again, as stated earlier although children will be playing, they will be practically experiencing mathematical activities.

3.0 Methodology

Research Design

This study employed a descriptive survey research design to assess the use of indoor play in enhancing the acquisition of Mathematical concepts and skills in ECDE pupils in Eldoret West Sub-county, Kenya. Since descriptive studies not only are useful in finding the facts but also result in the formulation of important principles of solution and knowledge to significant problems, descriptive design was adopted (Orodho, 2003). The descriptive design was adopted because descriptive studies are not only useful for fact finding but often result in the formulation of important principles of knowledge and solution to significant problems It was appropriate for obtaining factual and attitudinal information. This study sought to obtain descriptive and self-reported information from ECDE teachers. This was done by visiting the sampled ECDE schools from a target population that was identified to participate in the research.

Study Area

The study was conducted in Eldoret West Sub-county of Uasin- Gishu County. In 2002, Uasin -Gishu was subdivided into three districts: Eldoret East, Eldoret North and Eldoret West. Eldoret West district is bordered by Kericho to the South, Keiyo Marakwet to the East, Nandi to the West, Trans Nzoia to the North, Kakamega to the North West and Baringo to the South East. Eldoret West Sub-county has 181 public ECD schools which are fairly equiped with learning resources to facilitate the learning process (CSO'S Office, 2013). The researcher selected the area because the acquisition of mathematical concepts and skills by pupils is not up to optimum despite the 181 ECDE centers (DEO Office, 2014).

Target Population

The target population in this study consisted of 181 public ECDE centers. According to data from the District Education Officer's (DEO) office, Eldoret West Sub-county has a total of 181 public ECDE centers with a total of 181 top class ECD teachers that are qualified to teach mathematic activities and 3620 ECDE pupils (DEO's Office, 2013). The researcher thus targeted 181 ECDE centers and 181 ECDE teachers as the target population. Through the observational checklists, the study also targeted the ECDE children intherespective schools.

Data from the DEO's office indicated that there are 3620 ECDE children in the Sub-county.

Sample Size and Sampling Procedures

The sample size of the study was arrived at by using percentages as recommended by Mugenda and Mugenda (2003). Thus, 30% of the total number of ECD schools was sampled thus yielding a sample size of 54; that is, 54 ECDE centers out of 181. The researcher selected 362pupils who represented 10% of the target population. Simple random sampling technique was used to select the sample schools and ECDE pupils. In simple random sampling technique, each member of the population had an equal chance of being selected as subject (Kombo, and Tromp, 2007). The entire process of sampling was done in a single step with each subject selected independently of the other members of the population. The researcher then purposively sampled ECDE teachers that handled the mathematics activities. Further, the researcher chose 54 top class mathematics activities' teachers from ECDE because they have the relevant information regarding acquisition of mathematical concepts and skills in ECDE.

Research Instruments

The researcher used both the questionnaires, observation schedule and observation checklist to collect data.

Questionnaire

Kothari (2007) defines a questionnaire as that consisting of a number of questions printed or typed in a definite order on a form or set of forms. The researcher constructed closed-ended and open- ended questionnaires which were administered to the targeted ECD teachers. Besides its affordability, the researcher used the questionnaire because it is free from bias since respondents have adequate time to give well thought out answers. This method is quite popular especially when survey is used, as the researcher is interested in finding out the views, opinion and attitudes of the respondents regarding the use of indoor play in enhancing the acquisition of Mathematical concepts and skills in ECD children. Such information is collected rapidly through questionnaires. In this study, the structure of the questionnaire was such that it elicited responses relevant to the study.

Observation Schedule

The observations focused on type of indoor play, materials in class, discourse among children, and the mathematical concepts attributed to each type of indoor play. There were several possibilities for recording information to help guide the observations and to make sure that the observations were consistent for all the children involved. Some recording options included the use of schedule for formative (ongoing) assessment to monitor the children's behavior and progress towards reaching stated goals. The observation schedule only indicated whether the child could accomplish the listed objectives. The great advantage of observation schedule is that they are useful ways in which teachers can build judgments about individual pupils (Kothari, 2007). There were inventory of behaviors or skills that the observer marks or checks if the pupil was seen to demonstrate them. The focus was to easily observe behaviors or skills that happen within daily routines and activities. Three pupils were observed per every class of the selected public ECD centres.

Data Analysis

Data collected was organized, coded and entered directly into Statistical Package for Social Sciences (SPSS) version 20.0. This statistical tool aided the researcher to perform summary statistics and graphical presentations of the results.

Table 1. Availability of Indoor Play Materials for Teaching Mathematical concepts and skills.

Availability of Indoor Play Materials		SA	A	N	D	SD	Total	Mean
Block play materials are available in this school	Freq	13	19	10	6	3	51	3.65
	%	25.5	37.3	19.6	11.8	5.9	100	73%
Clay play materials are available in this school	Freq	15	17	5	9	5	51	3.55
	%	29.4	33.3	9.8	17.6	9.8	100	71%
Water and sand play materials are available in this school	Freq	5	6	8	16	16	51	2.37
	%	9.8	11.8	15.7	31.4	31.4	100	47.4%
Dramatic play materials are available in this school	Freq	9	11	9	12	10	51	2.94
	%	17.6	21.6	17.6	23.5	19.6	100	58.8%
All play materials are readily available in this school	Freq	10	11	8	13	9	51	3.00
	%	19.6	21.6	15.7	25.5	17.6	100	60%

Key: SA= Strongly Agree, A= Agree, N= Neutral, D=Disagree, SD= Strongly Disagree

The analysis employed the use of both qualitative and quantitative techniques. Qualitative techniques (thematic analysis) were employed where responses from observational checklist was discussed in themes that relate to the objectives of the study. In quantitative analysis, the researcher used descriptive statistics such as frequencies, percentages and means to analyze the data.

4.0 Findings

Availability of Indoor Play Materials for Teaching Mathematical concepts and Skills, the respondents were asked to indicate the availability of indoor play materials that can be used for teaching mathematical concepts and skills. The findings are as presented in table 1;

Table 1, shows that majority (73%) of the respondents were of the opinion that block play materials are available in this school (Mean=3.65) whereas a 71% of the teachers felt that clay play materials are available in this school with a mean of 3.55. The findings show that 47.4% of the respondents held that water and sand play materials are available in this school (Mean=2.37) and 58.8% felt that dramatic play materials are available in this school with a mean of 2.94 and the remaining 60% were of the opinion that all play materials are readily available in this school.

The findings show that the teachers were positive on the availability of block play materials in the school that are used in enhancing acquisition of mathematical concepts and skills in early childhood education as indicated by a mean value of 3.65. This shows that building with blocks provides one of the most valuable learning experiences available for young children. Block play stimulates learning mathematics in all domains of development, intellectual, physical, and social-emotional and mathematical concepts and skills.

The findings are in agreement with Moomaw, (2011) views that in block play, children increase their math, science, and general reasoning abilities when building with blocks. Block play offers a rich opportunity for early mathematics and science learning and the development of social, emotional language, motor and cognitive skills. Moreover, unit blocks can be found today in most preschools, nursery schools, and some kindergartens and more infrequently they are found in the early grades, where they are usually in the guise of math manipulative; the floor blocks, literally and figuratively, have been elevated to the table, assuming an academic aura. Important concepts and skills are practiced and strengthened through block play, including length, measurement, comparison, number, estimation, symmetry, balance. Block play requires fine and gross motor skills. Blocks enhance children's problem-solving abilities, mathematics skills, and language and literacy abilities.

And constructing creations builds self-esteem and feelings of success. This shows that block play is fundamental for later cognitive success for learning math and numbers. Block Play Performance among preschoolers as a predictor of later school achievement in mathematics proved that children who play with blocks when they are three, four and five years of age will do better in math, especially Algebra in middle school.

Conclusion and Recommendations

Findings with respect to the availability of indoor play materials that can be used for teaching mathematical concepts and skills revealed that majority of the respondents were of the opinion that block play materials are available in this school whereas a significant number of the teachers felt that clay play materials are available in this school and that water and sand play materials are available in this school. It was also clear that the least of the respondents felt that dramatic play materials are available in these schools. The study recommended that the school administration of ECD schools should provide adequate resources and play facilities/materials for the learners to improve on acquisition of mathematical concepts and skills.

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