The Use of Block Plays in Enhancing the Acquisition of Mathematical Concepts and Skills in Early Childhood Education: A Study of ECD Centres in Eldoret West Sub-County, Kenya

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***Abstract:-*Children have a right to receive education, and Early Childhood Education (ECDE) should be considered part of this right. An interesting challenge in the field of early education is the use of block plays in teaching and learning of children to promote thinking and learning in many areas including mathematics. Block play activities have been identified as to have a significant impact on the acquisition of mathematical concepts and skills in Early Childhood Education. The main purpose of this study was to assess the use of Block play in enhancing the acquisition of Mathematical concepts and skills in ECDE pupils in Eldoret West Sub-county, Kenya. This study was guided by Jean Piaget's theory of cognitive development in children. The study adopted the descriptive survey research design. The target population was 181 public ECDE centres with 181 ECDE mathematics teachers and 3620 ECDE pupils. Simple random sampling technique was used to select 54 public ECDE centres and 362 pupils respectively. Purposive sampling technique was used to select 54 top class mathematics teachers. The research instruments for data collection were questionnaires, observation schedule and checklist which were validated and piloted before the use. The study findings established that the variety of shapes and sizes in block play toys enables children through construction and experiment to discover the basic structure of mathematics, under geometry and spatial sense. The study recommends that the government through the Ministry of Education needs to come up with clear policy guidelines regarding play in pre-school centers and clearly define the play activities according to the developmental stages of children. The government should enhance provision of early childhood play materials to enable pre-school children develop holistically.**

Key Words: **CSO: Curriculum Support Officer, DEO: District Education Officer, ECE: Early Childhood Education, ITERS-R: Infant/Toddler Rating Scale, MOE: Ministry of Education, NAEYC: National Association for the Education of Young Children.**

I. INTRODUCTION

According to the Universal Declaration of Human Rights and the United Nations (UN) Convention on the Rights of the Child, children have a right to receive education, and Early Childhood Education (ECE) should be considered part of this right. According to UNESCO (2005), Early Childhood Education refers to a wide range of programmes that are aimed at the physical, cognitive and social development of children from birth to about age 7 or 8. The International Standard Classification of Education (ISCED) defines ECE as comprising of programmes that offer structured, purposeful learning activities in a school or a centre (as opposed to the home) to children aged at least 3 years (OECD, 2009). Such programmes are normally held to include organized learning activities that occupy on average the equivalent of at least two hours per day and 100 days per year.

An interesting challenge in the field of Early Education is the use of play in teaching the children. If the child's environment permits it, the child can learn whatever is available to learn, and if the child permits it, the environment will teach him everything it has to teach. The child learns to move when he/she can move around, handles and manipulates objects. Teaching through play therefore means providing play activities that will engage the child activity. The play method infuses activities with learning (VLNET, 1999). In order to do this effectively, the children need materials to interact with as they play. Play (more than any other activity) has been found to fuel the healthy development of young children. Briefly defined, play is a natural, spontaneous, creative activity, voluntary and intrinsically generated activity that brings fun to children (Sandberg, 2001).In this regard, play has been considered as to provide the foundation for learning in a child's world and open the door to a world of learning opportunities. As a common adage goes; "Play is children's work. If they are successful with this first job, it will lead to further success later in life."

Indoor play activities such as block play, clay play, water and sand play, and dramatic play have been identified as to have a significant impact on the acquisition of mathematical concepts and skills in early child hood education. Young children engage in significant mathematical thinking and reasoning in their play-especially if they have sufficient knowledge about the materials they are using, if the task is understandable and motivating and if the context is familiar and comfortable. Mathematics can be seamlessly integrated with children's ongoing play and activities, but it requires a knowledgeable teacher who creates a supportive environment and provides appropriate challenges, suggestions, tasks, and language.

Therefore, in classrooms where teachers are alert to all these possibilities, children's play enriches mathematical explorations.

Globally, several states and other education agencies in the United States of America

Statement of the Problem

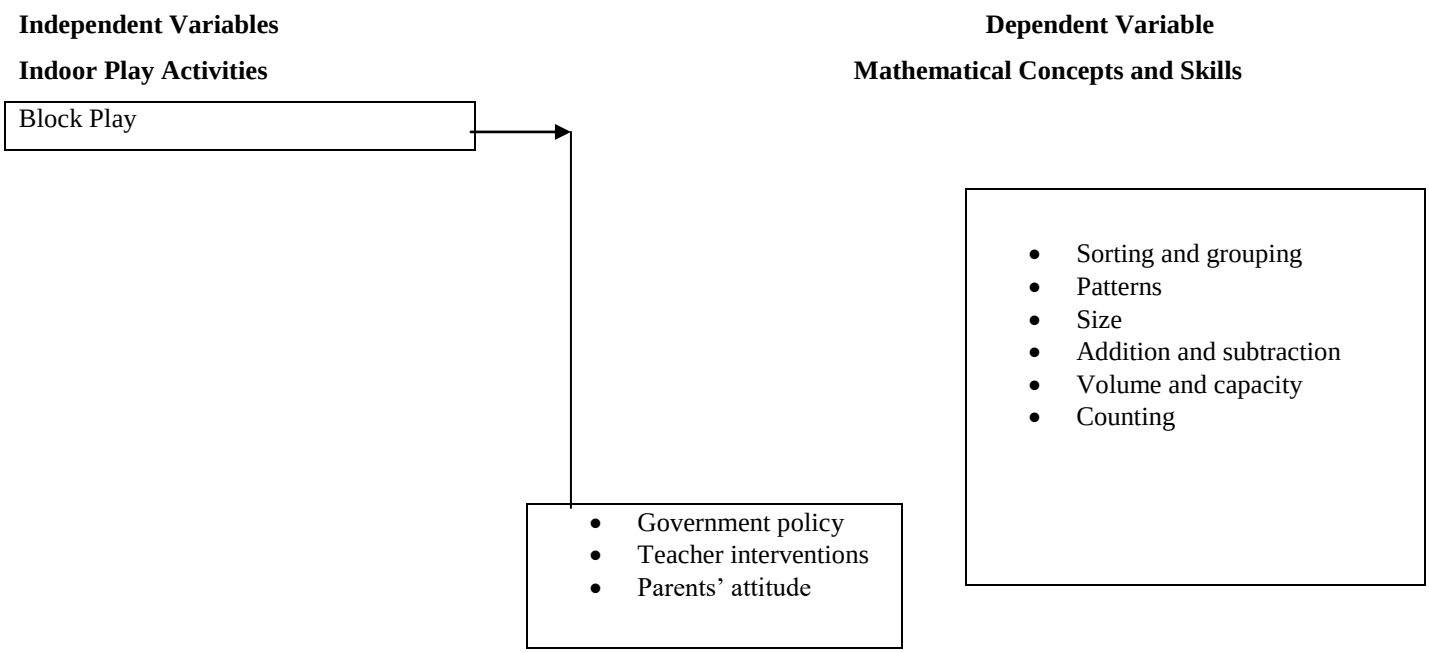
Indoor play enhances every aspect of children's development and learning. It nourishes every aspect of the foundation of intellectual, social, physical and emotional skills necessary for success both in school and in life. ECE is where learners are supposed to learn core skills in their preschool setting through the activities they undertake as indicated in the ECDE curriculum (Education News, Volume 112 of September 17th 2013- October 5th2013).

Currently, many ECE schools in Kenya are primarily engaged in outdoor play activities, such as playground activities, which are less safe for young children as opposed to the indoor play activities. ECE institutions, particularly those in rural areas are characterized by poor physical conditions showing poor maintenance which can be attributed to insufficient resources, perceived low priority, and negative attitude about children play or deferral of the activity, this study seeks to assess the use of block playin enhancing the acquisition of Mathematical concepts and skills by ECE children of ECD centers in Eldoret West Sub-county, Kenya.

Theoretical Framework

This study was guided by Jean Piaget's theory of cognitive development in children. Piaget formulated a series of developmental stages of play that corresponded to the successive stages in his influential theory (Piaget, 2008). The sensor motor stage (birth to approximately two years old), when children are focused on gaining mastery of their own bodies and external objects, is characterized by 'practice play' consisting of repeated patterns of movement or sound, such as sucking, shaking, banging, babbling, and, eventually, 'peekaboo' games in which objects are made to repeatedly disappear and reappear. As children learn more about the properties of objects and learn how to manipulate them, they begin to monitor the effects of play on their environment, and their relationship with that environment becomes increasingly systematic.

Conceptual Framework



Play and Mathematical Inquiry in ECD

Scholars have gathered a wealth of evidence that children between the ages of 3 and 5 actively construct a variety of fundamentally important informal mathematical concepts and strategies from their everyday experiences, especially during play. Indeed, this evidence indicates that they are predisposed, perhaps innately, to attend to numerical situations and problems. Thus, in the past 25 years, studies of the development of early mathematics have switched from looking at what children cannot do to what they can do. Observations of children during free play, for example, show them engaged in mathematical explorations and applications, and sometimes these are surprisingly advanced. However, the typical early childhood curriculum incorporates little in the way of thoughtful and sustained early mathematics experiences (Ginsburg, Inoue, &Seo 1999 as cited in Feuerstein, 2011).

Block play should be set up in an area that is free from other distractions and out of traffic. The type of blocks needed to meet the Environment Rating Scale for Infants and Toddlers –

Revised Edition, should be non-interlocking and at least 2 inches by 2 inches (Barbour, 2014). The ITERS-R tool suggests at least three sets of different types of blocks. Each set should contain at least 10 blocks to allow the children enough to properly explore. Accessories such as people, animals and transportation vehicles should also be available to expand play. Types of blocks recommended are light weight, hollow brick blocks, cardboard blocks, fabric blocks, hard and soft plastic, homemade and wooden and foam blocks.

The space in a classroom for block play is critical since preschoolers will be doing more constructive play where larger complex structures are made, with larger sized blocks, and many children working together. It is essential the block space is large enough to accommodate this type of play. The Early Childhood Environment Rating Scale – Revised Edition recommends the block play area should be big enough to allow at least three children to build sizable structures. Block play is more vigorous and louder than other areas in the classroom and should be located in a more active area of the classroom (Par Jane Hewes, 2010). The clay, water and sand should be located near the sink and have easy clean floor surface for easy cleaning after the activity.

Many teachers locate the block area next to the dramatic play area since both areas encourage cooperative imaginary play (BredeKamp&Copple 2009). The ECERS -R recommends the preschoolers have at least 2 different sets of blocks with 10-20 blocks in each set. Types of blocks suggested are large hollow blocks, ramps, boards, unit blocks (as many shapes and sizes as possible, wooden or foam), cardboard blocks, blocks made from boxes or milk cartons, covered with cloth or contact-paper, packing boxes boards, sticks, logs, tree-stump rounds and stumps and cardboard, metal, or plastic tubes. Accessories are also essential to allow children more imaginary play. The blocks should be stored in low open labeled shelves. The unit blocks should be labelled by shape to encourage organization, shape matching, and easy clean up. Block play is also strongly encouraged outside as there is often times more room for children to build even larger structures. The ECERS-R tool recommends a large flat surface, out of the way of traffic, with enough blocks and accessories for three children (BredeKamp&Copple 2009). .

Every dramatic play area should also include a table and chairs for children to use in role play (Kostelnik, *et al* 2009). If the play sets the teacher want for dramatic play center do not have adequate storage for play props and other materials, shelving units and storage containers can help the teacher keep everything organized (Nell & Drew, 2013). Like children, teachers also need to have spaces that are functional. Teachers need to be able to arrange and rearrange their classrooms for various class activities and supervision purposes. Classrooms that include permanent, built-in features such as lofts, playhouses, tables, benches, alcoves, and cubbies can be problematic. These types of fixed features make it difficult for teachers to create areas for gross motor activities, can cause injury in active children, or prevent inclusion of physical activities altogether (BredeKamp & Copple 2009). . Children may place materials on top of a low shelf, turn a box over or use a chair – expanding their play space beyond the table and floor (McAfee & Leong, 2010).

Block Play and the Acquisition of Mathematical Concepts and Skills in ECE Pupils

The importance of play as a recognized mode of learning for young children is clearly reflected in the history of blocks and construction toys. Educators should appreciate the central historical and contemporary use of these toys in early childhood education (Charney, Clayton &Wood, 2000). Block play is a great way to build skills that we ordinarily think of as academic or school-related. Blocks are especially beneficial when children are allowed to freely explore and manipulate the blocks in a variety of engaging ways. Children's creativity is further expanded through encouragement to make their own accessories from throw away junk items. When it comes to blocks, it's all in their imaginations (Charney et al., 2000).Examples of mathematical skills that children explore, practice, experiment and refine during opportunities with free exploration block play include: patterns, size relationships, geometry, equality and inequality, part-whole relationships, measurement, fractions, symmetry, adding, dividing, subtracting, classification, quantity, volume, and length.

Children have always built, testing their theories about the physical and social world (Stritzel, 2005). They stack units, knock them down, enclose spaces, bridge gaps, and repeat and refine ideas -often without the intervention of adults or the introduction of commercial materials. The natural world provides abundant building material: heavy stones to pile, sticky burdock to connect, green twigs to tie and weave. And children are quick to pick up discarded construction and commercial materials such as wood pieces or boxes. Purchased building blocks and construction sets afford days of open-ended play and learning.

That children's impulse to construct is inherent and connected to learning is an old idea. It can be found in the writings of Plato (429–347 B.C.), Comenius (1592–1670), and Pestalozzi (1746–1827), as well as in the work of modern thinkers such as Jean Piaget (1896–1980) (UNESCO, 2005).In 1913, Caroline Pratt, an educator who had received wood working training in Sweden, developed unit system blocks for her experimental classroom at Harley House and at the City and Country School that she helped found in New York City. She designed wood figures of family and community workers, to accompany the unit blocks. Pratt's designs, and her pioneering work on the use of blocks as a social, intellectual, and aesthetic learning tool, still resonate today (Moomaw, 2011).

In Italy, Maria Montessori (1870-1952) originated a series of blocks called 'didactic materials' based on the systematic training of the senses as a way for children to understand the world (Moomaw, 2011). She observed that children between the ages of two and six go through a period in which they are interested in the placement of objects. Montessori's sensorial

materials, used on small mats, were designed to isolate a specific attribute such as height, length, width, depth, or color. In *Spontaneous Activity in Education*, Montessori wrote, "Our sensorial material, in fact, analyses and represents the attributes of things: dimensions, forms, colors, smoothness or roughness of surface, weight, temperature, flavor, noise, and sounds. It is the qualities of the object, not the objects themselves, which are important, although these qualities, isolated one from the other, are themselves represented by objects." The materials designed by Montessori were precisely crafted and either painted with a single color or left natural. With little alteration, they are still being made for Montessori classrooms today.

Unit blocks can be found today in most preschools, nursery schools, and some kindergartens. More frequently 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. This Mathematics emphasis began in the late 1950s with the U.S. government's declaration that schools needed to improve the teaching of math and science (Moomaw, 2011). The initiative led to the development of a wide variety of manipulative and supporting educational guides, derived in part from the work of Froebel, Montessori, and Pratt -for example, Cuisenaire Rods, the Stern Apparatus, DienesLogiblocs, Unifix Cubes, and the LowenfeldPoleidoblocs.

The richness of block building was funneled into one specific area of knowledge: mathematical thinking. "The variety of shapes and sizes in Poleidoblocs G and A enables children through construction and experiment to discover the basic structure of mathematics. The range of shapes gives wide opportunities for discovering and establishing equivalencies in length, height, area, and volume, making tangible, and therefore real, what children have sofa learned only symbolically" (Moomaw, 2011). But the originators of the new manipulative also encouraged free play and exploration. Educators, developmental psychologists, designers, and manufacturers have helped develop and promote the educational value of blocks and open-ended play. Yet, except as Mathematics manipulatives, blocks are still rarely seen in classrooms beyond kindergarten. Even in many early childhood classrooms today, their full potential as learning tools is not considered.

The destructive/deconstructive activity characteristic of block play, an integral part of this activity, makes some adults uncomfortable. However, as in all learning, we cannot understand until we take apart, examine, and rebuild (Gura, 2002). Children need an environment with open-ended materials and teachers, who understand, encourage, build on, and even participate in this basic and complex mode of learning. This means having enough classroom space devoted to block play; having enough time set aside for serious and ongoing play with blocks; focusing on block work as evidenced by teachers' interaction with children through observation, documentation, revisiting structures, and sometimes participating in the play process; and having enough time for teachers to share observations with colleagues and understand how children's block play connects with the development of literacy, physical knowledge, and mathematical thinking. Conclusively, blocks have been with us for a long time -and the activity of building even longer. The rich potential of blocks as a learning tool for young children to invent and represent ideas is still a challenge for teachers today. According to Stritzel, (2005), when learners are first introduced to blocks they may learn how to hold on to them, how they feel, how heavy they are, they explore the bright colors, and begin to carry them around. Teachers help the learners in identifying blocks and accessories by proper name, shape, size, or color. Children can classify the blocks according to shapes, sizes, colours and types. All these actions performed by children as they manipulate blocks. These are activities that enhance mathematical concept in Early Childhood Education. They will experiment with how blocks may sound when they fall, or when they bang them together. Learners are able to master the different colours of blocks which include red, yellow and blue, green, purple. Concepts such as learning sizes, comparing objects by making exact matches and the order of objects are also being learned. Socially, block play contributes to their developing self-confidence, for example as they learn how to stack blocks they are proud of their success and feel a sense of accomplishment. Through block play a young child's expressive and receptive language is being expanded by learning words such as fill, dump, pick up, stack, balance, tall, and short.

Preschoolers are beginning to notice and explore more 3–dimensional objects such as cones, cylinders, cubes and prisms, (geometry). Science is also being learned through block play as children start making predictions, comparisons, experiment with cause and effect, stability and balance. Their vocabulary is also expanded by block play as they develop an understanding of spatial relations and words such as under, over, off, bottom, top, through and beside. They learn concepts such as sorting, ordering, counting, one to one correspondence, size and shape.

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. 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. According to Serem et al., (2013), a descriptive survey aims to collect information from a sample that is representative of the population as a whole, and the generalizability of the data is one of the reasons for the popularity of this approach.

II. RESEARCH METHODOLOGY

This study applied both the use of quantitative methods since it majorly focused on numerical data and qualitative methods since the checklist yields qualitative data. The quantitative data included information from the questionnaires and the qualitative data included information from the observation checklist and observation schedule.

III. DATA ANALYSIS, PRESENTATION

How Block Play Enhances the Acquisition of Mathematical Concepts and Skills

The teachers were asked to indicate how block play enhances the acquisition of mathematical concepts and skills in ECD pupils.

How Block Play Enhances the Acquisition of Mathematical Concepts and Skills

Block Play		SA	A	N	D	SD	Mean	SD
Blocks are frequently used in our classrooms right from kindergarten to lower primary	Freq	14	15	7	7	8	3.39	.825
	%	27.5	29.4	13.7	13.7	15.7		
Block play is especially beneficial when children freely explore and manipulate the blocks in various engaging ways	Freq	11	10	13	10	7	3.16	.797
	%	21.6	19.6	25.5	19.6	13.7		
The variety of shapes and sizes in block play toys enables children through construction and experiment to discover the basic structure of mathematics.	Freq	15	18	7	8	3	3.67	.806
	%	29.4	35.3	13.7	15.7	5.9		
Block play enables pupils to discover and establish equivalencies in length, height, area, and volume.	Freq	9	15	8	9	10	3.08	.805
	%	17.6	29.4	15.7	17.6	19.6		
The destructive/ deconstructive characteristic of block play makes some adults/parents uncomfortable with it	Freq	10	8	9	15	9	2.90	.912
	%	19.6	15.7	17.6	29.4	17.6		

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

The results showed that 29(56.9%) of the teachers agreed that blocks are frequently used in our classrooms right from ECD to lower primary, with 15 (29.4%) disagreed and 7(13.7%) undecided, with a mean of 3.39. At least 21 (41.2%) of the teachers agreed that block play is especially beneficial when children freely explore and manipulate the blocks in various engaging ways, with 17(33.3%) disagreed and 13 (25.5%) undecided (Mean =3.16).

Majority of the teachers 33 (64.7%) agreed that the variety of shapes and sizes in block play toys enables children through construction and experiment to discover the basic structure of mathematics with 11 (21.6%) disagreed and 7 (13.6%) undecided as indicated by a mean of 3.67. The findings also revealed that 24(47%) of the teachers agreed that block play enables pupils to discover and establish equivalencies in length, height, area and volume, with 19(37.2%) disagreed and 8(15.8%) were undecided as showed by a Mean of 3.08. At least 24 (47%) of the teachers disagreed that the destructive/deconstructive characteristic of block play makes some adults/parents uncomfortable with it, while 18 (35.3%) agreed and 9(17.6%) undecided.

The research findings showed that blocks were frequently used in classrooms right from ECD to lower primary and the variety of shapes and sizes in block play toys enables children through construction and experiment to discover the basic structure of mathematics. The block play is especially beneficial when children freely explore and manipulate the blocks in various engaging ways and block play enables pupils to discover and establish equivalencies in length, height, area and volume. The destructive/ deconstructive characteristic of block play does not make some adults/parents uncomfortable with it.

The findings agree with Ahmed (2010) views that the richness of block building was funneled into one specific area of knowledge: mathematical thinking. Young children explore patterns and shapes, compare sizes, and count things; which hold fundamental implications for their development. When children are studied during free play, six categories of mathematics content emerge. The variety of shapes and sizes in ECD schools enables children through construction and experiment to discover the basic structure of mathematics. The range of shapes gives wide opportunities for discovering and establishing equivalencies in length, height, area, and volumes, making tangible, and therefore real, what children have so far learnt only symbolically.

According to the observation checklist on the adequacy of block play, it was clear that the ECD centres have various blocks that pupils use to improve on the acquisition of mathematical concepts and skills. Block play develop children's mathematical skills and concepts during stacking, lifting and building processes. The findings on the observation checklist also revealed that adequacy of block play among ECD centers are used in arranging and counting during mathematics lessons. The learners are asked to form groups and arrange the blocks using different shapes and sizes. This showed that block play enables children to represent their ideas, knowledge and interest through different forms such as layouts, buildings, plans, sculptures and collages. Much of the children's learning was identified as scientific, mathematical, technological, and linguistic and was situated in creative,

flexible contexts that enabled them to explore the materials and their ideas and represents their thinking.

IV. SUMMARY OF FINDINGS

Block Play and the Acquisition of Mathematical Concepts and Skills

The research findings showed that blocks were frequently used in classrooms right from ECD to lower primary and the variety of shapes and sizes in block play toys enables children through construction and experiment to discover the basic structure of mathematics. The block play is especially beneficial when children freely explore and manipulate the blocks in various engaging ways and block play enables pupils to discover and establish equivalencies in length, height, area and volume. The deconstructive characteristic of block play does not make some adults/parents uncomfortable with it.

The findings are in line with Ahmed (2010) views that the richness of block building was funneled into one specific area of knowledge: mathematical thinking. Young children explore patterns and shapes, compare sizes, and count things; which hold fundamental implications for their development. When children are studied during free play, six categories of mathematics content emerge. The variety of shapes and sizes in ECD schools enables children through construction and experiment to discover the basic structure of mathematics. The range of shapes gives wide opportunities for discovering and establishing equivalencies in length, height, area, and volume, making tangible, and therefore real, what children has so far learnt only symbolically.

V. CONCLUSIONS

The objective was to investigate block play and how it enhances the acquisition of mathematical concepts and skills in ECD pupils, and it was established that the variety of shapes and sizes in block play toys enables children through construction and experiment to discover the basic structure of mathematics while a significant number of the teachers felt that blocks are frequently used in our ECD classrooms and that block play is especially beneficial when children freely explore and manipulate the blocks in various engaging ways. The findings also revealed that the least of the teachers agreed that block play enables pupils to discover and establish equivalencies in length, height, area, and volume and that the destructive/deconstructive characteristic of block play makes some adults/parents uncomfortable with it.

VI. RECOMMENDATIONS

Based on the findings, the following recommendations were made from the study;

i. School administration and parents should provide the learners with enough play space in the classroom and conducive environment.
ii. The school management should ensure that block play is extensively employed in schools to enable pupils to discover and establish equivalences in length, height, area and volume.
iii. The government through the MOE needs to come up with clear policy guidelines regarding play in pre-school centers and clearly define the play activities according to the developmental stages of children. The government should enhance provision of early childhood play materials to enable preschool children develop holistically.
iv. The supervision of ECD centers' need to be enhanced to ensure teachers allocate adequate time and play materials to pupils to enable them develop mathematical concepts and skills for holistic development of children.

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