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Does a teacher/pupil ratio influence teaching of mathematics in pre-schools?

Abstract

Mathematics games are valuable for stimulating and encouraging mathematics learning. The purpose of this study was to establish the teacher/pupil ratio and its influences to using games in teaching mathematics. The research question was how does the teacher/pupil ratio influence the teacher's use of games 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. The collected data was analyzed using descriptive statistics and where by the results are presented in form of tables. The findings indicated that the teacher/pupil ratio was a significant variable to teaching of mathematics as individual attention could not be achieved for the large classes. It was recommended that mathematics should have enough periods to accommodate the use of games in the classroom to enable teachers achieve their objectives based on acquisition of specified mathematic concepts.

Keywords: Teacher/pupil ratio, mathematics, teaching, pre-school, lengthy syllabus, enkorika zone, elangata zone, kajiado zone, bigger population, pupil, mathematical concepts

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Teacher/Pupil ratio in teaching mathematics

Past studies have revealed that children usually develop an enjoyment of mathematics and an understanding of some informal mathematical concepts prior to school.[1,2] Therefore it is the role of the teacher to build on children's informal knowledge and maintain the interest of mathematics and enjoyment of mathematics that they bring with them from home.[2] The manner in which they maintain the learner's interest and enjoyment may influence the attitude that is developed towards the subject. Additionally, developing children's mathematical skills in the early years lays the foundation for mathematics learning in their future in a comparative study of using differentiated instructions of public and private school teachers in Rawalpindi, Pakistan, noted that the use of games in teaching Mathematics is affected by overcrowded classes, lack of teacher training, lengthy syllabus and lack of motivation among pre-school teachers.[3,4]

Ng'asike[5] shows that individual attention cannot be achieved if the classes are too large. Moyles and Adam[6] claim that in developed countries the recommended teacher-child ratio is 1:10 enabling teachers to give quality and individual attention. KIE[7] state that for children below one year the teacher to child ratio should be three to four, children per teacher, for three years old children, it should be 10:15 children to one teacher, for children between 3-5 years old the ratio should be 25:30 children to one teacher and for 5:6 years old, the ratio should be 35 children per teacher. KIE[8] further suggests that the interactive discussions usually generated while playing games greatly encourage and promote children's mathematical perception and understanding. As children engage each other when playing a game, a guide is usually important to give the children directions in this case a teacher. In cases where a teacher is handling a large class, there is likelihood that he/she may not be able to observe and guide the learners effectively. However, in a relatively smaller class, the teacher is in a position to monitor, test each child, make conclusive generalisations, make decisions that are evidence based and easily evaluate how the game is being played by the different participants.

Pupils may build on their prior knowledge and form links between the game and their everyday mathematics when they are effectively guided. Few studies and reports such as those of Ng'asike,[5] Uwezo[9] respectively have been done in Kenya regarding the effects of teacher-pupil ratio on learning mathematics, however none of the few studies that was done in Kajiado County. The study sought to establish the current teacher-pupil ratio in Kajiado central sub-county and investigate how the ratio is affecting learning of mathematics in the selected schools. The findings may be of great importance to the Ministry of Education in allocating teachers to different counties.

Methods

a. 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. Through descriptive survey design, the researcher was able to describe pre-school teachers' opinions, frequency and attitudes on the use of games in teaching mathematical concepts in selected pre-schools in Kajiado County, Kenya. Kerlinger[10] points out that descriptive studies are not only restricted to fact finding, but may often result in formation of important principles of knowledge and solutions to problems. Descriptive research design also helps to collect information on people's attitudes, opinions and habits hence 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 and the independent variable was teacher/pupil ratio

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Teacher/pupil ratios:-This was measured by examining the number of pupils per class taught by one teacher during mathematic lessons.

The study was conducted in Kajiado central sub-county, Kajiado County. Kajiado Central sub-county was purposively selected as the area of the study because it has the majority of public pre-schools in Kajiado County. The purpose sampling was based on the facts that the schools in the area are public schools, they use the 8-4-4 curriculum and they have been in existence for at least one year. 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. Kajiado Central sub-county is an administrative unit in Kajiado County. 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. The choice of this area of study was ideal because it was presumed that most preschoolers had low memory in mathematical concept and poorly performed in tasks related to mathematics.

b. 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 central sub-county. 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.

c. 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.

d. Sample size

According to Kothari,[11] the required sample size for this type of study was determined using the following criteria:

e. Formula

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

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;

$n = (1.96)^2 . (0.019) . (0.981) / (0.05)^2 = 29$ (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 Kajiazo Zones). This represents 10% of the total pre-school teachers in the Sub-County. This is in accordance with Best and Kahn[12] 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).

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%

Teacher/Pupil ratios and teaching mathematics in pre schools

The study sought to find out how teacher/pupil ratios influence teaching mathematics in pre-schools. Teachers were asked to indicate their agreement with the statements related to teacher/pupil ratios and how they influenced the teacher's use of games in teaching mathematics. Table 2 summarizes the findings of the study on the basis of a 5-item Likert scale. Findings in Table 2 indicates that teachers agreed with the items as follows:" Learner's participation and active involvement is influenced by their number in class" 28(96.8%), "Managing expectations and proper presenting depends on the number of teachers available during the time" 27(93.1%), "That the more the number of teachers, the more the influence in creating opportunities for learners to practice applying game materials" 26(89.7%), "learning mathematics depends on the teachers' ability to apply games" 16(55.2%), and "Teacher/pupil ratios influence the teacher's use of games in teaching /learning mathematics" 8(27.6%). It can be deemed that all the items had high scores hence teacher/pupil ratio was significant. These study findings mean that acquisition of mathematical concepts using games could only be achieved through manageable number of learners per class. In this case, a smaller size of class enables the teacher to capture individual attention during teaching process (Table 2).

These results coincide with Ng'asike[5] who advocates that individual attention cannot be achieved if the classes are too large. Moyles and Adam[6] claim that in cases where a teacher is handling a large class, there is likelihood that he/she may not be able to observe and guide the learners effectively. However, in a relatively smaller class, the involved teacher is in a position to monitor, test each child, make conclusive generalisations, make decisions that are evidence based and easily evaluate how the game is being played by the different participants. Pupils may build on their prior knowledge and form links between the game and their everyday mathematics when they are effectively guided. Early Childhood Development Education Guidelines (1999) recommends that for children below one year the teacher to child ratio should be 3:4, for three years old children, it should be 10:15 children to one teacher, for children between 3-5 years

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old the ratio should be 25:30 children to one teacher and for 5:6 years old, the ratio should be 35 children per teacher. In a similar finding, Butt and Kausar[4] noted that the use of games in teaching Mathematics is affected by overcrowded classes, lack of teacher training, lengthy syllabus and lack of motivation among pre-school teachers.

Table 2 Influence of teacher/pupil ratios on teaching mathematical concepts

Item	F/%	Agree	Neutral	Disagree	Strongly disagree
Learner's participation and active involvement is influenced by their number in class	f	28	1	--	--
	%	96.6	3.5		
Managing expectations and proper presenting depends on the number of teachers available during the time.	f	27	--	2	--
	%	93.1		6.9	
That the more the number of teachers, the more the influence in creating opportunities for learners to practice applying game materials.	f	26	--	--	3
	%	89.7			10.4
That the teacher/pupil ratios influence the teacher's use of games in teaching mathematical concepts.	f	8	10	9	2
	%	27.6	34.5	31	6.9
That learning mathematics depends on the teachers' ability to apply games.	f	16	13	--	--
	%	55.2	44.8		

Conclusions

This study sought to find out how teacher/pupil ratios influence teaching mathematical concepts in pre-schools. The findings indicated that teacher/pupil ratio was a significant variable in teaching of mathematics as individual attention could not be achieved for the large classes. On the same, it was noted that the number of teachers was a factor of enhancing learning different and varied concepts in mathematics. Therefore, the number of teachers was a factor of enhancing learning different and varied concepts in mathematics. The size of class, size of pre-schools must be therefore given much attention towards making the use of games in teaching mathematical concepts in pre-schools reliable.

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None.

Conflicts of interest

Author declares that there is no conflicts of interest.

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