# Teacher - Pupil Ratio and Teaching of Mathematics Concepts Among primary School Grade Three Pupils in Magarini Sub County, Kenya

Esha Awadh Omar*, Mary Jebii Chemagosi (PhD), Robert J. Maneno (PhD)
*Department of Educational Psychology and Special Needs, Pwani University, Kenya*
**Corresponding author*

***Abstract:*** **Teachers have a critical role in the implementation of mathematics curriculum that has an impact on the quality of education for individuals and national future scientific development and innovation. The purpose of the study was to investigate on teacher: pupil ratio and teaching of primary school grade three mathematics concepts in Magarini Sub County, Kenya. The constructivism theory by Jean Piaget's (1973) guided the study. The study employed descriptive study design. The study had a sample of 12 head teachers and 68 teachers form a target population of 114 head teachers, 180 teachers and selected through stratified and simple random sampling technique. Data was collected by use of questionnaire, interview schedule and observation guide. A pilot study from the neighbouring Malindi Sub County was employed to as certain the instruments validity and reliability. Quantitative data was analysed using descriptive statistics; frequencies, means and standard deviation and findings presented in form of tables. Qualitative data was analysed in prose and narrative. The study established thatmost primary schools have a high teacher: pupil ratio that affects the teaching and acquisition of mathematics concepts among grade three pupils.Analysis of Variance (ANOVA) establisheda mean differences between teacher: pupil ratio and the teaching of primary schools pupils grade three mathematics concepts that were statistically significant; implying that teacher: pupil ratio has an influence on pupils acquisition of mathematics concepts. The study recommended that teacher training colleges should emphasize on equipping teachers with required skills, knowledge and attitude in order to improve their professional efficiency and to enable grade three pupils to acquire the desired mathematics concepts. The study suggested a further study to be conducted at other levels of learning on factors affecting performance of mathematics.**

***Key words:*** **Grade three level, mathematics concepts, primary school, teacher-pupil ratio**

## I. INTRODUCTION

In 2003, the Government of Kenya introduced the Free Primary Education (FPE) and brought on board over one million children public primary schools. Consequently, the high enrollment in schools stretched class size to more than 80 pupils' in public primary schools (Ngware, Oketch, & Ezeh, 2011).According to Tagliacollo, Volpato and Pereira(2010) increases in class size negatively influence students' performance. Similarly, stakeholders' expectations on teachers to assist learners to yield better academic performance remain despite increase class size. This is premised on the general assumption that a lower teacher-pupil ratio results in improved pupils academic outcomes in schools.

According to UNICEF (2009) the quality of successful schools manifests to collegial relationship between pupils and teachers, thereby promoting social competencies. In a nutshell, quality schools are associated with adequate time and instructional materials, efficient teaching and learning and, appropriate methodological approaches and teacher's competencies (UNESCO, 2012).

Chingos (2012) established that in Sweden, a reduction in teacher: students' class ratio at grade four to six aged from 13-16 years manifests to increase in mathematics performance with standard deviation of 0.023 to 0.033. Likewise, in France, some studies established a positive relationship between low teachers; pupil ratio and learners performance at both elementary and secondary grade levels (Gary-Bobo, & Mahjoub, 2013). However, in USA a study on teacher: pupil ratio from kindergarten to third grade level established a minimal relationperformance resulting from a small teacher: pupil ratio (Fredriksson, Öckert, & Oosterbeek, 2013).

A study by O'Sullivan (2006) in Ugandan on effectiveness of primary schools determinants of classroom equipment, size of classrooms, teacher-pupil ratio and appropriateness site for playground and latrines in relation to the school's readiness for the child's admission. O'Sullivan (2006) established though important they may be, most primary schools in Uganda lack these key determinants that affect children readiness to learn. Thus, most primaryschools in Uganda are not conducive enough to facilitate effective transition and learning in grade one. However, the present study focus on effectiveness of classrooms in determining grade three children acquisition of mathematics concepts.

A study conducted by Wekesa (2010) on school factors affecting the performance of mathematics at the KCSE in Kenyaestablished that schools with a small student-teacher ratio produced better academic outcomes. However, the study also found out that high student-teacher ratio did not necessarily affect students mathematics performance as some of the schools performed extremely well in national mathematics performance (Wekesa, 2010).

A study by Okwach and Odipo (1997) noted that a high and low teacher-pupil ratio could result to inefficiency in teacher performance. A low pupil enrollment could lead to under-performance of teachers besides other related resources that are common in most Kenyan primary schools. However, the quality of teachers is a matter of great concern in comparison to quantity. According to Kinyanjui (1979) the character of teachers in schools constitutes key inputs with immense influence on the outputs.

Kiptum (2018) established that with introduction of FPE, most primary schools in Kenya faced challenge of improved KCPE achievement emanating from teacher development, overcrowded infrastructure, lack of pupils' sitting and wring facilities, high enrollment and teacher workload, teacher understaffing and imbalancepupil-teacher ratio.With the introduction of Free Primary School education in Kenya, the enrollment increased in 2002 from 5.8 million to 7.2 million in 2003 and 10.1 million in 2019. In spite of this, the teaching staff is still low cope-up with the increasing enrollment (MOEST, 2019). According to Bold, Kimenyi, Mwabu and Sandefur (2010) assert that some rural schools experience an enrollment of 100 pupils and 120 pupils in urban slum areas which had effect on teacher-pupil interaction and little attention on slow learners.

*1.2 Statement of the problem*

Low performance in mathematics activity is of great concern to most children and stakeholders. Its importance is realized when employment opportunities arise with parents eager to see their children succeed in the activity area. Thus, all children need to acquire the required mathematics concepts at early years of learning in order to improve their self-fulfillment and quality of life. This can only be achieved with appropriate teacher: pupil ratio which seems to hinder the realization of mathematics concepts among grade three pupils in Magarini Sub County.

*Research objective*

The study had the following objectives

i. To find out influence of teacher: pupil ratio on grade three pupils acquisition of mathematics concepts
ii. To establish whether significant differences exist between teachers: pupil ratio on grade three pupils acquisition of mathematics concepts.

## II. THEORETICAL FRAMEWORK

The study employed the constructivism theory by Jean Piaget's (1973). The theory stipulates that acquisition of skills and knowledge entails active relationship between learner's hereditary knowledge content and the surroundings. The constructivism theory emphasize on child-centred approach. Teachers are viewed as facilitators of learners active participation during the teaching and learning process. Thus, pupil interaction with appropriate teacher: pupil ratio enables grade three acquisitions of basic mathematics concepts.

## III. METHODOLOGY

The study employed descriptive study design. The target population was 294 that included 114 head teachers and 180 teachers. Based on Mugenda and Mugenda (2003) postulation that 10% to 30% of the target population is ideal for a representative sample, the final study had 80 participants (12 head teachers and 68 teachers) selected for the actual study. Stratified random sampling technique was used to sample schools in which simple random technique was applied to select teachers sample for the study. Purposive sampling techniquewas used to select head teachers for the study. Data was collected from teachers questionnaire, headteachers interview guide and observation guide administered by the researcher. A pilot study from the neighbouring Malindi Sub County was employed to ascertain the strength and weaknesses of the study instruments in order to inform the final revision before the actual study. The instrument validity was ascertained by face and content validity. Split-half technique informed instruments reliability. Quantitative data was analysed using descriptive statistics, mean and standard deviation and findings presented in tables. Qualitative data was analysed in narrative and prose form.

Table 1.1: Gender of respondents

| Gender | Female | | Male | |
|---|---|---|---|---|
| | frequency | percentage | frequency | percentage |
| Head teachers | 4 | 33.3 | 8 | 66.7 |
| Teachers | 49 | 72.1 | 19 | 27.9 |

It can be observed from Table 1.1 that majority of grade three teachers are female. This may be attributed to their motherly tender care, perseverance and lovely approach to teaching of mathematics concepts to young children in contrast to male gender who prefer teaching upper primary class levels.

Table 1.2: Teacher qualifications

| Certificate | Diploma | Degree | Master's degree | Total |
|---|---|---|---|---|
| 31 (45.6%) | 29 (42.6%) | 6 (8.8%) | 2 (2.9%) | 68 (100.0%) |

It is concluded from Table 1.2 that most grade three teachers 31 (45.6%) possess professional certificate qualification and closely followed by diploma qualification 29 (42.6%). This implies that all the grade three teachers are professionally qualified to teach mathematics concepts.

*Teacher: pupil ratio and teaching of mathematics concepts at grade three levels*

Teachers were asked to provide their responses on teacher: pupil ratio and teaching of mathematics concepts at grade three levels. The response was based on a 4-point Likert scale of 4= strongly agree, 3= agree, 2= disagree and 1= strongly disagree. Teachers response was collapsed in two groups of either agree [strongly agree and agree] or disagree[strongly disagree and disagree]. The findings were further calculated

using mean in which a mean of ≤ 2.3= was considered disagree and a mean of ≥ 2.4 considered agree.

Table 1.3: Teachers response on teacher: pupil ratio and teaching of mathematics concepts

| Item | SA | A | D | SD | Mean | Std.dev. |
|---|---|---|---|---|---|---|
| Teacher: pupil ratio my class is below 1:40 | 0 0 | 09 | 31 | 28 | 1.7206 | .68775 |
| Teacher: pupil ratio in my class is between 1:41 to 1:59 | 18 | 28 | 12 | 10 | 2.7941 | 1.00088 |
| Teacher: pupil ratio my class is above 1:60 | 14 | 22 | 13 | 19 | 2.4559 | 1.11213 |
| Classroom furniture is adequate enough to facilitate the teacher: pupil ratio | 04 | 16 | 38 | 20 | 2.0294 | .86336 |
| The classrooms are adequate enough to allow to facilitate the teacher: pupil ratio | 03 | 15 | 29 | 21 | 1.9559 | .76165 |
| Adequate teacher: pupil ratio allows teacher efficacy during teaching and learning of mathematics concepts | 07 | 11 | 31 | 19 | 2.0882 | .92616 |
| A high teacher: pupil ratio result in better pupils mathematics achievement | 11 | 13 | 22 | 22 | 2.1912 | 1.06865 |
| A low teacher: pupil ratio result in declining pupils mathematics achievement | 15 | 19 | 18. | 16 | 2.4853 | 1.08576 |

It can be deduced from Table 1.3 that most teachers 31 [mean= 1.7, std.= .86336.] disagree that their schools have a teacher; pupil ratio of less than 1: 40.Most head teachers reported that their classes are over-enrolled with limited staff establishment to bring out meaningful learning. This implies that teachers have a heavy workload which is likely to produce low academic achievement. A survey observation indicated presence of pupil indiscipline during the learning process due to teachers' inability to contain the high pupils' enrollment. This confirms a study by Wekesa (2010)whose finding established that schools with a small student-teacher ratio produced better academic outcomes.

On flip flop, majority teacher 46 [mean= 2.7, std. =1.00088] indicated teacher: pupil ratio of between 1:41 and 1:59 with another teachers perception 36 [mean= 2.4] indicating a teacher: pupil ratio of above 1:60.Some head teachers noted that their schools had an enrollment of up to 90 pupils in a class that strained teacher's efficiency during teaching of mathematics. However, a few head teachers suggested that some learners had developed a negative attitude towards mathematics activity as manifested in secondary schools dismissal students'performance in mathematics. The observation established overcrowding and instances of teacher absenteeism and shortage that result in some classes not being idle without lessons. This manifests in poor mathematics performance as a result of lack of adequate and efficient staff establishment. The finding is inconsistence with Chingos (2012) who noted that in Sweden, a reduction in teacher: students' class ratio at grade four to six aged from 13-16 years manifests to increase in mathematics performance with standard deviation of 0.023 to 0.033.

On item of classroom furniture, majority of the teachers 58 [mean= 2.0, std. = .86336] disagree that their classes have adequate desks, chairs and tables. Most head teachers agreed that the Free Primary Education funding is inadequate to provide enough desks, chairs and tables for the pupils given that parents involvement in school infrastructural development is limited. In some schools pupil were cited sitting on floors while others resorted to standing during the teaching and learning process. This is likely to enhance detrimental acquisition of mathematics concepts because pupils manifests in negative attitude and lack of motivation. The finding agree with Tagliacollo et al., (2010) who assert that increase in class size negatively influenced students' performance.

In a nutshell, majority of teachers 40 [mean= 1.9, std. = .76165] disagreed that their schools have adequate classrooms to facilitate effective teacher interactions with the learners. An excerpt from one of the head teachers had this to say *"After the inception of FPE in 2003, school infrastructural set up was taken over by the Ministry of Education and Constituency Development Fund (CDF) that in itself is inadequate. Similarly, there is no clear policy on the allocation of funds in schools because everything is left at the mercy of the local Member of Parliament who determines the CDF allocation (Head teacher, 4)."*It was observed that most schools had inadequate classrooms. This led to congestion and ineffectiveness to classroom teaching and learning of mathematics concepts. The aforementioned is in agreement with O'Sullivan (2006) who noted that most primary schools in Uganda do not have classroom environment facilitate effective transition and learning in grade one.

Another teacher's perception 50 [mean= 2.0, std. = .92616] disagree that adequate teacher: pupil ratio allows teacher efficacy during teaching and learning process.A further probing from head teacher 6, stated *"Teacher personal attitude, personality, commitment and competencies is more important to pupils effective teaching and learning of mathematics concepts than the teacher: pupil ratio."* This implies that teacher personal characteristics play a pivotal role in enhancing effective class facilitation of mathematics concepts. According to Kinyanjui (1979) the character of teachers in schools constitutes key inputs with immense influence on the students' outputs.

Most teachers 44 [mean= 2.1, std. = 1.06865] are of contrary opinion that a high teacher: pupil ratio result in better pupils' mathematics achievement. This may be attributed to teacher's attitude, motivation and good learning environment that could lead to effectiveness in the teaching of mathematics concepts rather than the teacher; pupil ratio.Teaching and learning of mathematics concepts can best be achieved via modeling pupils' motivation and creativity by classroom effectiveness with natural and social environment. This is in line with UNESCO(2012) that quality schools are associated with adequate time and instructional materials, efficient teaching

and learning and, appropriate methodological approaches and teacher's competencies).

Half of the teacher response 34 [mean= 2.4, std. = 1.08576] are neither in agreement or disagreement that low teacher: pupil ratio result in declining pupils' mathematics achievement.An oral conversation with head teacher 2, revealed the following explanation *"Some schools have good infrastructural facilities and a low teacher: pupil ratio of 1:20 but pupils are unable to master basic mathematics competencies at grade three and Kenya Certificate of Primary Education (KCPE) national examination performance."*This implies that teacher: pupil ratio may not only influence pupils' acquisition of mathematics concepts but may also be influenced by other related characteristics resulting from family factors, teachers, government policy, pupils and school administration and management. This agrees with Fredriksson, Öckert and Oosterbeek (2013) that established teacher: pupil ratio from kindergarten to third grade level having a major relation on performance resulting from a small teacher: pupil ratio. Kiptum (2018) further established that established that with introduction of FPE, most primary schools in Kenya faced challenge of improved KCPE achievement emanating from teacher development, overcrowded infrastructure, lack of pupils' sitting and wring facilities, high enrollment and teacher workload, teacher understaffing and imbalance pupil-teacher ratio.

The study also sought to determine whether significant differences existed between teachers: pupil ratio and teaching of primary school grade three mathematics concepts. The finding indicated F Value of 78.915 and sig. =0.000 less than .05 as shown in Table 1.4.

Table 1.4: Teacher: pupil ratio and acquisition of mathematics concepts

ANOVA [a,b]

| Source | Sum of squares | df | Mean square | F | Sig |
|---|---|---|---|---|---|
| Regression | 72.315 | 12 | 6.026 | 78.915 | .000 |
| Residual | 4.200 | 55 | .076 | | |
| Total | 76.515 | 67 | | | |

a. Dependent variable: Mathematics concepts
b. Mode: (Intercept), Below 1:40, between 1:40 & 1:60, above 1:60, furniture, classroom, efficacy

Table 1.4 shows that the mean differences between teacher: pupil ratio and teaching of primary school grade three mathematics concepts were statistically significant; implying that teachers: pupil ratio has an influence on pupils acquisition of mathematics concepts.

## IV. CONCLUSION

The findings showed that most schools lack adequate furniture and classrooms to enable efficient teacher: pupil ratio to result in effective classroom teaching and learning process. Similarly, most primary schools have a high teacher: pupil ratio that affects the teaching and acquisition of mathematics concepts among the pupils. The study further established that a high teacher: pupil ratio cannot result to improved acquisition of mathematics concepts.

## V. RECOMMENDATION

i. The Teachers Service Commission (TSC) should ensure an equal teacher: pupil ratio in all public primary schools to facilitate the teaching and acquisition of mathematics concepts among the pupils.
ii. The Ministry of Education and TSC should ensure a fair involvement of female gender in administrative positions in order to serve as a motivating factor to female learners in educational achievement and self-fulfillment.

*Suggestion for further study*

i. The study suggested a further study to be conducted at other levels of learning on factors affecting performance of mathematics.
ii. A similar study to be conducted on teacher: pupil ratio and acquisition of mathematics concepts in private primary schools in order to have a comparative view on the findings of the current study.

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