

THE INFLUENCE OF TEACHERS' ACADEMIC QUALIFICATIONS ON PUPILS' NUMERACY PERFORMANCE IN ARUSHA CITY COUNCIL, TANZANIA

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ABSTRACT

The main objective of this study is to examine the influence of teachers' academic qualifications on pupils' numeracy performance in public-owned primary schools. Specifically, the study examined the relationship between teachers' level of education and pupils' numeracy performance. The population of this study included grade three pupils and early-grade teachers from 167 primary schools of the Arusha city council. The sample size of 1992 (30 teachers and 1962 pupils) respondents from 30 publicly-owned primary schools were involved in this study. Thus, the primary data were collected using questionnaires and numeracy tests. The correlation analysis indicated that there was a low negative correlation ($r = -0.397$, $p < 0.05$) between teachers' level of education and pupils' numeracy performance. That is, the higher the teacher's level of education, the lower the pupils' numeracy performance, and vice versa. The study further recommended that the government continue hiring teachers with Certificate and Diploma certificates to teach numeracy in early-grade classes as their qualifications positively influence the pupils' numeracy performance. However, teachers with higher academic qualifications must be exposed to the subject content and pedagogies to positively impact pupils' numeracy performance in the future.

Keywords: Qualification, Numeracy, Academic Qualifications, Teachers, Tanzania.

INTRODUCTION

This article examines the influence of teachers' academic qualifications on pupils' numeracy performance in the public-owned primary schools in Arusha city council in Tanzania. It consists of the following sections: the background of the study, the methodology, the results, and the conclusion.

LITERATURE REVIEW

Mathematics and numeracy are regularly used interchangeably in school and out-of-school environments. They are considered to be similar in meaning as no consensus on the definition of mathematics prevails, even among professionals (Yadav, 2017). However, Yadav (2017) defines mathematics as the scientific study of quantities, including their relationship, operations, and measurements expressed by numbers and symbols. Similarly, Kitta (2004) considers mathematics as the language that helps us to describe ideas and relationships drawn from the environment. Mayor (2009) supported that mathematics is the science of numbers and shapes. Mathematics as per literature demonstrated is a scientific discipline of reasoning and computations that comprises the study of numbers, quantities, and shapes.

On the other hand, numeracy is defined as the capacity, confidence, and disposition to use mathematics (O'Keeffe and Paige, 2021). This indicates that numeracy is the ability to use mathematics to meet our demands in different contexts such as school, home, work,

community, and civic life. Numeracy is further referred to as the capacity to use mathematics to interpret information or to solve practical problems, and apply mathematical knowledge appropriately in a context where people have to use mathematical reasoning processes (Stephens, 2009). Stephens added that there is a need to choose mathematics that makes sense in particular circumstances, make assumptions to resolve ambiguity, and judge what is reasonable. Hornby (2000) added that numeracy is a basic knowledge of mathematics, the ability to understand and work with numbers. Moreover, Mayor, (2009) defines numeracy as the ability to do calculations and understand simple mathematics. All these indicate that the basic numeracy skills consist of comprehending fundamental arithmetic operations such as addition, subtraction, multiplication, and division.

There is no doubt that numeracy performance in early grades or early childhood years adequately predicts later mathematics performance in upper grades (Jordan, Glutting, and Ramineni, 2010). This is simply because it lays a strong foundation for pupils' better mathematics performance in upper classes. However, the performance of mathematics in many countries is not impressive. There are notable regional disparities in mathematics performance. For example, students in many African and Latin American countries tend to score below the international average on both the Program for International Student Assessment (PISA) and International Mathematics and Science Study (TIMSS) assessments. Factors contributing to these disparities include differences in educational resources, teacher quality, socioeconomic status, and access to early childhood education (UNESCO, 2017). For instance, the 2019 TIMSS results showed that South African students scored an average of 374 at the fourth-grade level, significantly lower than the international average (Mullis et al., 2020).

In Kenya for example, in many public schools, achievement in mathematics remains dismal despite its role in career choice and day-to-day application in decision-making. The mathematics results for the Kenya Certificate of Secondary Education (KCSE) in the 2015 examinations indicate that the overall performance was below 50% nationally (Ochieng et al., 2017). While mathematics performance in Kenya lags behind relative to other subjects, gender disparity persists, male students perform better in mathematics compared to their female counterparts (Amunga & Musasia, 2011). In Uganda, students consistently perform poorly in the subject, which makes Uganda lose its economic advantage over other countries (Kiwauka et al., 2015). Similarly, the study done by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) conducted in 2005 and 2013 indicated that 80% of 1,000+ South African learners who participated in standardized mathematics tests did not demonstrate the acquisition of mathematical skills needed (Rademeyer, 2014).

Tanzania faces the same challenge as other countries. According to the study conducted by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) in 2013 Tanzanian students' performance in mathematics was below the regional average. Only 35% of grade 6 students achieved the minimum competency level in mathematics, and only 7% achieved the desirable competency level (SACMEQ, 2013). Likewise, the Basic Mathematics performance of the Certificate of Secondary Education Examination (CSEE) for the last six years from 2017 to 2022 issued by the National Examination Examinations Council of Tanzania (NECTA) was low (NECTA, 2017 – 2023) Statistics show that on average only 19.83% managed to pass Basic Mathematics, this means 80.17% of candidates failed on average. Table 1 provides a clear picture of the performance over the years.

The NECTA (2023) reported that candidates who scored low marks in the 2022 Basic Mathematics examination faced various challenges including the inability to: recall and apply

correct formulae, rules, theorems, properties and postulates, formulate mathematical inequalities, expressions and equations from word problems, use appropriate procedures when performing calculations and failure to sketch and interpret figures, graphs and diagrams correctly. This situation needs to be addressed through workable strategies which must be implemented by teachers and students themselves. But teachers and students cannot achieve this alone without the support of school administrations, parents, and the community at large. The performance of mathematics in the Primary School Leaving Examination (PSLE) in Tanzania is much better compared to CSEE (NECTA, 2017 – 2023). Statistics show that 59.35% of the candidates who did their Primary School Leaving Examination (PSLE) passed Mathematics on average from 2017 to 2023 (NECTA, 2017 – 2023). Despite the good performance, 40.65% of the candidates failed Mathematics on average as shown in Table 1 (NECTA, 2017 – 2023). However, NECTA (2024) reported that candidates' poor performance in Mathematics in 2023 was caused by several factors such as candidates' failure to: perform correctly mathematical operations, apply formulae for finding areas, circumference, and volume of different figures; and formulate mathematical expressions or equations from word problems as well as converting different metric units of measurements.

Table 1: Overall CSEE and PSLE mathematics performance

| YEAR | CSEE | | PSLE | |
|----------------------------|--------------|--------------|--------------|--------------|
| | PASS | FAIL | PASS | FAIL |
| 2023 | - | - | 48.83 | 51.17 |
| 2022 | 20.08 | 79.92 | 59.29 | 40.71 |
| 2021 | 19.54 | 80.46 | 57.63 | 42.37 |
| 2020 | 20.12 | 79.88 | 64.64 | 35.36 |
| 2019 | 20.03 | 79.97 | 64.97 | 35.03 |
| 2018 | 20.02 | 79.98 | 66.02 | 33.98 |
| 2017 | 19.19 | 80.81 | 54.10 | 45.90 |
| Average Performance | 19.83 | 80.17 | 59.35 | 40.65 |

Source: NECTA (2017 – 2023)

The statistics of mathematics performance in CSEE and PSLE from NECTA show that the performance of the subject is not satisfactory nationally (NECTA, 2017 – 2023). Uwezo (2013) revealed that out of every 10 standard 3 pupils, only 4 (40%) could manage to perform standard 2 multiplication. This implies that some of the pupils proceed to the subsequent classes without mastering some, if not all the required competencies. This raises a concern about how early-grade pupils are prepared to the extent that they can learn mathematics at all levels of education. Uwezo did another study in 2015 which revealed that one of the critical factors affecting mathematics performance in Tanzania is the quality of teaching as many teachers lack sufficient training in mathematics pedagogy (Uwezo, 2015).

According to Bloom et al (1956), learning is hierarchical as it starts from simple to complex things. Based on that, it's so hard for a pupil to perform well in mathematics in upper classes without mastering basic arithmetic operations (numeracy) in early grades. At the same time, the role of teachers is unavoidable in facilitating the pupils' learning process. Leigh and Mead (2005) added that the knowledge and skills of teachers are the most important factors influencing children's learning. Similarly, Adeyemo (2005) insisted that teacher characteristics influence teaching and learning in classrooms, and therefore affect learners' performance.

Some scholars argue that student performance is a function of student effort, attitudes, interest in the subject, and intellectual capabilities as well as the attributes of the teacher (Wayne & Youngs, 2003). Concerning teachers' roles in student achievement, there are various attributes or standards required in the teaching profession. Some of those attributes include educational

qualification, training, professional development, and work-related experience (Wayne & Youngs, 2003). Based on these attributes the researcher paid attention to teachers' education level. The focus is on this attribute as it is one of the aspects that is highly considered for the employment of teaching staff in Tanzania (Ministry of Education, Science and Technology, 2023).

METHODOLOGY

This study was done in Arusha city council in Tanzania. Arusha city council was purposively selected among other districts of the Arusha region which are Meru, Arusha Rural, Monduli, Ngorongoro, Longido, and Karatu. It was selected due to the highest performance of its primary schools in the region and is easily accessible. Twenty-two (22) wards from which 30 schools were involved in this study were randomly selected. The 22 wards are Baraa, Daraja Mbili, Elerai, Engutoti, Kaloleni, Kati, Kimandolu, Lemara, Levolosi, Moshono, Murieti, Ngarenaro, Olasiti, Olorieni, Olasiti, Olumoti Osunyai, Sekei, Sinoni, Sombetini, Terati, Themi, and Unga Ltd. Generally, this study employed simple and stratified random sampling to determine the sample size in the area of the study. The numeracy teachers and pupils of grade III were randomly selected on a stream basis.

Population and sample size

All 167 primary schools of Arusha city council both publicly and privately owned were subjected to this study. These schools were stratified in terms of their ownership whereby 51 are publicly-owned and 116 are privately owned. Given that, this study was done in publicly-owned schools; 30 schools which is equivalent to 59% were randomly selected out of 51 schools. The schools chosen came from 22 wards out of 25. In every school, only one teacher was randomly chosen among those teaching numeracy in the early grades. Therefore, 1962 pupils and 30 teachers of early grades from 30 public primary schools were involved in this study. This makes a sample of 1992 participants as shown in Table 2.

Table 2: Number of participants by schools

| Wards | Name of School | Teachers | Pupils | Sub. Total n (%) | |
|--------------|----------------|----------|--------|------------------|----------|
| Baraa | Baraa | 1 | 68 | 69 (3.5) | |
| Daraja mbili | Daraja mbili | 1 | 70 | 71 (3.6) | |
| Elerai | Elerai | 1 | 72 | 73 (3.7) | |
| | Azimio | Burka | 1 | 84 | 85 (4.3) |
| | | | 1 | 49 | 50 (2.5) |
| Engutoti | Engira | 1 | 51 | 52 (2.6) | |
| Kaloleni | Makumbusho | 1 | 53 | 87 | 54 (2.7) |
| | Kaloleni | 1 | | 88 (4.4) | |
| Kati | Meru | 1 | 1 | 82 | 83 (4.2) |
| | Uhuru | | | 64 | 65 (3.3) |
| Kimandolu | Kimandolu | 1 | 73 | 74 (3.7) | |
| Lemara | Lemara | 1 | 62 | 63 (3.2) | |
| Levolosi | Levolosi | 1 | 50 | 51 (2.6) | |
| Moshono | Moshono | 1 | 53 | 54 (2.7) | |
| Murieti | Murieti | 1 | 53 | 54 (2.7) | |

| | | | | | | |
|-----------|--------------|-----------|---|-------------|----|-------------------|
| Ngarenaro | Ngarenaro | 1 | 1 | 73 | 64 | 74 (3.7) |
| | Mwangaza | | | | | 65 (3.3) |
| Olasiti | Olasiti | 1 | | 54 | | 55 (2.8) |
| Olorieni | Olorieni | 1 | | 55 | | 56 (2.8) |
| Olumoti | Magereza | 1 | | 55 | | 56 (2.8) |
| Osunyai | Osunyai | 1 | | 60 | | 61 (3.1) |
| Sekei | Sanawari | 1 | | 67 | | 68 (3.4) |
| | Naura | 1 | | 55 | | 56 (2.8) |
| | Kijenge | 1 | | 75 | | 76 (3.8) |
| Sinoni | Ukombozi | 1 | 1 | 62 | | 63 (3.2) |
| | Sinoni | | | 77 | | 78 (3.9) |
| Sombetini | Sombetini | 1 | | 63 | | 64 (3.2) |
| Terati | Maweni | 1 | | 59 | | 60 (3) |
| Themis | Themis | 1 | | 69 | | 70 (3.5) |
| Unga ltd | Unga ltd | 1 | | 103 | | 104 (5.2) |
| | Total | 30 | | 1962 | | 1992 (100) |

n is the number of respondents

Data collection tools

This study was quantitative and therefore, it involves primary data. These data were collected from 1992 respondents using questionnaires and numeracy skills tests. The questionnaires were used for teachers while the numeracy test was used for the grade three pupils.

Data analysis

The quantitative data collected were analyzed descriptively and inferentially. Descriptive analyses were done using a spreadsheet in Microsoft Office 2020 in which tables and graphs were generated. Also, measures of central tendencies were calculated. Inferential analysis was conducted to determine the correlation between the independent variable (*teachers' level of education*) and the dependent variable (*pupils' average numeracy performance*). The Spearman rank-order correlation was employed to determine the direction and magnitude of the relationship between the variables. The analysis was run with the help of a statistical package for social sciences version 21.0 (SPSS V.21.0) software.

Validity and Reliability

In this study, validity was enhanced by establishing the content of teachers' questionnaires which reflected the stated objective. The questionnaires were thoroughly reviewed by colleagues and other academicians to ensure they reflected the objective the study and that improvements were made. The numeracy test for standard three pupils was set under the guideline of standard two pupils' syllabus and textbooks. The test was set by numeracy teachers from the schools which were excluded from this study. Then, it was moderated by a teacher who is an expert in this area. The Researcher further ensured that the content of the instruments (questionnaires and tests) was presented in a language that the respondents understood. Moreover, a pilot study was done in two public primary schools to test the designed instruments.

The pilot study was done in a population with similar characteristics in Moshi (Rural) in Kilimanjaro region. These similarities are based on the age of pupils which was 8 to 9, and the learning environment. Thereafter the results from the pilot study were compared with those

obtained from the area of study to measure the consistency. The reliability was also calculated using Cronbach's alpha which is the model of internal consistency (repeatability) of a questionnaire based on the average inter-item correlation. The results of the test are displayed in Table 3.

Table 3: Cronbach's Reliability Test

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | No. of Items |
|------------------|--|--------------|
| 0.755 | 0.551 | 11 |

The results shown in Table 3 on Cronbach's reliability test was 0.755. The questionnaire was therefore used for the study because the alpha coefficient (α) was greater than 0.6 which indicates a high level of internal consistency of a scale. This complied with a recommendation that for an instrument to be used Cronbach's alpha (α) must be at least 0.6 (Creswell, 2012).

RESULTS

Table 4 provides a detailed summary of the characteristics of one thousand nine hundred ninety-two (1992) respondents involved in this study.

Table 4: Respondents demographic characteristics

| Respondents | Gender | | Sub Total n (%) |
|--------------|----------------------|-------------------|--------------------|
| | Female/Girl n (%) | Male/Boy n (%) | |
| Teachers | 20 (66.7) | 10 (23.3) | 30 (100) |
| Pupils | 1060 (54) | 902 (46) | 1962 (100) |
| Total | 1080 (54.2) | 912 (45.8) | 1992 (100) |

n is the number of respondents

Table 4 shows that 66.70% of the teachers who participated in this study were females and 23.30% were males. Similarly, 54% of the pupils involved in this study were girls and 46% were boys. The data show that most teachers who teach early grades in the selected schools are females. The same scenario was noted for pupils as the majority of enrolled pupils were girls. These data imply that female teachers prefer teaching early grades probably because they are good caretakers, the societal expectation for women to be more involved in early childhood education, or greater job satisfaction and fulfillment in the early grades, where the focus is on foundational learning and child development.

Teachers' level of education

The thirty 30 numeracy teachers involved in this study had different levels of education which fall under the certificates to the bachelor's degree as indicated in Table 5.

Table 5: Teachers' level of education

| Educational level | Gender | | Sub Total n (%) |
|-------------------|-----------------|---------------|--------------------|
| | Female n (%) | Male n (%) | |

| | | | | | |
|------------------|------------------|-------|------------------|---------|-----------------|
| Doctorate degree | 0 (0) | 0 (0) | 0 | 0 (0) | 0 |
| Master degree | 0 (0) | (0) | 3 | (0) | 3 (10) |
| Bachelor Degree | 0 (0) | (30) | 4 | 12 (40) | 15 |
| Diploma | 8 (40) | (40) | 3 | (50) | |
| Certificate | 12 (60) | | (30) | | |
| Total | 20 (66.7) | | 10 (33.3) | | 30 (100) |

n is the number of respondents

No teacher from the selected schools had either master's or doctorate degrees as shown in Table 5. Only thirty percent (50%) of the teachers had certificates of education and the majority of them were females, 40% had a diploma level, 10% had bachelor's degrees and all were males. This indicates that when it comes to the higher education level men are always the champions probably because women prefer attending to other family issues like raising the kids and giving birth.

Teachers' level of education and pupils' numeracy performance

The objective of this study was to examine the relationship between teachers' level of education and pupils' numeracy performance in the public-owned primary schools in Arusha City Council. To achieve this objective data on early grades teachers' level of education and pupils' average numeracy performance for every selected school were collected and presented as indicated in Tables 5 and 6.

Table 6: Schools average numeracy test performance

| Average numeracy performance | | Schools n (%) |
|------------------------------|---------|------------------|
| 50 - 54 | | 4 (13.3) |
| 55 - 59 | 60 | (6.7) |
| - 64 | 65 - 69 | 8 (26.7) |
| 70 - 74 | 75 | (23.3) |
| - 79 | 80 - | 1 (3.3) |
| 84 | | |
| Total | | 30 (100) |

n is the number of schools

Table 6 shows the numeracy test average performance of the pupils in 30 public-owned primary schools visited. The results show that the majority of the pupils' average performance ranges from 65 to 69 which is equivalent to 8%. The lowest performance ranges from 50 to 54 which is equivalent to 13.3% of all the schools from which the data were collected. However, only one school had the highest scores which ranged from 80 to 84. The researcher further noted that no any school performed above 84 out of 100 scores.

Moreover, to examine the relationship between teachers' level of education and pupils' numeracy performance the following hypothesis was formulated and tested.

Ho: There is no statistically significant relationship between teachers' level of education and pupils' average numeracy performance.

This is a correlation study, therefore to establish the relationship between teachers' level of education and pupils' average numeracy performance, the Spearman rank-order correlation was used to test the stated hypothesis. After the test on the hypothesis was done results were presented in Table 7.

Table 7: Relationship between teachers' level of education and pupils' average Numeracy performance

| Variables | Pupils' average numeracy performance | | |
|------------------------------|--------------------------------------|---------|-----------|
| | n | r | P - value |
| Teachers' level of education | 30 | - 0.397 | 0.03 |

Significant at $P < 0.05$; n is the number of respondents

DISCUSSION

Table 7 shows that $r = - 0.397$, $p\text{-value} = 0.03$ for the variables of teachers' level of education and pupils' numeracy performance. Given that the $p\text{-value}$ was less than 0.05 level of significance, hence the null hypothesis which stated that there is no statistically significant relationship between teachers' level of education and pupils' average numeracy performance was rejected. It is therefore concluded that there was a low negative correlation ($r = - 0.397$) between teachers' level of education and pupils' numeracy performance. This means that the higher the level of education of a numeracy teacher the lower the numeracy performance of pupils and the lower the level of education of a numeracy teacher the higher the numeracy performance of pupils.

These findings are consistent with the previous studies on the relationship between teachers' level of education and pupils' performance. Buddin and Zamarro (2009) revealed that teacher quality has a large effect on student achievement; however, teacher qualification has a small effect on learners' achievement indicating that it explained little of the observed differences in students. Likewise, Zuzovsky (2003) revealed that academic qualification had only a marginal and statistically non-significant positive relationship with students' achievement. This show that there is no direct positive relationship between teachers' academic qualifications to students' performance. Therefore, regardless of the notable correlation among the variables, they are not strongly related to learners' performance.

Moreover, Dial (2008) conducted a study to examine whether teachers' degree level affects the overall achievement of students in mathematics, results of the study pointed out that teachers' degree level alone did not affect student achievement. Similarly, Kosgei et al (2013) conducted a study in Kenya and found no significant relationship between teacher qualifications and student academic achievement. However, the findings of the study done in Kigali, Rwanda by Gichuru (2016) acknowledged that teachers' qualifications have a significant relationship with pupils' mathematics performance. The same was revealed by Abe (2014) in Nigeria with the study which cemented the significant difference in performance between learners taught by professional and non-professional teachers.

These findings provide the true picture of the relationship between teachers' level of education and pupils' numeracy performance in the selected schools. Thus, the researcher of this work complied with the findings of this study which indicates that the lower the teachers' level of education the higher the learners' performance and vice versa. This further shows that the teachers placed in those schools meet the academic qualifications stated in the primary education curriculum (Ministry of Education, Science and Technology, 2023). Therefore, their

contribution to the learners' acquisition of numeracy skills is of paramount significance as they positively influence their performance. However, the findings are contrary to Daniel and Funmilola (2017) study, which revealed a notable difference between teachers with high qualifications and low qualifications. These scholars insisted that learners taught by teachers with high qualifications perform higher compared to their counterparts.

The researcher anticipated that the correlation was negative as teachers with higher academic qualifications such as Bachelor's degrees are always placed in secondary schools at the same time, they do not prefer teaching in primary schools either. Therefore, their influence on the pupils' numeracy performance was low as pupils performed less compared to their counterparts with certificates and diplomas who are always in place. Based on these findings it is beyond no doubt that lower classes need teachers with certificates and diplomas as they result in better pupils' numeracy performance. Meanwhile, those with higher levels of education are placed in the upper classes, however, if demand arises, they can be trained to cope with the curriculum of the lower classes.

CONCLUSIONS

Based on the findings of the study it was concluded that teachers' level of education negatively correlates with pupils' numeracy performance. This implies that the higher level of education of a teacher is not a guarantee that a pupil will perform highly as those with certificate and diploma levels produce the required results. Therefore, it is recommended that the government continue hiring teachers with certificate and diploma qualifications to teach in early-grade classes as they have a direct positive impact on the pupils' performance. Teachers with higher levels of education to be oriented on the content and pedagogical skills so that they can bring positive change to the early-grade learners. However, there is room for research on other attributes such as teaching experience and professional development.

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