

THE INFLUENCE OF TEACHERS' PARTICIPATION IN PROFESSIONAL DEVELOPMENT ON PUPILS' ATTAINMENT OF NUMERACY SKILLS IN PUBLIC PRIMARY SCHOOLS IN ARUSHA CITY

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ABSTRACT

It is widely accepted that teachers' professional development (TPD) is a hallmark for the successful attainment of educational goals including the provision of quality education in schools. Realizing the potential of TPD in promoting quality education, TPD is mandatory in most countries including Tanzania. This study examined the influence of teachers' participation in professional development programmes on the provision of quality education in public primary schools. Specifically, it established the relationship between the frequency of teachers' attendance in TPD and pupils' attainment numeracy performance. This is a quantitative research approach that employs a correlation research design. The sample size of 1992 (30 teachers and 1962 pupils) respondents from 30 publicly-owned primary schools were involved in this study. The samples were obtained through stratified and simple random sampling techniques. A stratified sampling technique was used to categorize primary schools considering ownership, while simple random sampling was used for selecting 30 primary schools and 30 teachers. Thus, the primary data were collected using questionnaires and numeracy tests. The study found a positive correlation ($r = 0.390$, $p < 0.05$) between the frequencies of teachers' participation in TPD and pupils' numeracy performance. This indicates that the more teachers engage in TPD, the higher the pupils' numeracy performance. The study recommends that teachers be encouraged and supported to attend workshops, seminars, or trainings related to their areas of specialization to update their knowledge and pedagogical skills as they positively influence pupils' numeracy performance.

Keywords: Professional Development Programmes, Numeracy, Teachers, and Tanzania.

INTRODUCTION

Teacher Professional Development (TPD) refers to the continuous process by which educators enhance their teaching skills, knowledge, and expertise to improve their effectiveness in the classroom (Desimone, 2009). It encompasses all activities that support professional career growth (Rogan & Grayson, 2003; Tecele, 2006). TPD is typically viewed as a set of programmes or workshops designed for teachers to develop their skills and knowledge at various levels. According to Iheanacho (2007), as cited in Loucks-Horsley et al. (1998), TPD provides opportunities for educators to acquire new knowledge, skills, approaches, and dispositions that improve their classroom effectiveness. This can include formal and informal methods, such as learning new skills, developing insights into pedagogy, refining teaching practices, and exploring advanced content and resources. TPD can take various forms, including formal training, workshops, conferences, peer collaboration, and self-reflection (Borko, 2004). The ultimate aim of TPD is to improve student learning outcomes by ensuring teachers are equipped with the latest educational strategies, technologies, and methodologies (Darling-Hammond et

al., 2017). Based on these definitions, teacher professional development is an ongoing process of equipping teachers with the knowledge, skills, and attitudes related to their subject of specialisation, with the aim of maximising their efficiency in the teaching and learning process. It is widely believed that when teachers are well-trained in their areas of specialisation, they positively impact learners' performance. However, various studies present differing results based on context. For instance, Huffman, Thomas, and Lawrenz (2003) conducted a study in the USA that explored the relationship between different types of TPD, instructional practices, and student achievement in science and mathematics. The results indicated that only curriculum development for mathematics was significantly related to student achievement, suggesting that TPD did not influence student achievement across the board. In contrast, Yoon et al. (2008) found that in-service training for teachers moderately affected student achievement. The study concluded that students would achieve more only if teachers received the necessary training. Similarly, Parish (2013) conducted a study in North Texas, USA, revealing that teachers who participate in TPD significantly enhance students' academic achievement.

Blank and Alas (2009) also found that professional development in mathematics has a significant positive effect on student achievement. Likewise, Johnson et al. (2006) demonstrated that TPD positively impacts student outcomes. Bishop (2016) further emphasised that professional development directly affects student performance. However, Lu et al. (2017), in a study conducted in rural China, found that the national teacher training program had no effect on students' mathematics achievement and could even harm student performance. Iheanachor (2007) arrived at similar conclusions in a study in Lesotho, showing no statistically significant relationship between student achievement and TPD. These findings suggest that not all TPD programmes directly affect student achievement; rather, they may be aimed at improving teachers' subject knowledge in areas such as mathematics.

The majority of the aforementioned studies show that student performance is strongly influenced by TPD. When teachers receive relevant and up-to-date training, it ultimately boosts student performance. In Tanzania, Komba and Nkumbi (2008) conducted a study which revealed that, TPD improves teachers both professionally and academically. The study concluded that TPD helps teachers meet the expectations of improving student performance. Similarly, Baradyana (2013) highlighted that TPD helps develop teachers' skills and competencies, enabling them to perform their duties more efficiently by linking theory and practice.

Moreover, Jamal (2014) noted that in-service TPD is a critical factor in improving the effectiveness of primary school teachers in Tanzania. Additionally, Ozkan (2015) argued that TPD provides teachers with opportunities to discover new roles, develop innovative instructional techniques and methods, refine their practices, and grow both professionally and personally. Mduma & Mkulu (2021) through their study done in Tanzania recommended that the Ministry of Education, Science, and Technology, education stakeholders in conjunction with school administrators (district educational officers and heads of schools) regularly organize and facilitate formative in-service training for teachers to enhance their job performance. This underscores the crucial role teachers play in students' academic achievements across all levels of education.

Recognising the importance of teachers in learners' academic performance, the MoEST, through the Tanzania Institute of Education (TIE), has implemented the Teacher's Continuous Professional Development (TCPD) program, commonly known as MEWAKA (Mafunzu Endelevu kwa Walimu Kazini). This program targets pre-primary, primary, and secondary

school in-service teachers to improve their teaching abilities and enhance the overall quality of education in Tanzania (Wizara ya Elimu, Sayansi na Teknolojia, 2022). The training is delivered through Communities of Learning (CoL), self-study, instructional workshops, and online platforms. Additionally, MEWAKA is conducted in schools and Teacher Resource Centres (TRCs). Despite these efforts, little is known about the impact of teachers' TPD attendance on learners' academic performance. This study, therefore, seeks to explore the relationship between the frequency of teachers' attendance in professional development programmes and pupils' numeracy performance.

METHODOLOGY

The study area

The study was conducted in Arusha city council in Arusha region. The Arusha city council was purposively selected among the other districts of Arusha region, which are Meru, Arusha Rural, Monduli, Ngorongoro, Longido, and Karatu. It was selected as a study area because it has the region's highest Primary School Leaving Examination (PSLE) performance and population, and is easily accessible.

Research design

The study employed a correlation research design using a quantitative research approach. The primary 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.

Population, sampling procedures, and sample size

The study population consisted of standard three pupils and teachers from public-owned primary schools in Arusha city council. The study sample was 1992 respondents. Simple random sampling and stratified sampling were used to select the respondents. Thus, the 167 primary schools of Arusha city council, both publicly and privately owned, were subjected to this study; stratified sampling was used to categorize these schools in terms of ownership, where 51 are publicly owned, and 116 are privately owned. Given that this study was done in publicly-owned schools, 30 schools (equivalent to 59%) were randomly selected out of 51 schools. The schools chosen came from 22 wards out of 25 of the Arusha city council. 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. The public-owned primary schools involved in this study were Baraa, Daraja Mbili, Elerai, Burka, Azimio, Engira, Makumbusho, Kaloleni, Meru, Uhuru, Kimandolu, Lemara, Levolosi, Moshono, Murieti, Ngarenaro, Mwangaza, Olasiti, Olorieni, Magereza, Osunyai, Sanawari, Naura, Kijenge, Ukombozi, Sinoni, Sombetini, Maweni, Them, and Unga Limited.

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 determined the correlation between the independent variable (*frequency of teachers' attendance on professional development programmes*) and the dependent variable (*pupil's 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. Colleagues and other academicians thoroughly reviewed the questionnaires to ensure they reflected the study's objective 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 excluded from this study. Then, it was moderated by a teacher who is an expert in this area. The content of the instruments (questionnaires and tests) was also presented in a language that the respondents could understand. 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 the Kilimanjaro region's Moshi (Rural) district. These similarities are based on the age of learners, that is, age 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 1.

Table 1: Cronbach's reliability test

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

The results presented in Table 1 show a Cronbach's reliability test value of 0.755. As the alpha coefficient (α) exceeded 0.6, the questionnaire was deemed suitable for the study, indicating a high level of internal consistency. This aligns with the recommendation that an instrument should have a Cronbach's alpha (α) of at least 0.6 to be used (Creswell, 2012).

RESULTS

Demographic characteristics of respondents

The demographic characteristics of the 1992 respondents of this study were analysed according to sex. Table 2 provides a detailed summary.

Table 2: Respondents demographic characteristics

Respondents	Gender		Sub Total
	Female n (%)	Male n (%)	
Teachers'	20 (66.7)	10 (33.3)	30
Pupils'	1,060 (54)	902 (46)	1,962
Total	1,080	912	1992

n is the number of respondents

Table 2 shows that 20 female teachers out of 30, which is equivalent to 66.70% of the teachers, participated in this study; this indicates that the majority of the teachers involved were females. Similarly, 1,060 learners, equivalent to 54% of all the learners involved in this study, were girls. It was noted that most teachers who teach early grades in the selected schools are females. The same scenario was noted for the pupils', as most 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' attendance in professional development programmes

Table 3 provides data on teachers' attendance at professional development programmes since they were employed.

Table 3: *Teachers' attendance in professional development programmes*

Attendance at professional development programmes	Gender		Sub Total n (%)
	Female n (%)	Male n (%)	
Have attended	11 (55)	9 (90)	20 (66.7)
Have never attended	9 (45)	1 (10)	10 (33.3)
Total	20 (66.7)	10 (33.3)	30 (100)

n is the number of respondents

Of all the 30 teachers asked whether they have ever attended professional development programmes or not, 33.3%, equivalent to 10 teachers, have never attended those programmes. However, 66.7%, equivalent to 20 teachers, have attended professional development programmes at different times since being employed, as shown in Table 3. Regardless of the importance of numeracy to the pupils, the researcher noted that some teachers have been teaching the subject for many years without attending any in-service training, which could enhance their pedagogical knowledge and skills. It was further noted that the majority of the teachers believed that professional development programmes are only those in which the participants are paid for attendance, something which is not always true.

Teachers' frequency of attendance in professional development programmes

Table 4 summarizes the data about the frequency of teachers' attendance on professional development programmes.

Table 4: *The frequency of teachers' attendance on professional development programmes*

Frequency of attendance	Number of teachers (%)
0 - 2	18 (60.0)
3 - 5	8 (26.7)
6 - 8	3 (10)
9 - 11	1 (3.3)
Total	30 (100)

Table 4 shows the frequency of teachers' attendance on professional development programmes since being employed. The statistics show that 60% of teachers have attended professional development programmes for a maximum of two times. It was further noted that 3.3% of the teachers, equivalent to 1 teacher, have attended 9 to 11 professional development programmes. Overall, the field data indicates that teachers are typically provided with opportunities to attend various professional development programmes to enhance their knowledge and skills in their areas of specialization.

Pupils' average numeracy performance

Table 5 shows the average numeracy performance of grade three pupils in the schools where this study was conducted.

Table 5: *Pupil's average numeracy performance per school*

Average numeracy performance	Schools n (%)
50 - 54	4 (13.3)
55 - 59	2 (6.7)
60 - 64	7 (23.3)
65 - 69	8 (26.7)
70 - 74	7 (23.3)
75 - 79	1 (3.3)
80 - 84	1 (3.3)
Total	30 (100)

n is the number of schools with that performance

Table 5 illustrates pupils' average numeracy test performance across 30 public primary schools visited. The data reveals that most pupils' average scores fall within the 65 – 69 range, representing 8% of the schools. The lowest performance bracket, ranging from 50 to 54, accounts for 13.3% of the schools. Notably, only one school achieved the highest scores, ranging from 80 to 84. Furthermore, the researcher observed that no school scored above 84 out of 100.

Normality test

The normality of the data was assessed before applying the Pearson product-moment correlation coefficient (Pearson r). The results indicated that the data were normally distributed, as shown in Figure 1.

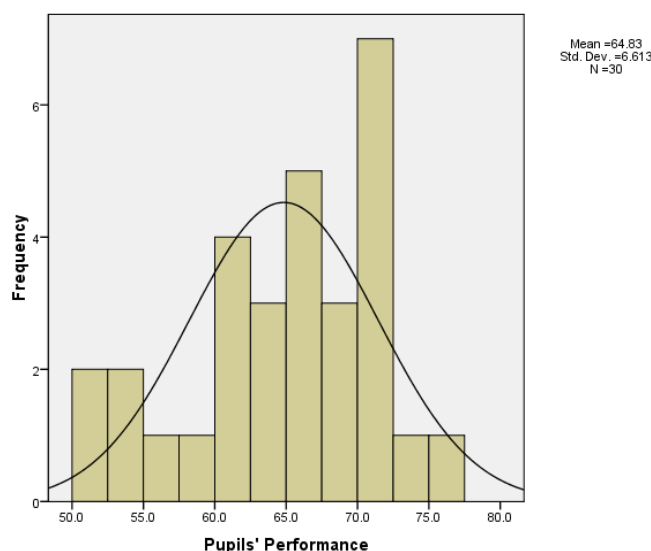


Figure 1: *Normality test on pupils' average numeracy performance*

Teachers' professional development and pupils' numeracy performance

The objective of this study was to examine the relationship between the frequency of teachers' attendance on professional development programmes and pupils' numeracy performance. To achieve this objective, data on whether numeracy teachers have ever attended professional development programmes, teachers' frequency of attendance on professional development

programmes, and pupils' average numeracy scores as an indication of their performance were collected and presented in Tables 3, 4, and 5.

The following hypothesis was formulated and tested to determine whether there is a relationship between the frequency of teachers' professional development programmes attendance and pupils' performance.

H₀: There is no statistically significant relationship between the frequency of teachers' professional development programmes attendance and pupils' numeracy performance.

To test the above hypothesis, the Pearson product-moment correlation coefficient (Pearson r) was run, and the results are presented in Table 6.

Table 6: Relationship between frequency of teachers' professional development programmes attendance and pupils' average numeracy performance

Variables	Pupils' average numeracy performance		
	n	r	p-value
Frequency of professional development programmes attendance	30	0.390	0.033

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

DISCUSSION

Table 6 shows that $r = 0.390$, $p = 0.033$ after correlating the frequency of teachers' attendance in professional development programmes (PDP) with pupils' numeracy performance. Since the p-value is less than 0.05, the null hypothesis, which states that there is no statistically significant relationship between the frequency of teachers' PDP attendance and pupils' numeracy performance, was rejected. Therefore, it was concluded that there was a low positive correlation of 0.390 between the frequency of teachers' PDP attendance and pupils' numeracy performance. This implies that the higher the frequency of teachers' PDP attendance, the higher the pupils' numeracy performance, and conversely, the lower the frequency of teachers' PDP attendance, the lower the pupils' numeracy performance.

The findings of this study are consistent with other research results. In the USA, Parish (2013) revealed that teachers who participate in PDP significantly improve learners' academic achievement. Similarly, a study by Blank and Alas (2009) indicated that the teachers' PDP in Mathematics has a significant positive effect on students' achievement. Johnson et al. (2006) also found that teachers' PDP positively impact students' achievement. Likewise, Bishop (2016) emphasized that professional development directly influences learners' performance. The reviewed literature demonstrates that when teachers undergo professional development, improvements in learners' performance are evident.

Furthermore, Jamal (2014) noted that in-service professional development training is a critical lever for enhancing the effectiveness of primary school teachers in Tanzania. Despite limited technical and financial resources, students' performance in the country has improved due to such training. Ozkan (2015) added that teachers' professional development provides opportunities to discover new roles, develop innovative instructional techniques and teaching methods, refine their practice, and grow professionally and personally. Based on these findings from Tanzania, there is no doubt that teachers' professional development is essential for improving learners' academic performance.

Contrary to this, Lu et al. (2017) found that the National Teacher Training Program in rural China did not improve Maths achievement and may even negatively affect student outcomes. Iheanachor (2007) reached similar conclusions, showing no statistically significant relationship between students' achievement and teachers' professional development in Lesotho. Likewise, Yoon et al. (2007) found no statistically significant effects of PDP on students' academic performance in the USA. In Tanzania, Kanisi (2012) revealed no significant relationship between teacher professional development and student performance in Mathematics. These studies suggest that not all teacher training programmes directly impact student achievement; instead, they may improve teachers' subject knowledge, such as in Mathematics.

Various studies have produced mixed results regarding the relationship between teachers' professional development and learners' performance. However, the findings of this study align with those suggesting that the knowledge and skills acquired by teachers through PDP have a multiplier effect on their learners. A study conducted in the United Arab Emirates (UAE) confirmed a positive link between teachers' professional development and learners' academic performance (Assali, 2014). Moreover, Daniel and Funmilola (2017) demonstrated a significant statistical difference in the achievement of students taught by trained versus untrained teachers. Carrillo et al. (2016) emphasized that professional development interventions are likely to lead to positive and significant improvements in learners' performance.

CONCLUSIONS

The study concluded that there is a significant positive relationship between the frequency of teachers' professional development programmes attendance and the pupils' numeracy performance. This implies that the higher the frequency of teachers' attendance on professional development programmes, the higher the numeracy performance of pupils and vice versa.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made: The Ministry of Education, Science, and Technology (MoEST), in collaboration with regional and district education administrators, should ensure the allocation of sufficient budget for in-service trainings and workshops for teachers. Also, the MoEST through Tanzania Institute of Education to organise and facilitate these trainings and seminars. Additionally, teachers should be encouraged and supported to attend various professional development programmes to enhance their teaching and learning capabilities. Furthermore, school administrators, together with the heads of schools, should take appropriate measures to ensure that newly employed teaching staff receive proper orientation, induction, and in-service training to improve their effectiveness in teaching and learning process.

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