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Teacher Quality Dimensions Associated with Learning Achievement in Tanzanian Primary Schools

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Research Article

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Abstract

Teacher quality is widely recognized as a key determinant of pupils' learning outcomes, yet evidence on the most influential dimensions remains limited in Tanzania. Using secondary data from the 2018 Tanzania Basic Education Statistics, this study employed descriptive statistics and binary logistic regression to examine the influence of teacher quality on pupils' learning outcomes. Results showed that inadequate subject matter knowledge significantly reduced the likelihood of outcomes (OR = 0.424, p = .017), whereas gender-responsive pedagogy increased the likelihood (OR = 2.185, p = .029). Teachers' age, teaching experience, curriculum knowledge, and overall teaching ability were not significant predictors. Among control variables, pupils' gender (OR = 0.276, p < .001), pupils' age (OR = 0.754, p = .014), and classroom condition (OR = 3.606, p = .002) were significant. The findings underscore the importance of strengthening subject matter competence, gender-responsive pedagogy, and school infrastructure to improve learning outcomes in Tanzania.

1. Introduction

Learning outcomes have emerged as a key objective of education systems around the world. While considerable success has been achieved in increasing access to primary schooling in the last few decades, several developing and middle-income countries still grapple with the problem of learning crisis where children pass out of primary schools without achieving basic competencies in reading and numeracy (World Bank, 2018; UNESCO, 2024). Hence, international education policy makers have moved away from making provision of school access as their topmost objective to that of learning and in line with Sustainable Development Goal 4 (UNESCO, 2006; United Nation [UN], 2015).

The importance of teacher quality is acknowledged by many scholars, who see it as one of the most significant school-level characteristics that influence the quality of education and academic success of students. In particular, teachers can impact learning through curricular implementation, creation of productive learning opportunities, and creation of a supportive environment that would help students develop both cognitively, socially, and emotionally (Darling-Hammond, 2000; Organisation for Economic Co-operation and Development [OECD], 2005). Furthermore, evidence from research into the impact of education has also shown that teacher effectiveness is a factor that contributes significantly to variations in students' performance in addition to socioeconomic status and other factors at the school level (Muijs et al., 2014; Scheerens, 2016). This implies the importance of effective teaching in improving educational outcomes, even when other external factors are considered. Thus, the improvement of learning outcomes presupposes not only an increase in the number of competent teachers but also improvement of their professional knowledge and pedagogic skills.

The understanding of teacher quality has changed tremendously over the past years. Previous studies focused on measurable qualities, such as education, qualifications, certificates, and teaching experience, which were considered to be the main factors that define the quality of teachers. While the above-mentioned variables still play their role in defining teacher quality, they are not able to describe the complexity of teaching (Stronge, Ward, & Grant, 2011). The contemporary understanding of the concept under discussion is based on the assumption that teacher quality is a multidimensional construct that includes the following components: subject matter knowledge, pedagogical content knowledge, curriculum knowledge, instructional skills, assessment, classroom management, and the capacity of dealing with diverse student needs (Guerriero, 2017; Voss et al., 2022). Thus, similarly educated and experienced teachers can show different results of their work since teacher quality depends not only on formal qualifications and experience but also on professional knowledge, pedagogical skills, and their application in the process of teaching (Baumert & Kunter, 2013; Kunter et al., 2013).

Consequently, there is ample evidence from international research studies supporting the idea of a multidimensional model of teacher quality. It is shown that subject matter knowledge and pedagogical content knowledge (PCK) of teachers are two of the most influential factors affecting students' academic performance as these qualities enable teachers to clearly deliver the concepts to the learners, identify their misconceptions, adjust their instruction to accommodate the needs of different learners and encourage the development of higher-order cognitive skills (Baumert et al., 2010; Guerriero, 2017; OECD, 2023b). Moreover, classroom management, formative assessment strategies, learner-centered approaches and inclusive teaching are seen as indispensable components of quality instruction as these approaches allow creating supportive learning environments and improving learners' engagement in educational processes in order to decrease educational inequity (OECD, 2023b). In addition, gender-responsive pedagogy receives increased attention as an approach to equity in education (UNESCO, 2020).

However, there continues to be a lack of consensus on which dimensions of teacher quality make the greatest contributions towards the learning of students empirically. In Sub-Saharan Africa, teacher effectiveness faces a myriad of systemic issues such as shortage of well-trained teachers, inequitable distribution of teachers, larger classes, insufficient instructional materials, and limited scope for

teacher development (Bold et al., 2019; UNESCO, 2023). While previous research has pointed to teacher qualifications and experience being positively correlated with better student performance, recent research shows that professional attributes of teachers such as subject content knowledge, pedagogical knowledge, and instructional practice are more strongly correlated to student achievement than demographic features alone (Darling-Hammond, 2000; Guerriero, 2017; Bold et al., 2019).

There is more than one challenge that characterizes this setting in Tanzania. Various reforms including Primary Education Development Programme (PEDP) and the Secondary Education Development Programme (SEDP), which have been carried out under the Education Sector Development Programme (ESDP), have made attempts towards increasing accessibility to education through improving teacher supply, implementation of the curriculum, and physical infrastructure of schools. The PEDP emphasized access to primary education through teacher training, construction of classroom buildings, and provision of necessary school infrastructure. On the other hand, the SEDP emphasized access to secondary education, quality teaching, and school infrastructure improvement (United Republic of Tanzania [URT], 2001;2004). Rapid enrolment expansion, however, brought about several challenges including those of teacher supply, teacher deployment, teaching quality, and suitable learning environment.

In this context, this study explores the extent to which specific aspects of teacher quality have an impact on learning outcomes among pupils in Tanzanian primary schools from the BEST database. The results of this study add to the existing literature on educational effectiveness by exploring teacher quality in the context of limited resources.

Theoretical Framework

The study is mainly guided by the Pedagogical Content Knowledge (PCK) Theory of Shulman, which posits teacher quality as the combination of subject matter knowledge and pedagogical skills (Shulman, 1986, 1987). While the theory does not consider effective teaching as the consequence of qualifications or years of teaching practice alone, it posits that the influence of teachers on the learning process is achieved through their capability to translate the discipline's knowledge into the process of meaningful learning. Pedagogical content knowledge involves teachers' knowledge of subject matter, curriculum, instruction, evaluation and responsiveness towards the varied learning needs of learners (Shulman, 1987; Kind & Chan, 2019). In line with this view, the current study considers teacher quality as a multi-faceted concept consisting of subject knowledge, curriculum knowledge, teaching skills and gender responsive pedagogy. This theory provides a theoretical basis for considering the role of professional competencies in explaining learning outcomes of pupils better than demographic variables like age, gender and years of teaching.

2. Methodology

Research Design and Data Source

The current study used the quantitative research methodology where secondary data were used from the Basic Education Statistics in Tanzania (BEST). BEST refers to the Education Management Information System (EMIS) managed by the Ministry of Education, Science and Technology (MoEST). The database has standardized national-level statistics about schools, teachers, learners, educational inputs, and education outputs and, thus, acts as an evidence base in relation to educational planning, monitoring, policy making, and decision making in Tanzania (Ministry of Education, Science and Technology (URT, 2018).

A cross-sectional research design was used due to the fact that the secondary data constituted data observed during a particular point in time. The cross-sectional research design was deemed to be the right one for analysing the relationship between teacher quality, learners' characteristics, school environment, and academic performance through the use of already existing administrative data. The cross-sectional design enabled efficient and cost-effective analysis of the relationship between these variables without being able to make causal inferences (Creswell & Creswell, 2023).

The target group included teachers and learners in Tanzanian public primary schools whose data was available in the BEST database. The sample for analysis included 215 cases where data on teacher’s characteristics, competences, learner’s characteristics, school facilities, and learning outcomes were complete. Since the study used a national database, no further sampling was done.

Variables and Measurement

Learning outcomes formed the dependent variable and were measured through the use of a binary indicators, reflecting the nature of the secondary data used.

Teacher quality was the main independent variable and was defined along two dimensions. These included demographic characteristics of teachers such as gender, age, and teaching experience, while the other included professional competencies such as knowledge about the curriculum and subject matter, pedagogy, gender-responsive pedagogy and teaching skills. The definition is reflective of modern conceptions of teacher quality, which define the professional competency of the teacher as the main factor determining the effectiveness of teaching, even though demographic factors can affect both practice and outcomes (Shulman, 1987; Darling-Hammond et al., 2020). According to Darling-Hammond et al. (2020), teacher professionalism includes knowledge, skills, and professional dispositions necessary for creating learning environments conducive to learners' comprehensive development. Effective teaching demands a combination of solid subject knowledge, pedagogical skills, knowledge of learners' development, and competence in creating inclusive and equitable learning opportunities (Darling-Hammond et al., 2020).

To be able to control the effects of various variables and identify the isolated effect of teacher quality on student performance, a number of control variables were included. These variables included pupil gender, pupil age, family structure, and school characteristics measured using the nature of the material of the main classroom floor, among others because the performance of students is a function of the joint effect of teachers, students, and school-level variables.

Study Hypotheses

The study tested four hypotheses:

1. H1: Teacher demographic characteristics significantly predict pupils' learning outcomes.
2. H2: Teachers' professional competencies significantly predict pupils' learning outcomes.
3. H3: Pupil demographic characteristics significantly influence learning outcomes after controlling for teacher quality.
4. H4: School infrastructure significantly predicts pupils' learning outcomes after accounting for teacher and pupil characteristics.

The null hypothesis stated that teacher quality has no statistically significant association with pupils' learning outcomes.

Analytical Model

To estimate the influence of teacher quality on pupils' learning outcomes, the study employs a binary logistic regression model because the dependent variable is dichotomous.

The model is specified as:

$$\ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 TG + \beta_2 TA + \beta_3 EXP + \beta_4 CK + \beta_5 SK + \beta_6 TS + \beta_7 GRT + \beta_8 PG + \beta_9 PA + \beta_{10} SI + \epsilon$$

where:

Variable	Description
P	Probability of positive learning outcome
TG	Teacher gender
TA	Teacher age
EXP	Teaching experience
CK	Curriculum knowledge
SK	Subject knowledge
TS	Teaching skills
GRT	Gender-responsive teaching
PG	Pupil gender
PA	Pupil age
SI	School infrastructure
E	Random error

Data Analysis

Data were analysed using IBM SPSS version 28. Descriptive statistics were computed in terms of frequencies and percentages to summarise teacher and pupils' characteristics, as well as the pattern of teacher absenteeism. An inferential analysis was later conducted using binary logistic regression in order to estimate the effect of teacher quality on pupils' learning outcomes while controlling for the pupils' and school-related characteristics. The use of binary logistic regression is justified since it is a statistical technique used to predict dichotomous outcome variables using several predictor variables at once (Hosmer et al., 2013; Field, 2018).

The logistic regression model estimation was done using IBM SPSS version 28. In particular, the program provided regression coefficients, standard errors, Wald's statistics, odds ratios (Exp(B)), confidence intervals, and significance values which allowed estimating the strength and significance of each variable. The level of statistical significance was set to 5%, $p < .05$), in accordance with accepted standards in educational statistics (Field, 2018).

Model Diagnostics

Diagnostic tests were conducted before estimating the model to determine if the binary logistic regression model would be suitable, and to determine whether the assumptions held. Independence of observations and binary nature of the dependent variable were assumed in the analysis. Reference categories for categorical independent variables and linear relationship between the independent variables and the logit of the dependent variable were some of the tests conducted for continuous variables.

The evaluation of model adequacy relied on a combination of different goodness-of-fit and predictive performance criteria (Table 1 to 3 and Fig. 1). Model fit was analysed with the help of the likelihood ratio chi-square statistic and the − 2 Log Likelihood (− 2LL), and calibration with the Hosmer-Lemeshow goodness-of-fit test. Explanatory ability of the model was estimated by the Cox and Snell and Nagelkerke pseudo-R^2. Furthermore, the predictive ability of the model was assessed in terms of classification accuracy, sensitivity, specificity, and Receiver Operating Characteristic (ROC) curve with the Area Under the Curve (AUC) representing the overall discrimination ability of the model between two outcome groups (Hosmer et al., 2013; Menard, 2010).

Table 1
Omnibus Tests of Model Coefficients

Test	Chi-square (χ^2)	df	Sig. (p-value)
Step	65.472	23	< .001
Block	65.472	23	< .001
Model	65.472	23	< .001
Source: IBM SPSS Output (BEST, 2018)			

As indicated in Table 1, an omnibus test of model coefficients indicated that the regression model was statistically significant, (χ^2 (23) = 65.47, $p < .001$), demonstrating that the inclusion of the predictor variables significantly improved model fit compared with the intercept-only model. This finding suggests that the predictors collectively contribute to explaining the outcome variable, warranting further interpretation of the individual parameter estimates.

Table 2
Model Summary

-2 Log Likelihood	Cox & Snell R^2	Nagelkerke R^2
201.299	0.263	0.369

a. Estimation terminated at iteration number 20 because the maximum number of iterations was reached. Final solution could not be found.

Source: IBM SPSS Output (BEST, 2018)

Table 2 reveals that, the − 2 Log Likelihood (-2LL) value of 201.299 represents the unexplained variation remaining after fitting the model. Lower values of -2LL generally indicate a better-fitting model when compared with alternative models. The pseudo coefficient of determination, Cox and Snell $R^2 = 0.263$, indicates that approximately 26.3% of the variation in the dependent variable is explained by the predictor variables. Because Cox and Snell R^2 cannot attain a maximum value of one, the Nagelkerke R^2 adjusts this limitation. The logistic regression model yielded a Nagelkerke R^2 of .369, indicating a moderate level of model fit and suggesting that the predictors

collectively account for a meaningful proportion of variability in the outcome. Because Nagelkerke R^2 is a pseudo-R^2 statistic, it should be interpreted as an index of relative explanatory power rather than as the exact proportion of variance explained in the outcome variable (Hosmer et al., 2013; Field, 2018).

Table 3
Hosmer and Lemeshow Goodness-of-Fit Test

Chi-square (χ^2)	Df	Sig. (p-value)
2.753	8	0.949
Source: IBM SPSS Output (BEST, 2018)		

Table 3 discloses that the Hosmer and Lemeshow goodness-of-fit test adequately fit the observed data, (χ^2 (8) = 2.75, p = .949). The non-significant result suggests no statistically significant difference between the observed and model-predicted values, indicating good model calibration (Peng et al., 2002; Hosmer et al., 2013).

Source: IBM SPSS Output (BEST, 2018)

Note

Figure 1. *Receiver Operating Characteristic (ROC) curve illustrating the discriminatory performance of the fitted logistic regression model. The y-axis represents sensitivity (.806 true positive rate), while the x-axis represents 1 – specificity (false positive rate)*.

Figure 1 reveal that, ROC demonstrated good discriminatory ability, with an Area Under the Curve (AUC) of .806. This value suggests that the model correctly distinguishes between individuals with and without the outcome approximately 80.6% of the time, substantially exceeding the level expected by chance (Peng et al., 2002; Hosmer et al., 2013).

Overall, the logistic regression model demonstrated good predictive performance and was appropriate for explaining the outcome variable. The model significantly improved prediction over the null model, exhibited moderate explanatory power, showed good calibration with the observed data, and achieved good discriminatory accuracy, indicating its effectiveness in distinguishing between participants with and without the outcome of interest. These findings collectively provide strong evidence that the model offers a reliable basis for interpreting the relationships between the predictor variables and the outcome, while noting that model convergence should be verified when interpreting individual parameter estimates.

3. Results

Respondents' Characteristics

The study analysed data from 215 teacher–pupil observations extracted from Tanzania's Basic Education Statistics (BEST) database. Demographic information about the teachers used in this study is provided in Table 2.

Table 4

Demographic information of teachers

Characteristics	Frequency	Percent
Teacher's highest level of academic education		
Primary school	15	7.0
Form 4	193	89.8
Form 6	4	1.9
Certificate	1	0.5
Diploma	2	0.9
Teacher's gender		
Male	88	40.9
Female	127	59.1
Teacher's age		
Under 30	74	34.4
31–40	76	35.3
41–50	29	13.5
51 and above	36	16.7
Working experience		
0–3 years	14	6.5
4–10 years	106	49.3
11 + years	95	44.2
Note. Data collected from the 2018 BEST		

Table 4 reveals that Female teachers were the predominant gender in the sample studied, forming 59.1% of all teachers. The biggest number of teachers was found within the age category 31–40 years (35.3%). As to the teaching experience, about half of the teachers (49.3%) had a teaching experience of four to ten years. Almost all teachers (89.0%) attained form four level of education.

Demographic information of pupils

Table 5 presents the demographic characteristics of the pupils included in the study. The variables described include sex, age group, and household size, providing a profile of the study sample and contextual information for the subsequent analyses.

Table 5
Demographic information of pupils

Characteristics	Frequency	Percent
Pupil gender		
Boy	98	45.6
Girl	117	54.4
Number of HH members 17 years old or younger		
One	2	0.9
Two	15	7.0
Three	33	15.3
Four or more	165	76.7
Pupil age		
00–04 years	7	3.30
05–09 years	38	17.70
10–14 years	170	79.10
Note. Data collected from the 2018 BEST		

As depicted in Table 5, the allocation of pupils in terms of sex ratio was fairly equal, whereby girls accounted for 54.4 percent of the study sample. Majority of the pupils (79.1%) fell within the age range of 10–14 years, showing that the study sample was largely comprised of individuals from the age category appropriate for primary education. Moreover, more than three quarters of the pupils (76.7%) came from families of four or more siblings.

Determinants of Pupils' Learning Outcomes

Binary logistic regression analysis was conducted to examine the association between teacher quality and pupils' learning outcomes while controlling for pupil characteristics and school infrastructure. The regression results, including the estimated odds ratios, confidence intervals, and significance levels, are presented in Table 4.

Table 6

Logistic model shows relationships between teacher quality and pupils learning outcomes.

Variables	Odds ratio	S.E.	Wald	df	Sig.
Teacher's gender					
Male (Ref)					
Female	1.059	0.345	0.028	1	0.868
Teacher's age					
Under 30 years (Ref)					
31–40 years	0.995	0.458	0.00	1	0.991
41–50 years	1.41	0.714	0.232	1	0.63
51 years and above	1.335	0.721	0.16	1	0.689
Working experience					
0–3 years (Ref)					
4–10 years	1.722	0.775	0.491	1	0.483
11 + years	1.131	0.914	0.018	1	0.893
Curriculum knowledge					
Yes (Ref)					
No	0.687	0.363	1.067	1	0.302
Subject knowledge					
Yes (Ref)					
No	0.424	0.36	5.682	1	0.017
Teaching skills					
Yes (Ref)					
No	1.125	0.344	0.118	1	0.731
Gender-responsive teaching skills					
Yes (Ref)					
No	2.185	0.358	4.777	1	0.029
Pupil gender					
Male (Ref)					
Female	0.276	0.348	13.695	1	0.000
Pupil age	0.754	0.115	6.071	1	0.014
Main building material of the floor					
Earth (Ref)					
Others	3.606	0.413	9.663	1	0.002
Constant	16.515	1.597	3.082	1	0.079
Note. Data collected from the 2018 BEST					

The outcome of the binary logistic regression analysis in Table 6 reveals that none of the teacher's demographic factors considered in the study were found to be statistically significant predictors of pupils' learning outcomes. This means that teachers' gender was not

found to have any statistically significant relationship with pupils' learning outcomes (OR = 1.059, p = .868). Similarly, teachers' years of experience and age were found to have no statistically significant relationships with pupils' learning outcomes (years of experience: OR = 1.722, p = .483; OR = 1.131, p = .893; age: OR = 0.995, p = .991; OR = 1.410, p = .630; OR = 1.335, p = .689).

Furthermore, on one hand, analysis reveals that two professional competency measures were found to be statistically significant predictors of pupils' learning outcomes. First, the teachers' lack of knowledge in the subject matter was found to predict lower likelihood of favourable pupils' learning outcomes (OR = 0.424, p = .017). On the other hand, practicing gender-responsive pedagogy is significantly and positively associated with pupils' learning outcomes (OR = 2.185, p = .029). Nevertheless, curriculum knowledge (OR = 0.687, p = .302) and teaching skills (OR = 1.125, p = .731) are not statistically significant predictors of pupils' learning outcomes.

In relation to the control variables, the findings reveals that three variables that significantly predicted the learning outcomes of learners were: gender of learners (OR = 0.276, p < .001), age of learners (OR = 0.754, p = .014), and school infrastructure (OR = 3.606, p = .002) all were significantly related to the probability of favourable learning outcomes.

4. Discussion

The present results lend support to the modern understanding of teacher quality as a multi-dimensional phenomenon defined mainly by professional competence and not demographic features. In line with the theory of teacher knowledge developed by Shulman (1986, 1987), COACTIV Model of Professional Competence (Baumert & Kunter, 2013), and more recent meta-analyses (König et al., 2021; Blömeke et al.,2022), professional competence and subject matter knowledge of teachers turned out to be strong predictors of pupils' academic performance. Likewise, evidence from African education systems indicates the impact of teachers' content knowledge on the performance of their pupils (Bold et al., 2019). The positive effect of gender-sensitive teaching can be explained by the positions of UNESCO (2020) and UNICEF (2022), as both organizations promote gender-responsive pedagogy as an effective way of achieving equitable participation and enhancing educational performance. As UNESCO (2020) claims, gender-responsive teachers establish educational settings free from gender stereotypes and guarantee equal chances for participation for all learners.

On the other hand, teacher gender, age, experience, knowledge of curriculum, and overall teaching abilities were not found to be strong predictors of pupil performance. This indicates that demographic variables and declarative knowledge of the curriculum do not suffice to enhance learning without being converted into actual instructional practice. While this may be somewhat in contradiction with the theoretical assumptions of Shulman (1987) and Kind (2019), it could mean that implementation of Pedagogical Content Knowledge is more effective than knowledge of the curriculum documents themselves. Moreover, since the significant influence of pupils' gender, age, and school infrastructure was demonstrated, these results are consistent with the theory of Educational Production Function (Hanushek, 2020) where learning outcomes are seen as a result of the interaction between teachers' quality, learners' attributes, and school resources. The same observations have been made by the World Bank (2018) and OECD (2023).

Of all the qualities of teachers that were studied, subject knowledge proved to be the most influential predictor of pupils' academic performance. Such a result lends empirical evidence to the Pedagogical Content Knowledge framework developed by Shulman in 1986 and 1987 that postulates the significance of the synthesis of disciplinary knowledge and pedagogically appropriate strategies in teaching. Teachers who have good subject knowledge have greater potential for explaining things to students, recognizing their misconceptions and adjusting their instruction to the needs of learners. The current results corroborate international research findings showing that subject matter knowledge is among the most important predictors of teaching effectiveness and students' achievements (OECD, 2020; Darling-Hammond, 2022; UNESCO, 2024). The current results complement previous research conducted in Tanzania through the demonstration that the effect of subject knowledge on learners' academic performance persists despite other variables considered in the study.

The strong connection between gender-responsive pedagogy and the academic success of the pupils show how important it is to embrace inclusive learning approaches. Gender-responsive pedagogy fosters equal participation, avoids gender bias, and provides classroom settings where every learner has an opportunity to participate regardless of their gender. Similar results are reported for Sub-Saharan Africa, showing that gender-responsive pedagogy leads to enhanced learner participation and academic performance (UNESCO, 2021, 2024; UNICEF, 2022). This information implies that gender-responsive pedagogy needs to be an integral part of instructional quality.

Interestingly enough, neither curriculum knowledge nor general teaching competence proved to be predictors of academic success of the learners. Even though all the three factors are undoubtedly important elements of quality teaching, the absence of the significant impact of the former two suggests that they may constitute necessary but not sufficient criteria for enhancing academic performance of

the learners. An assumption can be made that such competence as curriculum knowledge and general teaching competence became standardized to a large extent due to curriculum reform efforts and teacher training programs. Subject matter expertise and gender-sensitive instruction seem to differentiate successful teachers from unsuccessful ones (OECD, 2020; World Bank, 2023).

The significant impacts of the learners' gender, age, and school infrastructure further show that educational results depend on interactions between teacher effectiveness, characteristics of learners, and the education setting. This result is another piece of evidence for the theory of Educational Production Function since it explains educational success not just by teacher effectiveness but as an aggregate result of many educational inputs. Similar results obtained in previous researches revealed that better school infrastructure improves the attendance, engagement, and academic results of learners, especially in conjunction with good instructional strategies (Hanushek & Woessmann, 2021; World Bank, 2023). Therefore, interventions to improve teacher effectiveness must be combined with interventions in school infrastructure and other conditions conducive to learning.

5. Conclusion and Recommendations

The findings of this study have shown that professional competence rather than demographics provides a more appropriate explanation for teacher quality in Tanzanian primary schools. In particular, subject knowledge and gender-inclusive teaching practice were found to predict learning outcomes among pupils while teacher’s gender, age, and experience were not predictors of pupils' achievement. Additionally, pupil’s traits and school facilities have been found to impact learning outcomes on their own, showing that educational outcomes arise from interactions between teacher’s competence, learner’s traits, and school environment. The research findings expand the Pedagogical Content Knowledge model proposed by Shulman, showing the importance of additional teaching practices that complement disciplinary knowledge.

From the results above, one can conclude that the policies in education and educational practices should be geared towards improving teachers' content knowledge through constant professional development, while also adopting a gender-sensitive pedagogical approach at both pre-service and in-service teacher training. Meanwhile, there should be investment in school infrastructure in parallel with efforts at developing teachers. Future research should use long-term designs as well as consider direct measures of instructional quality along with mediation effects of school leadership on the link between teacher quality and pupils’ learning outcomes.

Declarations

Funding Declaration

This research received no external funding. The authors did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Consent to Participate

Not applicable. This study relied exclusively on anonymized secondary data obtained from the National Bureau of Statistics (NBS), Tanzania. No human participants were directly involved in the study; therefore, informed consent to participate was not required

Data Availability

The study analyzed secondary data obtained from the Tanzania National Bureau of Statistics (NBS). The relevant data record is available through the Tanzania microdata dissemination platform at https://doi.org/10.48529/rgr3-zp50. Where access to the underlying microdata is subject to the data provider’s access conditions, the data may be obtained from the Tanzania National Bureau of Statistics in accordance with its applicable data-access procedures.

Ethics Approval

Ethical approval was not required because this study used anonymized secondary data obtained from the National Bureau of Statistics (NBS), Tanzania. The study involved no human participants, human biological materials, or identifiable personal information. The research was conducted in accordance with the National Bureau of Statistics data access conditions and applicable institutional guidelines governing the ethical use of secondary research data.

Consent for Publication

Not applicable. This study involved secondary analysis of an existing dataset and did not involve recruitment or direct participation of human subjects by the authors. No primary human-participant data were collected.

Third-Party Material

The manuscript contains no third-party copyrighted material. All tables, figures, and analyses were developed by the authors from the National Bureau of Statistics dataset

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Figures

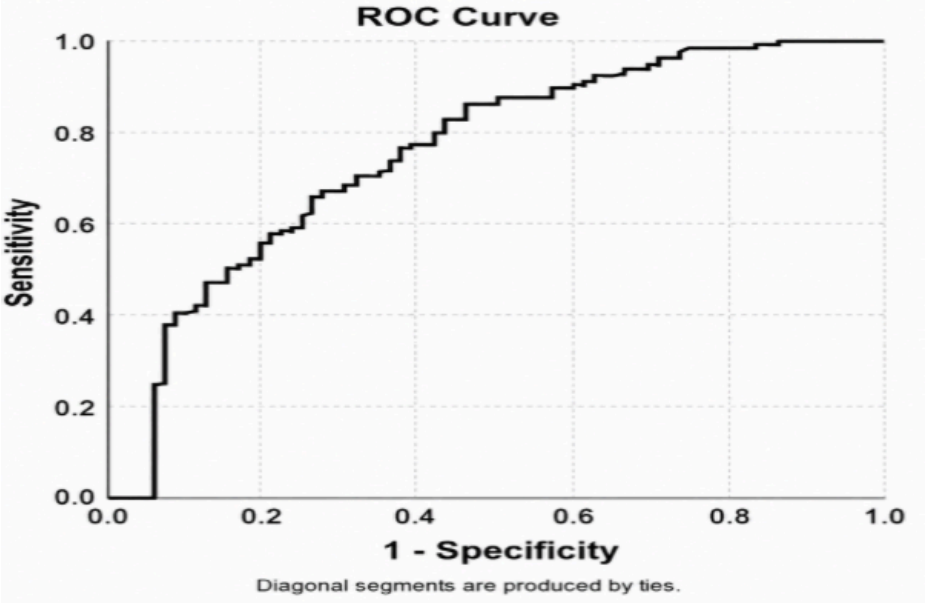


Figure 1

Receiver Operating Characteristic (ROC) Curve for the Logistic Regression Model

Source: IBM SPSS Output (BEST, 2018)

Note: *Figure 1. Receiver Operating Characteristic (ROC) curve illustrating the discriminatory performance of the fitted logistic regression model. The y-axis represents sensitivity (.806 true positive rate), while the x-axis represents 1 – specificity (false positive rate).*