Predictive Association between Teacher–Learner Ratio and Academic Performance in KCSE Business Studies in Public Secondary Schools in Nandi County, Kenya

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DOI: https://doi.org/10.47772/IJRISS.2026.101000676

Received: 04 November 2026; Accepted: 11 November 2026; Published: 15 November 2026

ABSTRACT

Teacher–learner ratio is an important educational input that may be associated with instructional interaction, individual attention and academic performance. However, empirical findings on its relationship with academic achievement remain mixed, and evidence specific to Business Studies in Nandi County, Kenya, is limited. This study examined the predictive association between teacher–learner ratio and academic performance in the Kenya Certificate of Secondary Education (KCSE) Business Studies examination in public secondary schools in Nandi County. Specifically, it determined teacher–learner ratios, established learners' performance in Business Studies and assessed the statistical association between the two variables. Guided by Hanushek's Basic Input–Output Education Production Function model, the study adopted a positivist paradigm and a cross-sectional design. The target population comprised principals, Directors of Studies and Business Studies teachers in public secondary schools that had presented KCSE candidates for four consecutive years up to 2023. A sample of 118 schools was selected through purposive and random sampling procedures. Data were collected using structured questionnaires and document analysis of staffing, enrolment and KCSE records. Descriptive statistics and simple linear regression were performed using SPSS version 20, with significance assessed at the .05 level. The analysis comprised 95 valid school-level cases. The mean teacher–learner ratio was 110.62 (SD = 38.19), while the mean Business Studies score was 4.96 (SD = 2.21). Regression analysis revealed a statistically significant positive predictive association between teacher–learner ratio and performance ((\beta=.343,\ t=3.520,\ p=.001)), with the model explaining 11.8% of performance variation ((R^2=.118)). The null hypothesis was rejected. The positive association contrasts with the expectation that higher ratios correspond to lower achievement and requires cautious interpretation. The cross-sectional, bivariate analysis does not establish causation or account for other potential predictors. The study recommends that staffing decisions consider teacher–learner ratios alongside instructional practices, teacher effectiveness, learner preparedness and school resources.

Keywords: Teacher–learner ratio, academic performance, Business Studies, KCSE, predictive association

INTRODUCTION

Academic performance is an important indicator of teaching and learning and is commonly measured through examination results. In Kenya, the Kenya Certificate of Secondary Education (KCSE) provides a standardized measure of achievement at the end of secondary schooling. Business Studies develops knowledge and skills in commerce, accounting, economics and office practice, supporting learners' further education and economic participation.

National KCSE mean marks in Business Studies declined from 45.76 in 2021 to 31.47 in 2022, rose to 35.06 in 2023 and fell to 33.05 in 2024. In Nandi County, mean scores declined from 4.15 in 2020 to 2.96 in 2021 and 2.38 in 2022, before increasing slightly to 2.41 in 2023. The four-year average was 2.975 out of 12, indicating low achievement.

Teacher–learner ratio is one school-level factor potentially associated with academic performance. It reflects the number of learners relative to available teachers and may influence workload, learner participation, feedback

and individual support. Although manageable ratios may facilitate instructional interaction, lower ratios do not automatically produce better outcomes without effective teaching and appropriate school practices (Hanushek, 2019; Schanzenbach, 2020).

Research on class size and achievement has reported mixed findings, and evidence specific to KCSE Business Studies in Nandi County remains limited. This study therefore examined teacher–learner ratios, learners' Business Studies performance and the predictive association between these variables in public secondary schools in the county.

Study Aim and Purpose

The study examined the predictive association between teacher–learner ratio and academic performance in KCSE Business Studies in public secondary schools in Nandi County, Kenya. It sought to provide context-specific evidence that could inform staffing decisions, instructional planning and further research on educational inputs.

Objectives

The study was guided by three objectives:

1. To determine the teacher–learner ratio in public secondary schools in Nandi County.
2. To establish students' KCSE performance in Business Studies in public secondary schools in Nandi County.
3. To determine the predictive association between teacher–learner ratio and KCSE Business Studies performance in these schools.

Research Questions

1. What is the teacher–learner ratio in public secondary schools in Nandi County?
2. What are students' academic performance in KCSE Business Studies in these schools?
3. What is the predictive association between teacher–learner ratio and KCSE Business Studies performance?

Hypothesis

The study tested the following null hypothesis:

H_0: Teacher–learner ratio has no statistically significant predictive association with KCSE Business Studies performance in public secondary schools in Nandi County.

Statement of the Problem

Business Studies equips learners with practical knowledge in commerce, accounting, economics and office practice. However, KCSE results indicate persistently low performance in Nandi County, raising concerns about the extent to which learners attain the subject's intended outcomes.

Expansion of access to secondary education may increase pressure on teacher availability and workload. A high teacher–learner ratio may constrain individual attention, feedback and monitoring, although staffing levels alone may not explain differences in achievement. Previous research has produced mixed findings, and limited evidence directly addresses the predictive association between teacher–learner ratio and KCSE Business Studies performance in Nandi County. This study addressed this gap by analyzing school-level staffing and examination records.

The Concept of Academic Performance

Academic performance refers to the extent to which learners attain educational objectives, commonly measured through examination scores, grades and other assessments (Kumar et al., 2021; Lozano-Blasco et al., 2022). Although achievement may also encompass competencies such as problem-solving and application of knowledge, this study operationalized performance using the school mean KCSE Business Studies scores.

Achievement is associated with multiple learner, teacher and school factors, including prior achievement, instructional practices, school climate and socioeconomic circumstances (Ye et al., 2021; Jin et al., 2026). Kenyan studies have similarly examined classroom management, teacher knowledge, leadership and school conditions in relation to examination performance (Opiyo et al., 2024; Kirui et al., 2021, 2022). These studies support the use of examination scores as measurable outcomes while cautioning against attributing performance differences to a single factor.

Accordingly, this study examined teacher–learner ratio as one potential predictor without assuming that it independently determines academic achievement.

Teacher–Learner Ratio and Academic Performance

Teacher–learner ratio represents the number of learners relative to the teachers available to teach them. It is an educational input that may be associated with workload, classroom interaction and opportunities for individual support (Hanushek & Woessmann, 2020).

Manageable class sizes may facilitate learner participation, individualized instruction and timely feedback. Such conditions may be particularly relevant to Business Studies, which requires conceptual understanding and application. Studies from different contexts have associated class size and teacher availability with instructional conditions and achievement (Owoeye & Yara, 2011; Baker et al., 2014). However, these relationships may vary according to teaching practices, teacher effectiveness, school resources and learner characteristics.

Evidence from African educational settings also highlights challenges associated with staffing and overcrowding. Studies in Zambia and Nigeria have examined pupil–teacher ratios, school facilities and achievement (Owoeye & Yara, 2011; Phiri, 2022). Kenyan research has similarly investigated teacher adequacy, classroom conditions and academic performance. However, findings have not been uniform, with some studies reporting no statistically significant relationship between student–teacher ratio and achievement (Njoroge, 2023).

These differences suggest that teacher–learner ratio should not be treated as a sufficient explanation for academic performance. Its relationship with achievement may depend on the wider instructional and institutional context. Since findings remain mixed and subject-specific evidence for Nandi County is limited, the present study tested the predictive association between teacher–learner ratio and KCSE Business Studies performance.

Theoretical Framework

The study was guided by Hanushek's Basic Input–Output Education Production Function model (1979, 1986). The model conceptualises educational achievement as an outcome associated with a combination of learner, teacher and school inputs.

In this study, teacher–learner ratio represented the focal educational input, while school mean KCSE Business Studies score represented the educational output. The framework provided a basis for testing whether variation in teacher–learner ratio corresponded with variation in Business Studies performance.

Todd and Wolpin's (2003) dynamic education production function was not adopted because the study did not use longitudinal measures of cumulative learning. Levin's (1974) efficiency model was also not central because the investigation examined predictive association rather than the efficiency of resource use.

Conceptual Framework

The conceptual framework identified teacher–learner ratio as the independent variable and KCSE Business

Studies mean score as the dependent variable.

The framework proposed that teacher–learner ratio might be associated with instructional interaction, teacher workload, individual attention and monitoring of learner progress. Other factors, including teacher effectiveness, learner preparedness, school resources, school climate and socioeconomic circumstances, could also be associated with performance but were not directly tested in the simple regression model.

The study examined whether variation in teacher–learner ratio was statistically associated with variation in Business Studies performance. Although a lower ratio might be expected to provide more opportunities for individual support, this expectation was tested empirically rather than assumed to establish causation.

Research Gaps

Existing literature identifies teacher availability and class size as potentially relevant educational inputs, but findings on their relationship with academic achievement remain mixed. Furthermore, findings from other subjects and geographical contexts cannot automatically be generalised to Business Studies in Nandi County.

There was therefore a need for context-specific evidence on whether teacher–learner ratio statistically predicted KCSE Business Studies performance in public secondary schools in the county. This study addressed the gap by analysing school-level staffing, enrolment and examination records.

METHODOLOGY

Philosophical Paradigm

The study adopted the positivist paradigm, which emphasises objective measurement, systematic observation and statistical testing of relationships between variables (Creswell & Creswell, 2022; Mustofa, 2023). It was appropriate because teacher–learner ratio and KCSE Business Studies performance could be quantified and analysed statistically.

Research Design

A quantitative cross-sectional design was used to examine teacher–learner ratio and Business Studies performance. Data were obtained through questionnaires and document analysis. The design enabled the description of study variables and estimation of their predictive association but did not establish causation.

Study Area

The study was conducted in Nandi County in Kenya's North Rift region. The county covers approximately 2,884 square kilometres and has its headquarters in Kapsabet. Public secondary schools are distributed across six sub-counties, providing a varied context for examining staffing and academic performance.

Target Population

The target population comprised principals, Directors of Studies and Business Studies teachers in public secondary schools that had presented KCSE candidates for four consecutive years up to 2023.

County education records identified 180 eligible schools: four National, 23 Extra-County, 34 County and 119 Sub-County schools. Principals provided institutional and staffing information, Director of Studies provided academic and enrolment records, and Business Studies teachers provided information on staffing and teaching conditions.

Sample Size and Sampling Procedure

The school sample comprised 118 schools: all four National schools, 23 Extra-County schools, 34 County schools and 57 randomly selected Sub-County schools. Purposive selection was used for the first three categories because of their limited numbers, while computer-generated random numbers were used to select Sub-County schools. The study also targeted Business Studies teachers and selected a sample of 136 proportionately across school categories. Principals and Director of Studies were included from sampled schools. Complete school-level data for the focal regression analysis were available for 95 schools.

Although 118 public secondary schools were initially selected for the study, the final regression analysis was based on 95 schools. This reduction resulted from the availability of complete school-level data required for the analysis of teacher–learner ratio and KCSE Business Studies performance. Only schools with complete and usable information on both variables were retained for the regression analysis. Consequently, 95 schools, representing 80.5% of the initially selected schools, constituted the final analytical sample. The remaining 23 schools (19.5%) were excluded from the regression analysis because the required information was not sufficiently complete for the analysis.

Research Instruments

Questionnaires and document analysis were used to collect data. Structured questionnaires were administered to principals, Director of Studies and Business Studies teachers. Document analysis extracted information on teacher numbers, learner enrolment and KCSE Business Studies results from official school records.

The number of Business Studies learners and teachers was used to calculate the teacher–learner ratio, while KCSE records provided the measure of academic performance. Using both data sources supported cross-checking of staffing and performance information.

Validity of the Research Instruments

Content and face validity were addressed by aligning questionnaire items with the study objectives and reviewing them for clarity and relevance. University supervisors reviewed the instruments, and their recommendations informed revisions. A pilot study in schools outside the final sample was used to test question clarity and administration procedures.

Reliability of the Research Instruments

Reliability was assessed through test–retest administration during a pilot study in neighbouring Uasin Gishu County. The pilot involved 24 principals, Director of Studies and Business Studies teachers. Questionnaires were administered twice, two weeks apart. Pearson correlation coefficients were .775 for teachers, .7946 for principals and .7875 for Director of Studies. All exceeded the study's .70 acceptability threshold.

Data Collection Procedures

The researcher obtained an introductory letter from Moi University, a NACOSTI research permit and authorisation from relevant education and administrative authorities. Principals were contacted to arrange school visits. Respondents were informed about the study's purpose, voluntary participation and confidentiality. Questionnaires were administered, and staffing, enrolment and KCSE records were reviewed and checked for completeness.

Data Analysis and Presentation Techniques

Data were coded and analysed using SPSS version 20. Descriptive statistics, including means and standard deviations, summarised teacher–learner ratio and KCSE Business Studies performance. Simple linear regression tested the predictive association between the two variables. Statistical significance was assessed at the .05 level, and results were presented in tables and narrative form.

Assumptions of Regression Analysis

The analysis considered the assumptions of linearity, normality of residuals, homoscedasticity, independence of errors and influential observations. Residual plots and normal probability plots can be used to assess model assumptions, while measures such as Cook's Distance and leverage help identify potentially influential observations. Multicollinearity is not applicable to the focal simple linear regression because it contains only one predictor.

Ethical Considerations

The researcher obtained the required university, NACOSTI, county and school authorisations. Participation was voluntary, and respondents were informed of their right to withdraw without penalty. Confidentiality was maintained, personal identifiers were not required on questionnaires, and the data were used for academic purposes. Sources were acknowledged and findings reported accurately.

RESULTS

Teacher–Learner Ratio in Public Secondary Schools

The first objective sought to determine the teacher–learner ratio in public secondary schools in Nandi County. Descriptive analysis of the 95 valid school-level cases showed substantial variation in ratios across the sampled schools.

Teacher–learner ratio was operationalised as the number of Business Studies learners relative to the available Business Studies teachers in each sampled school. It was calculated by dividing the total number of Business Studies learners enrolled in the school by the number of teachers assigned to teach Business Studies. The information was obtained from official school enrolment and staffing records. The resulting figure represented the number of learners per Business Studies teacher and was used as a continuous predictor in the regression analysis.

The mean teacher–learner ratio was 110.618 (SD = 38.18935), with values ranging from 14 to 167. The variation indicates differences in teacher availability relative to learner enrolment. These descriptive statistics establish the distribution of the ratio but do not independently explain differences in academic performance.

KCSE Business Studies Performance

The second objective sought to establish students' KCSE performance in Business Studies.

Table 1 presents the school-category mean scores for 2021–2024, as reported in the original dataset.

Table 1. Business Studies mean scores by school category

School category	2021	2022	2023	2024	Average
National	8.2	7.9	8.6	7.1	7.95
Extra-County	5.3	6.2	5.7	5.6	5.7
County	4.1	3.8	4.3	4.8	4.3
Sub-County	3	3.1	3.2	3.5	3.2
Overall mean	5.2	5.3	5.5	5.3	—

Source: Researcher (2024).

National schools recorded the highest average score (7.95), followed by Extra-County (5.70), County (4.30) and Sub-County schools (3.20). Overall means ranged from 5.2 to 5.5. The differences indicate variation in

achievement across school categories, although the table alone does not establish that teacher–learner ratio explains these differences.

The descriptive statistics for the 95 schools included in the regression analysis are presented in Table 2.

Table 2. Descriptive statistics for teacher–learner ratio and Business Studies performance

Statistic	KCSE mean score	Teacher–learner ratio
Valid N	95	95
Missing	0	0
Mean	4.9621	110.618
Median	4.3	109.6
Mode	3.5	97.4
Standard deviation	2.21331	38.18935
Variance	4.899	1458.426
Minimum	2	14
Maximum	10.8	167

Source: Researcher (2024).

The mean Business Studies score was 4.96 (SD = 2.21), with scores ranging from 2.00 to 10.80. The teacher–learner ratio ranged from 14 to 167. These findings show substantial variation in both staffing ratios and subject performance across the sampled schools.

Predictive Association Between Teacher–Learner Ratio and Academic Performance

The third objective examined whether teacher–learner ratio statistically predicted KCSE Business Studies performance. Simple linear regression was conducted using teacher–learner ratio as the predictor and school mean Business Studies score as the outcome.

Table 3. Regression model summary

R	R Square	Adjusted R Square	Standard error of estimate
0.343	0.118	0.108	2.09027

Predictor: Teacher–learner ratio.

The model produced an (R) value of .343 and an (R^2) of .118. This indicates that teacher–learner ratio accounted for 11.8% of the observed variation in Business Studies mean scores. The remaining 88.2% was not explained by this single-predictor model.

Table 4. Analysis of variance for the regression model

Source	Sum of squares	df	Mean square	F	p
Regression	54.143	1	54.143	12.392	0.001
Residual	406.34	93	4.369	—	—
Total	460.484	94	—	—	—

Dependent variable: Business Studies mean score. Predictor: Teacher–learner ratio.

The regression model was statistically significant, (F(1,93) =12.392,\ p=.001). Teacher–learner ratio therefore significantly predicted school mean Business Studies scores in the bivariate model.

Table 5. Regression coefficients

Predictor	B	Standard error	Standardised β	t	p	95% CI for B
Constant	3.464	0.477	—	7.267	<.001	[2.517, 4.410]
Teacher–learner ratio	0.012	0.003	0.343	3.52	0.001	[.005, .019]

The fitted regression equation was:

Y=3.464+0.012X

where (Y) represents the predicted KCSE Business Studies mean score and (X) represents teacher–learner ratio.

The coefficient was positive and statistically significant ((B=.012,\ \beta=.343,\ t=3.520,\ p=.001)). Under the model's coding, a one-unit increase in teacher–learner ratio corresponded to a predicted increase of .012 in the mean Business Studies score. The confidence interval for the coefficient was positive, [.005, .019].

The positive direction contrasts with the conventional expectation that more learners per teacher necessarily correspond to lower achievement. It should therefore be interpreted cautiously. The result does not demonstrate that increasing learner numbers per teacher improves performance, because the bivariate analysis did not control for other school and learner characteristics.

Since the p-value (.001) was below the .05 significance level, the null hypothesis was rejected. Teacher–learner ratio had a statistically significant positive predictive association with Business Studies performance in the sampled schools, accounting for 11.8% of its variation.

Summary of Findings

The mean teacher–learner ratio was 110.618 (SD = 38.19), with a range of 14–167. The mean KCSE Business Studies score was 4.962 (SD = 2.21). Simple linear regression identified a statistically significant positive association between teacher–learner ratio and performance ((\beta=.343,\ t=3.520,\ p=.001)). The model explained 11.8% of score variation ((R^2=.118)). The positive direction requires further investigation and should not be interpreted as a causal relationship.

DISCUSSION

An interesting finding of this study was the statistically significant positive predictive association between teacher–learner ratio and KCSE Business Studies performance (β = .343, p = .001). This indicated that schools with higher numerical teacher–learner ratios tended to record higher Business Studies mean scores, contrary to the conventional expectation that higher learner numbers relative to teachers may constrain individual attention, classroom interaction and effective instructional support.

Several contextual factors may account for this unexpected association. First, differences in school characteristics, particularly school category, may partly explain the observed pattern, as schools with relatively high enrolments may also have stronger academic cultures, better examination preparation practices and more established instructional support systems. Second, the total number of teachers in a school may not necessarily reflect the actual distribution of teachers assigned to Business Studies. Third, variations in learners' prior academic preparedness may influence examination performance independently of teacher–learner ratios. However, these explanations were not directly examined in the present study and should therefore be regarded as possible interpretations rather than established explanations.

Furthermore, the simple linear regression model did not control for school category, teacher qualifications, teaching experience or learners' prior academic achievement. Therefore, the positive association should not be interpreted to mean that increasing the number of learners per teacher improves academic performance. Rather,

it suggests that the relationship between teacher–learner ratio and academic achievement may be influenced by other institutional and learner-level characteristics.

The relatively low explanatory power of the model should also be understood in the context of its focus on teacher–learner ratio as a single educational input. Academic performance is a multidimensional outcome associated with several learner, teacher and school-level characteristics, including professional qualifications, teaching experience, instructional resources and socioeconomic backgrounds. Since these factors were not included in the present bivariate analysis, the findings demonstrate the individual statistical association between teacher–learner ratio and academic performance rather than its independent contribution after controlling for other educational inputs. Further research using multivariable regression models is necessary to establish whether this association persists and to determine the combined predictive contribution of these factors.

CONCLUSION

Teacher–learner ratio had a statistically significant but modest positive predictive association with KCSE Business Studies performance in the sampled public secondary schools in Nandi County. The model explained 11.8% of performance variation, leaving most of the variation unexplained.

The positive direction was contrary to the expectation that higher numerical ratios correspond to lower achievement. It should not be interpreted as evidence that increasing the number of learners per teacher improves performance. Rather, the result highlights the need to investigate teacher–learner ratio alongside teacher effectiveness, instructional practices, learner preparedness, school resources and other contextual factors.

IMPLICATIONS AND RECOMMENDATIONS

The findings have implications for teacher deployment, instructional planning and educational research.

First, the Teachers Service Commission and school administrators should continue monitoring teacher availability relative to learner enrolment, especially in schools experiencing high enrolment. Staffing decisions should consider subject requirements, workload and the instructional needs of learners.

Second, schools should examine staffing ratios alongside teaching practices, assessment, learner participation and the use of learning resources. The ratio alone is insufficient to explain differences in academic performance.

Third, policymakers should not interpret the positive association as justification for increasing class sizes or reducing teacher numbers. The direction of the relationship and the limited explanatory power of the model require further investigation before policy conclusions are drawn.

Finally, researchers should use multivariable and longitudinal analyses to determine whether teacher–learner ratio remains a significant predictor after accounting for other relevant school and learner characteristics.

LIMITATIONS

The study was confined to public secondary schools in Nandi County, so its findings may not be generalised to counties with different school and socioeconomic contexts. Questionnaire responses may have been affected by response bias, while classroom practices were not directly observed.

The analysis did not include all potential predictors, including learner attitudes, socioeconomic status, parental involvement and school resources. In addition, the cross-sectional design established statistical association rather than causation. The simple regression model consequently provides limited evidence about the independent contribution of teacher–learner ratio.

SUGGESTIONS FOR FURTHER RESEARCH

Future studies should investigate teacher–learner ratio and Business Studies performance across multiple counties and examination years. Multivariable analyses should account for factors such as teacher qualifications and experience, prior learner achievement, school category, learning resources and socioeconomic context.

Longitudinal research could establish whether changes in teacher–learner ratio are associated with changes in

performance over time. Qualitative research and classroom observations could also explore how staffing levels relate to teaching practices, feedback, learner participation and individual support.

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