CLASS SIZE AS A PREDICTOR OF STUDENTS' ACADEMIC PERFORMANCE IN TECHNICAL DRAWING IN TECHNICAL COLLEGES IN EDO STATE, NIGERIA

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Abstract

This study investigated the extent to which class size predicts students' academic performance in Technical Drawing in Technical Colleges in Edo State, Nigeria. The persistent underperformance of students in Technical Drawing in national examinations has drawn attention to the role of the learning environment, particularly class size, in shaping student achievement in technical colleges. The study adopted a correlational research design. The target population consisted of 1,129 Tech I–III students enrolled in Engineering and Construction Trades across five technical colleges in Edo State. A sample of 330 Tech II students was purposively selected for the study. Data were collected through two validated instruments: the Class Size Scale (CSS) and the Technical Drawing Achievement Test (TDAT). The split-half reliability method yielded a reliability coefficient of 0.78 for the CSS, while 303 properly completed instruments were found suitable for data analysis. Pearson product-moment correlation and simple linear regression were employed for data analysis at a 0.05 significance level. The findings established a negative, low, but statistically significant relationship between class size and students' academic performance in Technical Drawing ($r = -.35$, $p < .01$). Furthermore, regression analysis confirmed that class size was a significant predictor of academic performance, explaining 12% of the variance in student achievement. The study therefore concluded that larger class sizes are associated with diminished academic performance in Technical Drawing. Consequently, it was recommended that class sizes in technical colleges be reduced in accordance with the standards prescribed by the National Board for Technical Education (NBTE). Additional recommendations included the recruitment of more qualified teachers and the provision of adequate instructional resources to enhance students' learning outcomes in Technical Drawing.

Keyword: academic performance, class size, technical drawing.

Introduction

Education plays a pivotal role in cultivating essential skills, competencies, and knowledge that underpin the holistic development of individuals, societies, and countries. Individuals receiving education commonly exhibit motivation to achieve their objectives and excel in various domains. Furthermore, applied educational programmes enhance community welfare and overall societal well-being (Jacobson et al., 2019). This highlights the significance of education as an engine for social transformation and national progress. In the context of Nigeria, the educational system is structured to include universal basic education, comprising primary and junior secondary levels, senior secondary education which integrates vocational education and training, and tertiary or higher education.

The Federal Republic of Nigeria (FRN) (2013) defines Technical Vocational Education and Training (TVET) as an inclusive concept within educational frameworks that integrates the learning of technology and allied scientific disciplines with the development of practical skills and knowledge relevant to diverse economic and social occupations. According to the FRN education policy, the principal goals of vocational education and training are: (a) to introduce students to technological concepts, cultivate an appreciation for technology, and direct them toward vocational interests and professional endeavours post-junior secondary education (JSS); (b) to facilitate the acquisition of technical competencies; (c) to enhance awareness of potential career opportunities through exposure to different occupations; and (d) to empower youths to comprehend the multifaceted nature of technology. These aims are targeted at both the junior secondary and technical college stages to establish a solid vocational skills base, thereby promoting employment prospects, entrepreneurial initiatives, and further educational advancement.

A thorough analysis of these goals reveals that both federal and state governments recognise the critical role of Technical Vocational Education and Training (TVET) in preparing individuals with the skills and competencies necessary to support Nigeria's socio-economic development. TVET is pivotal in producing skilled artisans, technicians, technologists, and craftsmen, all of whom are essential for the country's economic rejuvenation. It provides a foundation for Nigeria’s progression from a developing to a developed economy, emphasising a shift from consumer-driven to production-oriented growth. Within the TVET curriculum, Technical Drawing emerges as one of the most prominent and widely taught subjects.

Within the domain of technical education, particularly in engineering and construction disciplines, Technical Drawing constitutes an essential element for fostering technological progress globally, including in Nigeria. It functions as a fundamental course in technical colleges and involves the creation of diagrams, dimension annotations, and specifications that collectively convey critical information necessary for the actualisation of design concepts. According to the National Board for Technical Education (NBTE, 2014), Technical Drawing is a compulsory trade-based subject in all technical colleges, reflecting its significance for students pursuing technical careers. The pedagogical objectives of Technical Drawing encompass proficiency in the utilisation and upkeep of diverse drafting tools and materials; a robust understanding and interpretation of core graphical communication principles; the ability to accurately represent the construction of basic geometric figures; mastery of multiple projection methodologies, including axonometric and orthographic projections; and competency in

illustrating the intersections of standard solids. The attainment of these educational objectives may be affected by various determinants impacting student academic performance in this subject area.

Academic performance functions as a metric for assessing students' attainment of educational goals and compliance with the criteria set by educational institutions or examination authorities (Amadi, 2021). It represents the outcomes derived from the instructional process. Within the Nigerian context, performance in external evaluations such as NECO, WAEC, and NABTEB is utilised as a standard for appraising the quality of educational institutions. Academic performance is crucial in ascertaining the fulfillment of educational objectives; subpar results often reflect inadequacies in pedagogical approaches, whereas superior results denote successful learning outcomes. Consequently, a correlation exists between academic performance and the learning environment.

The concept of the learning environment pertains to both the physical and psychological contexts in which educational activities take place. Key elements include class size, the availability of specialised facilities such as drawing studios and libraries, accessibility to educational resources, and the quality of interpersonal interactions between educators and learners. A well-structured learning environment enhances students' ability to focus their intrinsic motivation, creativity, and overall academic performance by ensuring sufficient facilities, safety, comfort, and opportunities for active engagement in pedagogical activities. In contrast, environments that are inadequately resourced and are characterised by overcrowding, limited instructional materials, substandard infrastructure, and ineffective teacher-student rapport can obstruct the efficacy of teaching and learning processes. Thus, the learning environment is fundamental in influencing students' attitudes, competencies, behaviours, and their holistic educational outcomes. These components substantially affect learners' engagement levels and their self-perception regarding academic abilities. For example, maintaining an orderly classroom environment may augment student motivation and participation, whereas well-equipped drawing studios can support hands-on learning in Technical Drawing, regardless of class size.

Class size, as conceptualised by Bainomugisha et al. (2025) as the mean number of students allocated per instructional session, holds substantial influence over the pedagogy and comprehension of Technical Drawing, particularly within the context of public educational institutions. Empirical evidence suggests a positive correlation between reduced class sizes and enhanced academic outcomes, attributable to augmented opportunities for personalised instruction and intensified teacher-student interactions, which collectively foster a conducive learning atmosphere. Conversely, an increased number of students per class may stimulate academic competition, potentially driving students to optimise their academic performance. Nonetheless, larger classes are accompanied by certain detriments, including diminished individual engagement and heightened potential for distractions, which can negatively affect student involvement. In the Nigerian educational framework, class size parameters differ across educational tiers; the Federal Republic of Nigeria (FRN, 2013) prescribes maximum class sizes of 20 for pre-primary, 35 for primary, and 40 for secondary education. According to the National Board for Technical Education (NBTE, 2014), an optimal class size for Technical Drawing is established at 20 students, implying that any class exceeding

this threshold is categorised as oversized. Surpassing these recommendations predisposes institutions to overcrowding, thereby exacerbating the associated adverse effects on educational quality.

The academic performance of students attending technical colleges in Nigeria, especially in the subject area of Technical Drawing, has been notably inadequate. Corroborating this observation, the National Board for Technical Education (NBTE) (2024) has documented a persistent pattern of poor student outcomes in Technical Drawing over recent years. Detailed analysis of performance metrics, as presented in the NABTEB Chief Examiner's reports from 2017 to 2023, reveals a concerning pattern whereby the failure rates consistently surpass the proportion of students securing credit-level passes. This data underscores a continual decline in examination results throughout the period from 2017 to 2023, with the highest average score reaching only 45.8% in 2018 and a nadir of 28.7% recorded in 2020 (NBTE, 2024).

The substandard academic performance in Technical Drawing, as reported by the National Board for Technical Education (NBTE), indicates that students' underachievement may be linked to insufficient and demotivating learning environments. Despite various interventions by successive administrations, including programmes initiated by the Ministry of Education and the Post Primary Education Board aimed at improving the educational setting through enhanced supervisory mechanisms, students in technical colleges in Edo State persistently exhibit poor academic performance in Technical Drawing.

Within the domain of educational research focusing on technical and vocational education, several foundational factors have been identified as contributing to the ongoing decline in the academic performance of Technical Drawing students in technical colleges across Edo State. Oviawe et al. (2015) highlighted that deficient pedagogical approaches and instructional techniques, combined with students' low self-efficacy regarding the subject matter (Abkpa & Iji, 2011) and unfavorable learning conditions, significantly impair academic performance in science and technology disciplines (Olunloye, 2010). Accordingly, this research investigates the prevalent issue of suboptimal academic performance among students enrolled in technical colleges in Edo State, particularly in Technical Drawing. This challenge may be attributable to their exposure to inadequate learning environments, including factors such as class size. Within this framework, the study intends to provide empirical evidence concerning class size as a predictor of students' academic performance in Technical Drawing in technical colleges in Edo State.

The purpose of this study was to examine the extent to which class size influences students' academic performance in Technical Drawing in technical colleges in Edo State. Specifically, the purpose of this study was to: examine the extent to which class size determines students' academic performance in Technical Drawing in Edo State technical colleges. The following research question was raised to guide the study: To what extent does class size correlate with students' academic performance in Technical Drawing in technical colleges in Edo State? In this study, the following null hypothesis was tested at 0.05 level of significance": there is no significant relationship between class size and students' academic performance in Technical Drawing in Edo State technical colleges.

1. Literature Review

Abizada and Seyidova (2024) conducted an empirical analysis within the field of educational assessment to examine how class size influenced student achievement in Azerbaijani public secondary education. Utilising final examination results from the State Examination Center (SEC) as a performance metric, the researchers analysed a comprehensive dataset obtained from the Ministry of Science and Education, comprising approximately 80,000 students from grades 9 and 11 across 4,400 schools. The study examined the relationship between class size and academic performance by applying statistical methods, including correlation and regression analyses. Findings consistently indicated a positive association between larger class sizes and higher student achievement, a relationship that persists across various school classifications.

In an allied investigation, Abrahamsen et al. (2024) examined the association between class size and academic performance within the context of tertiary education. Utilising data obtained from the Common Student System (FS) at the University of Stavanger, spanning the years 2011 to 2021, their analysis revealed a negative correlation between student enrollment numbers in courses and examination outcomes. Specifically, as course enrollment increased, the average examination scores tend to decrease.

Etim et al. (2020) conducted an empirical investigation within the field of educational administration, focusing on the influence of class size on academic achievement at the elementary and middle school levels. Using data extracted from the North Carolina School Report Cards (SRC) datasets, their study aimed to explore two primary inquiries: first, the potential association between the average class size and the performance scores of elementary schools; second, the corresponding relationship for middle schools. Employing analytical methods including linear regression and ordered logit models, the findings revealed that average class size serves as a significant predictor of school performance in both elementary and middle school contexts in North Carolina. Notably, the data indicated a divergent pattern whereby increased average class size correlates negatively with elementary school performance, whereas it exhibits a positive correlation with middle school performance. These outcomes underscore the grade-specific effects of class size on educational outcomes, suggesting that the relationship between class size and student achievement varies according to the educational stage under consideration.

A study, situated within the field of educational economics, used recently acquired data on academic achievement collected through a local government survey in Japan to examine the impact of class size on student test scores, specifically in English, Japanese, and Mathematics. The empirical analysis revealed a negative association between class size and test performance in Mathematics and English, indicating that smaller class sizes correspond to improved test outcomes in these subjects. Nonetheless, the influence of class size is relatively modest when compared to other factors such as the academic grade level and gender of the students. Furthermore, the study identified a non-linear concave relationship between class size and Mathematics test scores, modeled by a downward-opening quadratic function, with an optimal class size estimated at 36.2 students. Up to this threshold, Math scores declined as class size increased (Hirao & Iida, 2025).

Bainomugisha et al. (2025) conducted an empirical investigation into the association between class size and academic achievement among students in public secondary schools within Ntungamo District. The primary objective of this research was to elucidate the extent to which class size influenced student academic

outcomes. The study's target population encompassed 7,588 individuals, including 7,182 students, 396 teachers, and 10 headteachers. A cross-sectional research design was employed, integrating a mixed-methods approach for data collection and analysis. Purposive sampling was utilised to select 10 schools and their corresponding headteachers, while simple random sampling was applied to recruit 350 students and 20 teachers. Data were gathered through questionnaires and interview schedules. The internal consistency of quantitative instruments was evaluated using Cronbach's alpha, and qualitative data were recorded and transcribed for analysis. Statistical analyses comprised correlation and regression methods to assess the strength and predictive capacity of relationships between class size and student performance. Results demonstrated a strong positive correlation between class size and academic performance ($r = 0.76$, $p < 0.001$). Furthermore, regression analysis revealed that the model explained 74.1% of the variance in academic achievement ($R^2 = 0.741$), with class size exhibiting the most substantial standardised effect on student outcomes (Beta = 0.276). These findings underscored the significant role of class size as a determinant of students' academic performance.

Shiyyab et al. (2024) explored the influence of accounting instructors' attributes and class size on the academic outcomes of students within accounting education. Academic performance was operationalised using two indicators: the class mean score and the proportion of students achieving success. The research employed diverse methodologies and proxy measures to assess the independent variables, namely educators' characteristics and class enrolment numbers, thereby augmenting the robustness and validity of the results. Regression analysis was utilised to evaluate the associations among the variables studied. Findings pertaining to instructor experience corroborated extant literature, indicating that greater teaching tenure positively impacted students' academic achievement. Additionally, the analysis revealed that increased class sizes were associated with improved academic performance, potentially attributable to enhanced collaborative learning and peer-assisted tutoring opportunities.

In their 2023 study, Ogunjobi et al. examined the influence of information and communication technology (ICT) resources and class size on the academic achievement of secondary school students in science disciplines within Ekiti State. The primary objective was to assess how ICT resource availability and class size affected students' performance in science subjects at the secondary education level. Employing a mixed-method approach, the research combined descriptive survey and ex-post facto designs to gather relevant data. The study's sample comprised 110 science teachers and 2,444 students, whose performance on the West African Senior School Certificate Examination (WASSCE) served as the performance metric. Participants were selected through a multistage sampling method. Two key research instruments were utilised: a questionnaire assessing ICT and class-size facilities directed at teachers (ICTCSFQT), and a Three Years Examination Result Template (TYERT) compiling students' examination results. The ICTCSFQT's face and content validity were established via expert review by professionals specialising in science education and educational measurement and evaluation. Reliability was determined using the test-retest procedure, yielding a coefficient of 0.76. The WASSCE results utilised represented standardised assessments administered by the West African Examinations Council (WAEC). Data analyses were conducted using Pearson's product-moment correlation coefficient.

Hypotheses were evaluated at the 0.05 significance level. Findings demonstrated a statistically significant positive correlation between ICT availability and students' academic performance in science. Additionally, the study found a significant relationship between class size and academic outcomes in the context of secondary school science education.

Previous research on this variable focused on other subject areas, in different geopolitical zones, population of study, and statistical tools used, and their reports vary with respect to subject area, academic level, and statistical tools used. Therefore, the limitations of earlier and more recent papers informed the undertaking of the current study, indicating that more research is needed on the influence of class size and students' academic performance in Technical Drawing in technical colleges in Edo state.

2. Research Methodology

3.1. Research Design

A correlational research design was employed for the study. The design enabled the researcher to determine the influence of class size and students' academic performance in Technical Drawing in technical colleges in Edo State. Such a design necessitated the gathering of data to assess the presence and strength of associations between two or more measurable variables (Uzoagulu, 2011).

Participants

The population of the study comprised 1,129 Tech I–III students in Engineering and Construction Trades in the five technical colleges in Edo State during the 2025/2026 academic session (See Table 1).

Table 1: Students' Population in Engineering and Construction of Technical Colleges in Edo State

Technical Colleges	Tech 1	Tech 11	Tech 111
Government Science and Technical Colleges, Afuze	27	17	70
Government Science and Technical Colleges, Irrua	17	43	16
Government Science and Technical Colleges, Igarra	27	34	50
Government Science and Technical Colleges, Benin	409	220	174
Government Science and Technical Colleges, Ehor	7	21	0
Total	489	330	310

Source: Edo State Board for Technical and Vocational Education, Benin City (2026)

However, a sample of 330 Tech II students was purposively selected for the study. Tech II students were selected because Tech III students were preparing for external examinations, while Tech I students were still in the introductory stage of the programme.

Instruments

The instruments used for data collection were a structured questionnaire titled Class Size Scale (CSS) and the Technical Drawing Achievement Test (TDAT). The CSS consisted of 10 items adapted from Oguejiofor and Obiakor (2020).

The CSS comprised 10-items adapted from a 8-items class sizes questionnaire from Oguejiofor and Obiakor (2020); Technical Drawing Achievement Test (TDAT) was made up of 40 objectives questions drawn from NABTEB past questions based on the topics: Drawing instrument and materials, Angles, Circles, lines, Solid geometry, Conic section and Tangency that the students have been taught. TDAT was administered to Tech II students of Engineering and Construction Trade in the five Technical Colleges in Edo State.

The questionnaire was divided into sections A and B. Section A dealt with the personal data of the respondents as well as questions on Class Size Scale (CSS), while Section B consisted of questions from the Technical Drawing Achievement Test (TDAT). Responses in Section A were measured using a five-point Likert scale in which they were required to tick only one option. Strongly Agree (SA) - 5 point, Agree (A) - 4 points, Undecided (UD) - 3 point, Disagree (D) - 2 point and Strongly Disagree (SD) - 1 point, the benchmark for this section was 3.00. But in Section B, the respondents supplied the correct answer provided from option A to E in the Technical Drawing Achievement Test (TDAT), 2 marks were allotted each for every correct option, and 0 mark for every wrong option A to E. A total score of 70-100 was regarded as high performance (HP), 50-69 was regarded as moderate performance (MP), and 0-49 was regarded as low performance (LP). Face and content validity were carried out by three lecturers in the Department of Vocational and Technical Education, and Department of Guidance and Counselling, both of the Faculty of Education, Ambrose Alli University, Ekpoma. These lecturers were presented with the research topic, the purpose of the study, research question, hypothesis, and a draft copy of the proposed instrument for data collection. The lecturers examined the instruments for data collection, relevance of content, suitability of instruction, and clarity of item statements and made corrections where necessary. Their comments and remarks were integrated into the final draft of the instruments before administering.

The split-half reliability method was used to determine the internal consistency of the instrument. The instrument was administered to 30 Tech II students from a technical college in Asaba, Delta State, who were not part of the study sample. The items were divided into odd and even numbers, and Pearson Product Moment Correlation Coefficient (PPMCC) was used to determine reliability. A reliability coefficient of 0.78 was obtained for the CSS, indicating that the instrument was reliable for the study. 303 valid data due to missing responses were analysed using the Statistical Package for Social Sciences (SPSS) version 23. PPMCC was used to answer the research question, while simple linear regression was used to test the hypothesis at the 0.05 level of significance. For the regression analysis, a p-value less than or equal to 0.05 was regarded as statistically significant, while a p-value greater than 0.05 was regarded as not statistically significant.

Table 2: Coefficient of Relationship between Class Size and Students Academic Performance in Technical Drawing

Variables	N	Mean	Standard Deviation	R	P	Remark
Class Size	303	42.10	1.30	-.35	**< .01**	Significant
Students' Academic Performance	303	55.44	11.63			

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 presents the relationship between class size and students' academic performance in Technical Drawing. The data yielded a mean score of 42.10 (SD = 1.30) for class size and 55.44 (SD = 11.63) for academic performance. Findings from the correlation analysis indicate a statistically significant negative relationship between class size and academic performance ($r = -.35$, $p < .01$). This implies that as class size increases, students' academic performance in Technical Drawing tends to decline, suggesting that overcrowded classrooms may hinder effective learning outcomes among students in technical colleges in Edo State.

Table 3: Linear regression on the Relationship between Students' Class Sizes and Academic Performance in Technical Drawing in Technical Colleges in Edo State

	Unstandardised Coefficients		Standardised Coefficients		
Model	B	Std. Error	Beta	T	Sig.
(Constant)	186.040	14.249		13.056	.000
Class Size	-3.102	.338	-.347	-9.170	.000

Table 3 reveals that class size is a significant predictor of students' academic performance in Technical Drawing, $F(1, 301) = 84.087$, $p < .05$. The standardised regression coefficient ($\beta = -.347$) confirms a negative predictive relationship, indicating that an increase in class size corresponds with a decline in academic performance. Furthermore, the coefficient of determination ($R^2 = .120$) suggests that class size accounted for approximately 12% of the total variance observed in students' academic performance in Technical Drawing. Based on these findings, the null hypothesis was rejected, leading to the conclusion that class size significantly predicts academic performance in

Technical Drawing among students in technical colleges in Edo State.

Discussion of Findings

The results of the data analysis with respect to the research question revealed a relationship between class size and students' academic performance in Technical Drawing in technical colleges in Edo State. The findings indicated a negative, low, but statistically significant correlation between class size and students' academic performance. Similarly, the test of the hypothesis confirmed that a significant relationship exists between class size and students' academic performance.

The implication of this finding is that larger class sizes are associated with lower academic performance in Technical Drawing. This may be attributed to the limitations inherent in large classes, such as reduced opportunities for individualised instruction, limited teacher–student interaction, and increased classroom distractions. In contrast, smaller class sizes tend to provide a more supportive learning environment that enhances students' motivation, engagement, and understanding.

Furthermore, smaller classes enable teachers to adapt instructional strategies to accommodate diverse learning styles, thereby facilitating better comprehension of complex concepts such as perspective, scale, and proportion, which are essential in Technical Drawing. In addition, students in smaller classes benefit from more immediate feedback and increased opportunities for participation. Collaborative learning is also more effective in such settings, as students can easily engage in group work and peer review activities.

The findings of this study are consistent with those of Hirao and Iida (2025) and Abrahamsen et al. (2024), who reported that smaller class sizes are associated with improved academic performance. Similarly, Ogunjobi et al. (2023) found a significant relationship between class size and academic performance, with students in smaller classes outperforming those in larger ones. In the same vein, Etim et al. (2020) reported that large class sizes have a negative effect on students' academic performance.

However, the findings of this study contrast with those of Bainomugisha et al. (2025), who reported a positive relationship between class size and students' academic performance. Likewise, Shiyyab et al. (2024) found that larger class sizes may enhance academic performance, possibly due to increased opportunities for peer interaction and collaborative learning. Similarly, Abizada and Seyidova (2024) reported a positive correlation between class size and student performance.

Conclusion

The study revealed a significant negative relationship between class size and students' academic performance in Technical Drawing in technical colleges in Edo State. The findings suggest that larger class sizes are associated with lower academic performance among students. The study therefore concludes that smaller class size may enhance students' academic performance by promoting effective teacher–student interaction, improved classroom management, and greater opportunities for individualised instruction.

Recommendation

Based on the findings of the study, the following recommendations were made:

1. The Edo State Government, through the State Board for Technical and Vocational Education, should ensure that class sizes in Technical Drawing classes comply with the National Board for Technical Education (NBTE) recommendation of not more than 20 students per class.

2. More qualified Technical Drawing teachers should be recruited and deployed to technical colleges in Edo State to improve teacher–student interaction and instructional effectiveness.
3. Government and relevant stakeholders should provide adequate drawing studios, drawing instruments, and instructional materials to enhance practical learning in Technical Drawing.
4. School administrators should restructure overcrowded classes into smaller streams through effective timetabling and utilisation of available facilities.
5. The Ministry of Education and relevant supervisory agencies should regularly monitor class sizes and instructional practices in technical colleges to ensure compliance with policy standards.

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