

## Original Article

# Influence of teacher quality and professional development on the students' academic performance in technical drawing in technical colleges

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### ABSTRACT

This study investigated the influence of teacher quality and professional development on students' academic performance in technical drawing in Edo State technical colleges, Nigeria, using correlational survey research design. The sample size for the study comprised 20 technical teachers and 150 technical drawing students selected through simple randomly balloting technique. Two instruments developed by the researcher were used for data collection: Teacher quality and professional development questionnaire (TQPDQ) and Technical Drawing Achievement Test (TDAT). The instruments were validated by three experts. TQPDQ had a reliability coefficient of 0.86, while TDAT had a reliability value of 0.76 obtained using the test-retest technique. Data collected were analyzed using multiple regression. The findings of the study revealed that despite low percent variation in students' academic performance in technical drawing that can be attributed to teacher quality; there exists a significant positive relationship between students' academic performance in technical drawing and teacher quality. Furthermore, it was observed that there was no significant relationship between students' academic performance in technical drawing and technical drawing teachers' professional development as a result of poor attendants of teachers' to professional development programs. The findings of this study imply that teacher quality and professional development are major factors in the academic performance of students' in technical drawing. Based on the findings of this study, it was recommended among others that the government should organize and expose technical teachers to diverse opportunities that will facilitate them to develop professionally.

**Keywords:** Academic performance, Professional development, Relationship, Teacher quality, Technical drawing

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## INTRODUCTION

The technical drawing is the language of technology. It is the most popular technical subject in any technical education program be it at the universities, polytechnics, colleges of education (Technical), technical colleges, or secondary schools.<sup>[1]</sup> The technical drawing is a skill-oriented subject or course that covers work done by architects, engineers, interior designers and electricians, technical drafters, craftsmen, and technical teacher educators and students. The technical drawing is essentially the universal and graphic language used by architects, technicians, engineers, technologists, designers, craftsmen, operators, manufacturers, and industrialists to communicate ideas by means of pictures, drawings, graphics, and symbols.<sup>[1]</sup> The usability of technical drawing goes beyond

cultures and languages, and for any country to advance technologically, such a country must enlarge the preparation of her citizens in a technical drawing which is the language of technology.

The technical drawing is offered in Nigerian senior secondary schools, technical colleges, and tertiary institutions that offer courses in the areas of technical education, architecture, urban and regional planning, and engineering. The technical drawing course outline according to the National Board for Technical Education<sup>[2]</sup> includes: (i) Drawing studio practice; (ii) geometrical construction; (iii) development of geometrical solids; (iv) pictorial drawing; (v) points and lines in space; (vi) building and engineering design and drawing; and (vii) business opportunities in drawing studio practice. Its

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objectives are: To provide an understanding of the theoretical and applied concepts relating to the use of information and communication technology to facilitate visual communication of ideas in the construction and production industries; provide introduction to modern drawing studio practice; lay the foundation for technological development and further studies in building and engineering; and stimulate, develop, and enhance entrepreneurship skills in the diverse areas of drawing studio practice. Technical drawing is offered at the technical colleges in Nigeria for 3 years. During this period, technical teachers are expected to expose students to practical activities toward arousing and stimulating the students' interest in technology and cultivating their attitude positively to entrepreneurship and national development in technology.

Oviawe<sup>[3]</sup> described technical drawing as the prime mover of all other technical related subjects that forms a picture of the concept of what should be drawn before actually drawing it. He added that greater form is done where the teacher finds it difficult to assist students to create the image of the picture required. These difficulties, according to Oviawe and Adeola,<sup>[1]</sup> are of a mechanic tradition.<sup>[1]</sup> Further stated that Nigeria as a developing country is just starting to experience the technology age, with the result that most of her young people, unlike youths elsewhere have had no acquaintance with machines, mechanical knowledge, attitude, habits, and thinking that are normal part of growing up in a technology culture. This clearly implies that something is lacking in Nigeria's quest for technological growth and development. To this end, Oviawe<sup>[3]</sup> posited that the required background that ought to be the foundation for the study of engineering and technology, which is technical drawing is missing. This forms the basis for the technological culture most researchers refer to. The technical drawing needs a high level of imagination and vision; and students are required to acquire or possess the creative skills to enable them to perform well in technical drawing.

Despite the laudable objects of technical drawing to technology education, studies have revealed that students' academic performance in technical subjects has been poor over the years. The analysis of students' results in NABTEB, according to Chief Examiners' report of the National Business and Technical Examination Board from 2009 to 2013, revealed that the percentage of failure is higher than the percentage of credit pass annually. This depicts an ugly trend in the students' performance in NABTEB technical drawing. Furthermore, the National Board for Technical Education in the years 2009, 2010, 2011, and 2012 asserted that the overall achievement of students in the technical drawing has been quite low with the highest mean score in technical drawing recorded as 34.67%, 38%, 40.43%, and 27.78%, respectively.<sup>[4]</sup> This situation cannot necessarily produce the ingredients for the actualization of the achievement of one of the objectives of teaching technical drawing in technical colleges and senior secondary

schools, which is to prepare students' for further studies in technology-related fields. This poor academic performance of students in technical drawing is blamed on many reasons: Poor teaching approach and instructional strategy;<sup>[5]</sup> lack of confidence in the subject;<sup>[6]</sup> poor learning environment;<sup>[7]</sup> and the unique and standardized teaching material provided to all learners tends to be of unique benefit to only those students whose learning style and background knowledge fit well with the teaching materials. This does not take care of the individual differences that exist between the learners, such as learning styles, abilities, and background knowledge;<sup>[8]</sup> and teachers and government's inability to effectively sponsor education and motivate teachers to enhance their productivity.<sup>[9]</sup> The foregoing reports suggest that the mastery of technical drawing in Nigeria is at a shallow level and needs to be improved on Oviawe and Adeola.<sup>[1]</sup> The students' poor performance in technical drawing has been a major concern to all stakeholders (parents, technical teachers, and technical teacher educators and curriculum experts) across the nation, and they are keen to grip any effort geared toward ameliorating this horrible peril.

The success of any endeavors is reliant on certain factors. This may be true of academic performance in training and schooling. A key principle factor for the success of students' academic performance is the teacher.<sup>[10]</sup> Thus, to ensure that the stated objectives of technical drawing are effectively realized, the teachers of technical drawing who are primary implementers of its curriculum have crucial roles to play. The ugly trend in students' academic performance in NABTEB and NBTE technical drawing could also be linked to teachers' classroom variables such as teachers' quality, professional development, and characteristics external to classroom practices.

Within the context of this study, teacher quality includes teachers' qualifications, years of experience, and areas of specialization. Teachers' qualifications and exposure can go a long way to bring about students' high academic achievement. To this end, the Federal Republic of Nigeria<sup>[11]</sup> posited that no education can rise above the quality of its teachers. The function of the teachers' in the preparation of students to succeed in examinations cannot be undermined. Gbore<sup>[10]</sup> asserted that the shortage of qualified teachers is responsible for the poor academic performance observable among students while Adegbemile<sup>[12]</sup> stated that teachers hold the key to nation-building. The aspiration of any nation to transform into a greater country can only be possible if there are competent and dedicated teachers to impact the appropriate attitudes, skills, and knowledge. Adegbemile<sup>[12]</sup> Added that students taught by more qualified and experienced teachers in terms of knowledge of the subject matter perform better than those taught by less qualified but experienced teachers.

Teachers are expected to be competent and professional in their related fields and subject-matter.<sup>[13]</sup> The teaching

qualification is an end product of professional development which encompasses all types of learning embarked on by teachers outside the point of their earlier preparation in school before becoming a teacher. According to Aina and Olanipekun,<sup>[14]</sup> teachers' qualification is a particular type of experience or knowledge someone possesses to make him/her suitable to teach. Maphoso and Mahlo<sup>[15]</sup> asserted that a teacher must possess instructional/intervention skills to maximize the learner's outcomes. A teacher's qualification refers to all the requisite skills a teacher needs to effectively teach. These skills include formal education, experience, subject matter knowledge, pedagogy studies, duration of training, certificate/licensing, and professional development.<sup>[16]</sup> Sowder<sup>[17]</sup> stated that teacher's qualification depends on the professional growth, which is noticeable by the change in teachers' knowledge, beliefs, and instructional strategies.

Akinsolu<sup>[18]</sup> conducted a study in which he examined the number of qualified teachers and its relationship to students' learning in public secondary schools in Osun State. Twenty-one public senior secondary schools were randomly sampled. The instrument for data collection was titled: Quantity and quality of teachers and students' learning readiness. The senior school certificate examinations results from 2000/2001 to 2004/2005 were used to analyze students' learning readiness. The data collected were analyzed using ANOVA and Spearman rank correlation coefficient to test the three operational hypotheses. Findings of the study revealed that teachers' qualifications, experience, and teacher-student ratio were significantly related to students' learning readiness.

Teachers are appointed based on their qualifications to teach and execute other administrative tasks. Teachers are the catalyst between the students and the subject matter. They are to ensure that learning occurs. Stigler and Hiebert<sup>[19]</sup> opined that increased qualification might increase teaching effectiveness. According to the Federal Republic of Nigeria,<sup>[11]</sup> to be a teacher, an individual should possess the Nigerian Certificate in Education, Bachelor of Education, Postgraduate Diploma in Education, and Professional Diploma in Education. Abe<sup>[20]</sup> outlined three ways in which teacher qualification can be quantified: (i) Level of education; (ii) years of experience in preparation of subject matter and pedagogy; and (iii) certification in their expertise area and their ongoing professional development.

Professional development is the activities that develop a person's skills, knowledge, expertise, and other characteristics as a teacher. This definition recognizes that development can be provided in several ways, ranging from the formal to the informal. It is a continuum of learning and support activities designed to prepare individuals for work. It can be made available through external expertise in the form of courses, workshops, or formal qualification programs through collaboration between schools and teachers across schools

(e.g., observational visit to other schools or network teachers) or within the schools in which teachers work. It can also include training specific to the field that is on-going over the course of a career, 1 time in service training, coaching, mentorship or even peer support, or online tools for learning. It is intended to benefit all teachers; each teacher brings a different set of characteristics to the classroom, which has the potential to influence the impact of the professional development.<sup>[21]</sup>

Professional development contributes to learning process of effective teaching and classroom interactions which lead to classroom quality. Single session professional development trainings contribute to stronger instruction practices within the classroom. Professional development with 14 or more hours of training time increases likelihood that teachers retain new information and are able to implement new skills effectively. It is also important to provide a variety of professional development layouts (single session, online modules, and workshops) because teachers respond differently based on individual characteristics and interest.<sup>[22]</sup> The Wilson<sup>[23]</sup> asserted that there is universal agreement that high-quality, ongoing professional development for teachers is equally necessary. Research linking professional development to changes in teacher knowledge or practice is suggestive. Desimone *et al.*<sup>[24]</sup> found that professional development focused on specific instructional practices increases teachers' use of those practices and that the use of specific features such as active learning opportunities, increases the effect of the professional development on teachers' instruction. Research in the school sector in Australia and internationally is unequivocal about the importance and impact of teacher quality on students learning.<sup>[25]</sup> Yoon *et al.*<sup>[26]</sup> examined nine studies that looked at the influence of teacher professional development on students' achievement and found that the students of teachers who had on average of 49 h of professional development had greater achievement. This indicates the place of teacher professional development in teaching and learning. Similarly, Jillian<sup>[27]</sup> studied how teacher characteristics influence the impact of professional development on classroom quality in Rhode Island using a population of 490 teachers and a sample size of 210 teachers selected through simple random sampling technique. These teachers were assigned to four different treatment groups: Course and consultancy, course only, consultancy only, and control group. Classroom assessment scoring system scores were used to measure the study. Regression analysis and *t*-test were used to test the hypotheses at 0.05 level of significance. The findings of the study show that the teachers with higher education levels benefit from each of the three treatment combinations, which may be a result of their pre-existing ability to foster a stronger learning environment than those who have lower credentials. Related to this factor is the experience of the technical drawing teachers in the field of teaching.

Technical drawing teachers' experience in the field of teaching contributes to the educational environment of the learners, which in turn will have an impact on the learners' academic performance. There is a common assumption that with regard to the relationship between teacher experience and students' academic performance. It is generally perceived that students' taught by the most experienced teachers achieved higher levels. This is because such teachers had mastered the content and obtained classroom management skills to deal with different types of classroom problems. However, researches on the relationship between the teachers' experience and students' academic performance revealed contradictory results. For example, Chhinh and Tabata<sup>[28]</sup> found a positive relationship between teachers' experiences and students' achievement while Klecker<sup>[29]</sup> found that there is no significant relationship between students' achievement and their teachers' years of teaching. Abe<sup>[20]</sup> found that teacher quality characteristics, such as certification status and degree in subject to be taught are very significant and positively correlated with subject outcomes.

Ewetan and Ewetan<sup>[30]</sup> examined the influence of teachers' teaching experience on the learning readiness of public secondary school students in Mathematics and English Language in Ado-Odo/Ota and Ifo Local Government Areas of Ogun State, Nigeria. The study population consisted of all the 31 senior secondary schools in the two local government areas. Simple random sampling technique was used the selection of 20 schools; 14 schools from Ado/Ota, and six from Ifo Local Government Areas. An inventory schedule was the instrument used for data collection. Four hundred questionnaires, 20 per school, were administered. Three hundred and eighty-eight questionnaires (97%) were duly completed and returned. Their responses were analyzed through content analysis. Regression analysis and *t*-test were used to test the hypotheses at 0.05 level of significance. Findings indicated that teachers' teaching experience has significantly influenced students' readiness in Mathematics and English Language as measured by their performance in the senior secondary school certificate examinations and as perceived by the respondents. Interestingly, Owioye and Yara<sup>[31]</sup> found in their studies that students with Mathematics teachers' assigned in-field scored higher and had greater gains than students with teachers' assigned out-of-field, which shows a connection of content-knowledge, but not necessarily applying pedagogical knowledge to other content areas.

Kimani *et al.*<sup>[32]</sup> discarded the notion that more experienced teachers and principals demonstrate greater executive and professional responsibility than the less experienced ones or that the length of teaching experience positively correlated with productivity or age of the teacher is a determinant of efficiency and effectiveness. These authors in their study titled: Production of academic achievement as a function of teachers' experience and salaries reported that teachers' experience is

an important factor in students' learning. However, most of these researchers do not use or test other teacher variable to convince us that there is absolute unrelated between teaching experience and effectiveness in the classroom.

Agbatogun<sup>[33]</sup> opined that teaching experience is positively correlated with students' learning outcomes. Agbatogun<sup>[33]</sup> found that years of teaching experience are consistent predictors of higher test scores, other documents revealed a negative effect when a high proportion of non-experienced teachers is present in a school in terms of high drop-out rates and lower students' achievement scores. Alufohai<sup>[34]</sup> reported that the effect of teacher experience is a small relative to other desirable teachers' characteristics such as teachers' content knowledge and overall academic ability. It is in the light of these conflicting findings that this study was conducted to find out the direction of the relationship between teachers' experience and students' achievement in technical drawing. The findings of this study will help to understand the place of professional development in teaching and learning.

## MATERIALS AND METHODS

The study adopted the correlational survey research design to investigate the relationship between teacher quality and professional development on students' academic performance in technical drawing in Edo State technical colleges.

The population for the study consisted of all the technical drawing teachers from the technical colleges in Edo State, Nigeria. The sample comprised 20 technical drawing teachers and 150 technical drawing students selected through a simple random sampling technique by balloting.

The two instruments used for data collection were developed by the researcher from the literature reviewed. They are: Teacher quality and professional development questionnaire (TQPDQ) and technical drawing achievement test (TDAT). TQPDQ consisted of A and B. Section A sought information on the demographic variables of the teacher and teacher quality; while section B consisted of 13-items bordering on the type of professional development programs that technical drawing teachers have taken part in as well as the frequency of attendance to such programs. TQPDQ was administered to 20 teachers in a neighboring Delta State as a pilot test, and a reliability coefficient of 0.86 was obtained. The TDAT consisted of 40 multiple choice items with four options.

The instrument was validated by three experts in test and measurement and technical drawing from Ambrose Alli University, Ekpoma, and technical colleges in Edo State. Their suggestions and corrections resulted in the final draft used for this study. TDAT had the reliability of 0.76 using test-retest



technique. The difficulty index of the items ranged between 0.45 and 0.55; while the discrimination index ranged between 0.4 and 0.65.

Data collected were analyzed using multiple regression analysis.

## RESULTS AND DISCUSSION

Research question 1: What is the relationship between students' academic performance in technical drawing and teacher quality?

Table 1 shows the regression analysis of the influence of teacher quality (years of experience and qualification) on students' academic performance in technical drawing. The analysis implies that the correlation between teacher quality and students' academic performance is 0.326 with a coefficient of determination of 0.106. This indicates that 10.6% variation in students' academic performance in technical drawing can be attributed to teacher quality.

Hypothesis 1: There is no significant relationship between students' academic performance in technical drawing and teacher quality.

Table 2 reveals that the probability associated with the calculated value of F (11.013) is 0.05. Since the probability value of 0.034 is less than the 0.05 level of significance, therefore, the null hypothesis of no significant relation was rejected. Hence, it is concluded that a significant relationship exists between students' academic performance in technical drawing and teacher quality. This means that teachers' quality influences students' academic performance in technical drawing.

Research Question 2: What is the relationship between students' academic performance in technical drawing and teacher professional development?

Table 3 reveals the regression analysis of the influence of teacher professional development on students' academic performance in technical drawing. The result shows that the relationship between technical drawing teachers' professional development and students' academic performance in technical drawing is 0.224 with a coefficient of determination of 0.050. This implies that only 5% variation in students' academic performance in technical drawing can be attributed to technical drawing teachers' professional development. The low correlation may have been due to the fact that most of the available technical drawing teachers involved in this study had poor attendance to professional development programs as revealed in their responses to the items in the questionnaire.

Hypothesis 2: There is no significant relationship between students' academic performance in technical drawing and teacher professional development.

Table 4 reveals that the probability associated with the calculated value of F (0.955) is 0.341. Since the probability value of 0.341 is greater than the 0.05 level of significance, therefore, the null hypothesis of no significant relationship was retained. Hence, it is concluded that there is no significant relationship between students' academic performance in technical drawing and technical teacher professional development. The observed no significant relationship between students' academic performance in technical drawing and technical teacher professional development might be as a result that the technical teachers are not being exposed to various professional development as revealed by their responses to the items on professional development in the questionnaire.

**Table 1: Regression analysis of the influence of teacher quality on students' academic performance in technical drawing**

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.326 <sup>a</sup>	0.106	0.001	11.509

<sup>a</sup>Predictors: (Constant), teaching experience, qualification

**Table 2: Regression analysis of the influence of teacher quality on students' academic performance in technical drawing**

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	268.394	2	134.197	11.013	0.034
	Residual	2251.806	17	132.459		
	Total	2520.200	19			

**Table 3: Regression analysis of the influence of teacher professional development on students' academic performance in technical drawing**

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.224 <sup>a</sup>	0.050	-0.002	11.53059

<sup>a</sup>Predictors: (Constant), teaching professional development

**Table 4: Analysis of variance of the influence of teacher professional development on students' academic performance in technical drawing**

Model		Sum of squares	df	Mean square	F	Sig.
1	Residual	2393.183	1	127.017	0.955	0.341
	Regression	127.017	18	132.955		
	Total	2520.200	19			

Research question 3: What is the relationship between students' academic performance in technical drawing and the combination of both teacher quality and professional development?

Table 5 reveals that the correlation between the linear combination of teacher quality and professional development and students' academic performance in technical drawing 0.338 with a coefficient determination of 0.114. The result shows that 11.4% variation in students' academic performance in technical drawing can be attributed to the linear combination of teacher quality and technical drawing teachers' professional development.

Hypothesis 3: There is no significant relationship between students' academic performance in technical drawing and the combination of teacher quality and professional development.

Table 6 reveals that the probability associated with the calculated value of F (0.689) is 0.572. Since the probability value of 0.572 is greater than 0.05 level of significance, therefore, the null hypothesis of no significant relationship was retained. Hence, it is concluded that there is no significant relationship between students' academic performance in technical drawing and linear combination of technical teacher quality and professional development.

## DISCUSSION OF FINDINGS

The findings of the study revealed that low percentage variation in students' academic performance in technical drawing can be attributed to teacher quality. However, there is a significant and positive relationship between students' academic performance in technical drawing and technical teacher quality. The low relationship between teacher quality and students' academic performance in technical drawing could be a result of a lack

**Table 5: Regression analysis of the influence of teacher quality and professional development on students' academic performance in technical drawing**

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.338	0.114	-0.052	11.810

**Table 6: Analysis of variance of the influence of teacher quality and professional development on students' academic performance in technical drawing**

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	288.333	3	96.11	0.689	0.572
	Residual	2231.867	16	139.492		
	Total	2520.200	19			

of appropriate qualifications and experiences by some of the technical teachers involved in the study. These findings are in line with that of Goe<sup>[35]</sup> and Kane<sup>[36]</sup> who reported that teachers' teaching experience had a significant positive influence on students' achievement in science and mathematics. Similarly, Alufohai<sup>[34]</sup> stated that teacher quality characteristics, such as certification status and degree in subject to be taught are very significant and positively correlated with subject outcomes in English Language.

The findings of the study also revealed that there was no significant relationship between students' academic performance in technical drawing and technical teachers' professional development. Furthermore, the findings of the study indicated that there is no significant relationship between students' academic performance and the combination of technical teacher quality and professional development. These findings corroborate the findings of Alufohai<sup>[34]</sup> who reported that these variables were found to be positively associated, though not significantly related to English Language achievement. Furthermore, Akinsolu<sup>[18]</sup> stated that teachers required professional knowledge and professional teaching skills, as well as a broad base of general knowledge to promote teachers' job effectiveness and learners' achievement to support the findings of this study. The findings of the study are in contrary to the findings of Yoon<sup>[26]</sup> who reported that teacher professional development is significantly related to students' achievement in science. This indicates the place of teacher professional development in the preparation of technical teachers. Nevertheless, the low relationship reported may be ascribed to the lack of specialized preparation of technical teachers in Nigeria. In addition, most technical teachers in the technical colleges used for the study have poor attendance for professional development programs.

The findings of this study imply that technical teacher quality is a fundamental factor in the academic performance of students in technical drawing. This means that technical drawing teachers who do not possess the essential intrinsic worth are not expected to teach technical drawing. Furthermore, the professional development of technical teachers' is extremely vital in the preparation of technical teachers. Hence, technical teachers who are not competently trained are not supposed to teach the subject.

## CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, the researcher concluded that teacher quality is an influential factor in the academic performance of students in technical drawing. However, no significant relationship was found between students' academic performance in technical drawing and technical teachers'

professional development. This could be due to the fact that poor or none attendance of technical teachers' to professional development programs. Based on the findings of the study, the following recommendations were made:

1. Government should expose technical teachers to a variety of programs for the training, re-training/refresher of technical teachers such as conferences, seminars, and workshops that will assist them to broaden their potentials, help update technical teachers on innovative ways of teaching technical drawing
2. More qualified technical teachers should be engaged to handle the instructional delivery of technical drawings in technical colleges
3. Technical students' should be taught by very qualified and experienced teacher teachers to enhance students' academic performance
4. Technical teachers should be engaged in various professional development programs to develop professionally. This can be achieved through self-sponsorship if the school authorities or government do not avail them of the opportunities.

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