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Effect of Technology-Enabled Video Instruction on Senior Secondary School Students' Performance in Selected Technical Drawing Concept in Ilorin

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ABSTRACTS

The study examined the effect of technology-enabled video instruction (TEVI) on senior secondary school students' performance in selected technical drawing (TD) concepts in Ilorin. The sample for this study consists of an intact class in a senior secondary school in Ilorin. The research adopted a mixed method of quantitative and qualitative research, pre-experimental research of one-group pretest-posttest design. Technology-Enabled Video was used for data collection. The findings from the study revealed that TEVI had a positive effect on the academic performance of students taught selected TD concept, (63.1 > 51.5), there was a significant difference in the pretest and posttest performance of students taught selected technical drawing concept using TEVI i.e. (df=15, t=-565, p=.000 < 0.05). The study concluded that technology-enabled video instruction which is an improvised instructional aid did enhance the academic performance of the students. The study implies that proper integration of technology-based packages like TEVI for instructional delivery will adequately enhance students' performance. The study Recommended that TEVI should be encouraged among teachers and students, as this will help to boost learners' interest and provide learners the ability to learn in a direct, self-paced, and individualistic manner, which will, in turn, translate to better academic performance.

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1. INTRODUCTION

Teaching and learning around the world are mainly technology-driven, and the need to make learning captivating, attractive, interesting, and impactful cannot be over-emphasized. The conventional learning system is gradually giving way for new horizons in teaching and learning, and the teacher-centered learning approach is now losing its relevance due to the emergence of new technologies of learning, which are mainly learner-centered approaches to teaching and learning. The daily millisecond rate of development and advancement in technology has created an environment where learners in this era of technology-rich innovation in learning can learn without the interference of the instructors. The instructor must facilitate, guide, and provide enabling environments which is the basis for learning to take place. Theories of learning that emphasize the need for students to be fully involved in the construction of self-understanding have challenged the theoretical underpinnings of instructor-focused teaching by the telling approach.

The conventional mode of instruction in technical drawing has been the demonstration method; it is a teaching method where the teacher explains by demonstrating the subject matter to his students on the chalkboard or marker board. This technique of teaching used alone has failed to provide the needed transformational input expected of it in the job market (Gambari et al., 2015). This method has become obsolete and so, refused to meet up with the changing trends noticeable in the field of learning, hence the need to employ one of the emerging technologies of learning referred to as active learning (Diraso et al., 2013). Active learning helps students to engage in self-learning. It encourages students to do something other than taking notes and the following direction, by creating in them the ability to think critically and solve problems. They participate in activities to construct new knowledge and build new scientific skills (Jung, 2021).

Hodges (2020) also posited that anything that involves students in doing things and thinking about the things they are doing may be referred to as active learning. A technology-enabled active learning environment is an innovative teaching and learning structure that features a multimedia-equipped studio that helps to facilitate learning in science and technology courses (Dori & Belcher, 2005). New learning format that combines educational content from a lecturer, simulation, and student's experience using technological tools to provide a rich collaborative learning experience to students. The development of science and technology has created the opportunity for the implementation of learning by utilizing the technological advances either through a computer or internet media. Technology has undoubtedly permeated every aspect of our daily lives. Its ubiquitous availability today has put education systems of all levels at an unprecedented advantage with access to boundless information and the possibility of new exploration and invention. Educators believed that technology could potentially transform learning environments from passive to active, which would enable students to become more actively involved in their learning (Young, et al 2021). A study by Kim et al. (2013) gathered that active learning environments enhanced the students' engagement in different aspects of critical thinking that was necessary for the field of science and technology, namely; applying, analyzing, evaluating, and synthesizing what they have learned to address authentic problems.

Winarto (2020) noted that computers and the internet as an audiovisual tool have advantages over other media and that the use of audiovisual aids such as animated video functions as a medium to convey messages or information during the learning process. It is therefore expected that the use of instructional video will improve students' motivation and innovation, and later lead to improved learning outcomes. Instructional videos tend to be short and are designed to teach a specific skill (Pai, 2014 & Shipper, 2013). Instructional videos

are short, say 3-5 minutes, straight to the point, and they are designed to focus on one or two main ideas. They are also designed to hold viewers' attention for the duration of the video, and the video can provide knowledge about several topics. Embedding instructional video into the classroom is not a new concept, but one that is increasingly popular (Shipper, 2013). Isiaka (2007) opined that a video is a powerful tool for instruction in the classroom; using it, children could learn about lands and people they can never visit, and learn also how to cope with their environment.

Instructional video as the production of video programs directed towards helping students achieve specific instructional objectives with a specific target population. The availability of video continues to increase the impact within the classroom, and it is affecting the educational process and positively impacting education. Boateng *et al.* (2016) affirmed that videos are useful, innovative, and convenient, and add a new perspective to the content. It stated that videos for instructional purposes enabled learners to gain deep knowledge of the subject matter being learned. Instructional video-based materials boost students' creativity. Access to the video can help motivate students and create a distinctive context for their learning experience. Gambari *et al.* (2014) reported that the incorporation of video-based multimedia instruction has helped students' retention and achievement in learning.

Chief examiners' report that some topics in the subject require collaboration and use of improvised media aids for learners to be able to reflect and discover tangible ideas at solving the problem, topics like; ellipse, sectioning, isometric projection, orthographic projection, assembly drawings, geometry, and loci among others. In the entire topics mentioned earlier, students' performance has not been impressive in the West African Senior School Certificate Examinations (WASSCE) in the years under review as shown in **Table 1**.

Table 1. Showing National Performance of Students in West African Senior School Certificate Examination (WASSCE) in Technical Drawing from 2012-2016.

Year	Total No That Sat	Grades 1-6	%
2012	14906	10462	70.19
2013	16160	7468	46.21
2014	15477	7739	49.99
2015	14440	8685	60.14
2016	14950	7947	53.15

The basis for the introduction of technical drawing in the Nigerian educational curriculum was to bridge the gap between underdevelopment and development by becoming an instrument for the promotion of environmentally sound and sustainable development which will, in turn, have a direct positive bearing on the nation's economy. Technical Drawing deals with a graphical representation of ideas, technical drawing as a means of clearly and concisely communicating all the information necessary to transform an idea or concept into a reality. Therefore, TD often contains more than just a graphical representation of its subject matter; it also contains dimensions, notes, and specifications. One of the critical knowledge domains that received much attention is technical education. Several educational initiatives were drawn and implemented with a special focus on the integration of computer technology in the curriculum of technical and vocational teaching and learning (Rafi & Samsudin, 2007).

The general education component in the curriculum is hinged on the provision for the trainee, the complete knowledge in secondary education, while technical courses are tailored towards enhancing the understanding of machines, tools, and materials of their trades. Since TD knowledge and skills have become indispensable in everyday life as Kabouridis submitted, the following aims of TD are reflected in the assessment of the objectives of teaching the subject as articulated here; to encourage the acquisition of a body of knowledge applicable

to solve practical and technological problems through the process of planning and designing; to stimulate the development of a range of communication skills, which are central to design, production and evaluation; and to stimulate the development of a range of practical skills.

The importance of TD also includes, the ability to generate a range of outline solutions to a design problem, giving constraints of time, costs, skills, and resources, ability to recognize information in one form and where necessary change it into a more applicable form, ease of proposing and communicating ideas graphically, and the ability to develop ideas and present detail of forms, shapes, construction, movement, size, and structure through graphic representation. The curriculum table and module specifications in Technical Drawing as designed by NBTE stated that Technical Drawing like any other technical subjects cannot be taught in abstract, as the acquisition of TD knowledge and skills depend on the provision of relevant equipment and tools.

Various researches have shown that there are no genetically gender-related differences among males and females. It has not been proved scientifically, rather, there is biological proof to show that females are inferior or vice-versa. Also, the author stated that the perceived gender differences in the classroom are innate. The author associated the hypothesized differences to gender stereotypes in the curriculum and instruction which reflects such in the society in favor of the male. Lorenzo, Crouch, and Mazur (2006) reported that interactive engagement instruction, like the encouragement of in-class peer interaction, reduces drastically and possibly removes the gender gap in conceptual understanding of an introductory calculus-based physics course. The author also noted that interactive engagement in physics courses effectively helped the female students move from low-scoring group to high-scoring group.

This study sought to achieve three specific objectives: (i) to examine the effect of technology-enabled video instruction on senior secondary school student's academic performance in selected technical drawing concepts in Ilorin (ii) to determine the difference between pretest and posttest performance of students taught selected technical drawing concept using technology-enabled video instruction; (iii) to examine the difference between male and female students taught selected technical drawing concept using technology-enabled video instruction. The hypothesis is: There is no significant difference in the pretest and posttest performance of students taught selected technical drawing concepts using technology-enabled video instruction. There is no significant difference in the academic performance of male and female students taught selected technical drawing concepts using technology-enabled video instruction.

2. METHODS

This study was carried out to examine the effect of technology-enabled video instruction (TEVI) on senior secondary school students' performance in selected technical drawing concepts in Ilorin. The study was conducted during the early part of the second term of the 2019 and 2020 academic sessions in Ilorin. The primary purpose of this study was to examine the effect of TEVI on technical drawing students' performance. The following null hypotheses were formulated and tested at $p=0.05$ to obtain answers to the research question. The research design was a mixed method of qualitative and quantitative, pre-experimental research of one-group pretest and protest design was carried out through an intact class in a senior secondary school in Ilorin. The population comprised of all the senior secondary school technical drawing students in Ilorin. The target population for this study was the senior secondary school Two (SS2) students offering technical drawing in Ilorin. An intact class of 16 SS2 TD students participated in the study. The independent variable in this study is the

technology-enabled video instruction. The dependent variable is the performance scores of respondents obtained from a researcher-designed performance test, while the moderating variable is gender. Two instruments were used in this study; a researcher-developed instructional video on orthographic projection and a researcher-designed performance test tagged: Students' Performance Test on selected Technical Drawing Concept (SPTTDC). The SPTTDC contains two (2) essay questions on the module used in the study. The students were made to answer the two questions. The performance test in TD was used to measure the performance of students in both pretest and posttest. The two instruments used were subjected to face and content validation. The test question (essay) were carefully drawn to ensure that the questions fell within the scope of the SS2 module and the specific area that has been selected for the study. The instructional video package and test were given to the experts in both technology education and educational technology for criticism and their observations influenced some modifications on the instruments. The mean, range, standard deviation, and the t-test statistical analysis were used. Pretest and posttest scores were computed and used in testing the hypotheses. The level of significance adopted for the analysis was $p=0.05$. The level of significance formed the basis for rejecting or not rejecting each of the hypotheses.

3. RESULTS AND DISCUSSION

Three research questions were raised in the study and two null hypotheses were formulated and tested to provide answers to the research questions. Analysis of the pretest and posttest data collected when taught with the conventional method (demonstration) and when taught with the use of technology-enabled video instruction were used to answer the research questions using the two hypotheses as a guide. Mean, range, Standard deviation, and t-test were employed in analyzing the pretest and posttest data.

The summary of the data analyses and results are presented below:

In computing the distribution of respondents based on gender, male TD students formed larger distribution of a sample, compared to females ($68.8 > 31.3\%$) as shown in **Table 2**. In testing the performance of students, a pretest was administered to the group to ascertain their academic capability on the concept covered in the study. A posttest was administered to the group to measure their new performance after their exposure to TEVI. The test was a 2 essay type students' performance test on selected TD concepts. The respondents were allowed 80 minutes to do the test. The test was given to determine the academic performance of the students when taught in the conventional class and after their exposure to TEVI in the experimental class.

Table 2. Distribution of Respondents Based on Gender.

Gender of Respondent	Frequency	Percentage
Female	5	31.3
Male	11	68.8
Total	16	100.0

The result in **Table 3** indicated that there was an improvement in the performance of students when taught the selected technical drawing concept using technology-enabled video instruction. This implies that the performance difference of 11.6% revealed that TEVI had a positive effect on the academic performance of students when taught the selected technical drawing concept ($63.1 > 51.5\%$, Performance difference=11.6%). Frequency, range, and percentage were used to compare the pretest and posttest performance of students. The result as shown in Table 4 revealed that since the table value is less than the benchmark

(df=15, t=-565, p<0.05), we reject the hypothesis and concluded that the pretest means the score was significantly different from the posttest mean score concerning technology-enabled video instruction use in teaching selected TD concept.

Using TEVI assists the teacher and also allows for students’ engagement in the learning process. It makes students use their critical thinking skills during the teaching and learning process. The results of the findings also show that there is no significant difference in the performance of male and female students taught the selected TD concept using TEVI. The result of the study affirmed the findings of Lowerison et al. (2006) on technology integration in education who posited that technology could potentially transform the learning environment from passive to active, which would enable students to become more actively involved in their learning, and if well integrated into instruction could foster students’ better performance.

Table 3. Students’ academic performance in learning selected technical drawing concept using TEVI.

S/N	Grading Value	Performance Levels (%)	Pre-test Frequency	%	Post-test Frequency	%
1.	0-39	Fail	1	0.0	0	0.0
2.	40-44	Poor	2	12.5	0	0.0
3.	45-49	Fair	5	31.3	0	0.0
4.	50-59	Good	8	50.0	5	31.3
5.	60-69	Very Good	1	6.3	8	50.0
6.	70-100	Excellent	0	0.0	3	18.0
Average Performance			51.5		63.1	
Score Range			Good		Very Good	
Performance Difference			11.6			

From **Table 4**, it can be deduced that there was a significant difference between the pre-test and post-test performance of students taught selected technical drawing concepts using technology-enabled video instruction. This is reflected in the findings of the hypothesis tested df (15), t = -5.65, p< 0.05. Thus, the hypothesis which states that “there is no significant difference in the pre-test and post-test performance of students taught selected technical drawing concept using technology-enabled video instruction” is rejected. It has therefore been discovered that the use of TEVI can enhance the teaching and learning of orthographic projection as a selected TD concept in Ilorin. It is revealed from the result that TEVI had a positive effect on the academic performance of students taught orthographic projection in selected TD concepts. Furthermore, the result of the first hypothesis revealed that students performed better in the posttest where TEVI was used than in the conventional classroom pretest. Instructional video is the production of video programs directed towards helping students achieve specific instructional objectives with a specific target population. This could be because TEVI captured students’ interest and boost their critical thinking skills. It can be deduced that significant differences exist between the pretest and posttest performance of students taught the selected TD concept. The statistical test indicated that the first hypothesis is rejected. This signified a significant impact on students’ performance in using TEVI in instructional delivery. This result validated the view of (Kim et al., 2013).

Table 4. Paired sample t-test analysis of difference in pre-test and post-test performance.

Perf. test	N	X	SD	df	t	Sig. (2-tailed)	X Dif.	Remarks
Pre-Test	16	51.50	5.35	15	-5.65	0.000	11.6	Rejected
Post-Test	16	63.13	9.09					

From **Table 5**, it can be deduced that there was no significant difference in the attitude of male and female students toward the use of technology-enabled video instruction in learning selected technical drawing concepts in Ilorin. This is reflected in the findings of the hypothesis tested $df (14)$, $t=.215$, $p>0,05$. Thus, the hypothesis which states that “there is no significant difference in the attitude of male and female students toward the use of technology-enabled video instruction in learning selected technical drawing concept in Ilorin” is accepted.

The test result (of the t-test on analysis of gender differences) in **Table 5** showed that there was no significant difference in the performance of male and female students taught selected technical drawing concepts using technology-enabled video instruction. Since the table value is greater than the benchmark ($df=14$, $t=-617$, $p>0.05$). Therefore, the deduction can be made that there was no significant difference in the performance of male and female students. Hence, the hypothesis which stated that there is no significant difference in the performance of both sexes is accepted.

The result of the second hypothesis showed that gender differences do not exist when students were taught the selected TD concept using TEVI. The result showed that the table value is greater than the benchmark as shown in **Table 5**. There are no genetically gender-related differences among males and females. The test revealed that the second hypothesis is accepted. This result agreed with the view of [Lorenzo et al. \(2006\)](#) who reported that interactive engagement instruction reduces drastically and possibly removes the gender gap in conceptual understanding of an introductory calculus-based physics course.

Table 5. Independent sample t-test analysis of gender difference in the attitude of students toward learning using TEVI.

Gender	N	X	SD	df	t	Sig. (2-tailed)	Remarks
Male	11	2.62	0.19	14	0.215	0.833	Accepted
Female	5	2.64	0.27				

4. CONCLUSION

Conclusively, it could be seen that the use of TEVI as an improvised instructional aid had a positive effect on the academic performance of students taught orthographic projection in the selected TD concept. Therefore, there should be a cordial relationship between our policymakers and TD teachers by way of the provision of funds available for improvisation. Teachers should be encouraged and well-remunerated to take up the challenge of producing these improvised instructional aids, because, there is the need to note that students require information that will capture their interest, to bring an understanding of what they are being taught. If this is done, the unimpressive performance in TD could be reduced.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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