

The Effect of Multimedia Instruction on the Performance of Male and Female Students in the Technical Colleges of Adamawa State, Nigeria

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Abstract

The study is on the effect of multimedia instruction on the performance of male and female students in the Government Science and Technical College (GSTC) of Adamawa State. The study was a quasi-pre-test, post-test, non-equivalent design. The instrument for data collection was a test instrument adopted from the National Business and Technical Examination Board (NABTEB) past question papers on Mechanical Engineering Craft Practice (MECP). The population of the study consists of 53 students of MECP registered for the 2019/2020 academic session in two selected GSTCs; out of this population, 13 were females and 40 were males. Students of GSTC Yola were assigned to the experimental group, while students of GSTC Numan were assigned to the control group, respectively. Six specific objectives, three research questions, and three formulated null hypotheses guided the study. The data was analysed using mean and standard deviation to answer the research questions, and the analysis of covariant was used to test the null hypothesis at the 0.05 level of significance. The findings of the study reveal that demonstration and multimedia instructions are effective and do not have an effect on male and female academic performance; the academic performance of students increases significantly when taught using multimedia rather than demonstration instruction. Technical teachers should blend demonstration and multimedia instruction in teaching and learning was the recommendation of the study.

Keywords: Effect, Multimedia and Demonstration Instructions

Introduction

Right from the inception of technical education in Nigeria, many Nigerians have had misconceptions about technical education as it pertains to girls. They believe technical education is not for girls and should only be for boys. Thus, technicians are considered men who engage in technical repairs and maintenance. While females were seen as fit for vocational education such as secretarial studies, home economics, and catering services, among others (Ndahi, 2002), It was not conceived that females could be mechanics, carpenters, electricians, or builders; hence, enrolment in technical institutions was strictly for males at that time, while females were enrolled in vocational studies (Nzewi, 2010). This separation, according to Ndahi, conformed to the traditional setting of the Nigerian people. Most cultures strictly place women in a position of child upbringing and menial home activities. Similarly, some religious ideologies isolate women from the public, and some vocations are perceived as manly. It is clear that our cultural and religious beliefs played a significant role in technical education masculinity. Consequently, girl children lost interest in technical education

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(Faulkner, 2006) and conceived that male children were better at technical courses (**Udofia, Ekpo, Nsa, & Akpan, 2012**). This perception has necessitated low enrolment of girls in technical and engineering trades across the technical colleges in Nigeria. Nevertheless, as sensitization or advocacy continued on gender equality and gender equity, people began to let go of those cultural beliefs and ideologies that restrained girls potential. With this development, society is gradually developing a positive perception towards technical education, which is relevant to girl child education. By and large, girl children are as good at some things as male children are academically (**Nzewi, 2010**).

Multimedia instruction is a combination of text, image, and visual elements into one formidable instructional platform that guarantees a multisensory learning experience for the learner (**El-Sayed & El-Sayed, 2013**). It provides a unique opportunity to present and teach from the unknown to a known learning experience. Instruction using multimedia enhances the internalisation of information received by the learner as well as draws specific attention to details on the subject to be taught (Gertner, 2011; Robert, 2011). Multimedia instruction presents an excellent learning platform that ensures a three-dimensional view of objects and realistic scenes and presents sequences in motion along with their accompanied audio built into the instruction (**Nazir, Rizvi, & Pujeri, 2012**). Instruction with multimedia mirrors the way the human mind thinks, learns, and remembers by moving easily from words to images to sound, giving interpretation, making analysis, and engaging in in-depth exploration. The flexibility of multimedia is enormous, including adaptability to sociocultural and environmental factors, time, and space, among others (**Mahajan, 2012**). The multimedia instruction is readily accessible and packaged in different formats compatible with multimedia devices.

Many studies have shown that multimedia instruction is effective in instructional delivery. Udofia et al. (2012) found out that male and female academic performance improved significantly when taught using multimedia instruction. Similarly, Agomuo and Nzewi (2004) also observed that multimedia instruction does well in instructing boys and girls. Also, Agomuo (2010) noted that multimedia instruction improved the conceptual ability of the learner and showed no disparity in male and female performance. In the same vein, Osuagwu (2006) proved that the performance of male and female students was not significantly different when taught using multimedia as a medium for teaching male and female students of auto mechanics at Technical College and advocated for the integration of multimedia instruction in our classrooms. Similarly, Bianca, Ngozi, Umate, and Attah (2021) found that multimedia instruction is effective for teaching science, and the performance of male and female teachers of basic science using multimedia integrated instruction does not differ significantly. This implies that under normal circumstances, females have the capacity to learn as many industrial and technical courses as their male counterparts; after all, there is nothing in the nature of females that makes them not do well in their quest for learning (Nzewi, 2010; Udofia et al., 2012).

The demonstration instructional method is recommended as the most suitable method for teaching practical subjects in science, technical, and vocational education (Okoro, 2006). The major components of demonstration instruction include the instructional materials, tools, or equipment and the teacher, who will perform an operation before the learners (**Cyril, 2013**). Gestures, performances, and exchange of verbal ideas from the activities between teachers and the students during the demonstration instructional method. Concepts, principles, and practical activities can be taught through demonstration instruction. The demonstration method of instruction enhances holistic teaching and learning that cuts across the psychomotor, cognitive, and affective learning domains. The demonstration method of teaching elicits the desire to emulate the action of the teacher and builds up the learner's curiosity and confidence (**Idris & Rajuddeen, 2012**). However, the

limitations of the demonstration method of instructions, which requires expensive equipment and materials, are not suitable for large classes, and complex concepts and theories cannot be easily illustrated by using demonstration (Bakpo, 2011; Neo & Neo, 2002).

Objectives of the Study

The main objective of the study was to determine the effect of multimedia and demonstration instructions on the performance of male and female students in Mechanical Engineering Craft Practice (MECP). The study specifically determined: The mean performance of male and female students taught Mechanical Engineering Craft Practice using demonstration method of instruction.

1. The mean performance of male and female students taught Mechanical Engineering Craft Practice using multimedia instructional methods.
2. The mean performance of male and female students taught Mechanical Engineering Craft Practice using multimedia and demonstration instructional methods.
3. The significant difference between the mean performance of male and female students taught mechanical engineering craft practice using the demonstration method of instruction.
4. The significant difference between the mean performance of male and female students taught mechanical engineering craft practice using multimedia instructional methods.
5. The significant difference between the mean performance of male and female students taught Mechanical Engineering Craft Practice using multimedia and demonstration instructional methods.

Research Questions

1. What is the mean performance of male and female students taught Mechanical Engineering Craft Practice using demonstration method of instruction?
2. What is the mean performance of male and female students taught Mechanical Engineering Craft Practice using multimedia instructional method?
3. What is the mean performance of students taught Mechanical Engineering Craft Practice using multimedia and demonstration instructional methods.

Hypotheses

H_{01} : There is no significant difference between the mean performance of male and female students taught Mechanical Engineering Craft Practice using demonstration method of instruction.

H_{02} : There is no significant difference between the mean performance of male and female students taught Mechanical Engineering Craft Practice using multimedia instructional method.

H_{03} : There is no significant difference between the mean performance of male and female students taught Mechanical Engineering Craft Practice using multimedia and demonstration instructional methods.

Methodology

The design for this study was pre-test, post-test, non-equivalent control group, and quasi-experimental. The study was conducted at the Government Science and Technical Colleges (GSTCs) in Yola and Numan, Adamawa State, respectively. The population of the study consisted of 53 students of Mechanical Engineering Craft Practice registered for the 2027/2018 academic session in two selected technical colleges, out of which 13 were females and 40 were males. There are 5 female students in GSTC Yola and 8 female students in GSTC Numan. Similarly, 17 male students in GSTC Yola and 23 in GSTC Numan.

The test instrument was adapted from the NABTEB past questions from the 2015–2018 examinations, drawn using a table of specifications based on Bloom's taxonomy of learning. Hence, 40 multiple-choice and six essay questions with an assessment profile of 40% and 60%, respectively, formed the test instrument. The reliability coefficient of the test instrument was 0.89, as determined by the Crouchback Alfa reliability instrument, when tested on eight males and four females of GSTC Mubi in the Mechanical Engineering Craft Practice trade. There were no randomizations, as intact classes were used. GSTC Yola was used as the experimental group, while GSTC Numan was used as the control group. The control group was taught using the demonstration method. Whereas, the experimental group was taught using a multimedia instructional method. The pre-test was administered to both groups before the instruction. After the instruction, a post-test was administered to the groups after two weeks of instruction. To ensure the students did not produce the same answer to their early testing, the numbering sequence of the pre-test was changed and used as a post-test. The mean and standard deviation were used to answer the research questions. While the null hypothesis was tested at the 0.5 level of significance using Analysis of Covariant (ANCOVA), The minimum pass mark for the NABTEB examination is 40 and above, which was taken as passed, while a student's performance below 40 was considered failed. Additionally, the decision on the null hypothesis was that if the probability value (P-value) is less than the significant value (sign value = 0.05), the null hypothesis is rejected, and otherwise, accept the null hypothesis.

Data Analysis

Research Question 1

What is the mean performance of male and female students taught Mechanical Engineering Craft Practice using the demonstration method of instruction?

Table 1 Mean and Standard Deviation of Male and Female Students in the Control Group				
Group	N=31	X	STD	REMARK
Male	23	48.13	9.43	Passed
Female	8	54.87	10.78	Passed

Key: N, Sample size; X, Mean; STD, Standard Deviation

The analysis presented in Table 1 showed that the mean performance scores of male and female students were 48.13 and 54.87, respectively. The standard deviation of male and female students showed that deviations from the mean were far from the mean in both cases. However, the female mean is above their male counterpart with about 6.74 scores.

Research Question 2

What is the mean performance of students taught Mechanical Engineering Craft Practice using multimedia instructional method?

Table 2 Mean and Standard Deviation of Male and Female students in Experimental Group				
Group	N=31	X	STD	REMARK
Male	17	71.71	7.25	Passed
Female	5	68.60	14.57	Passed

Key: N, Sample size; X, Mean; STD, Standard Deviation

Table 2 above indicated that male students had a mean performance score of 71.71 and a 7.25 standard deviation. Female students had a mean performance score of 68.60 and a 14.57 standard deviation. Male students performed higher than female students. The mean difference between male and female students was 3.11 in favour of male students.

Research Question 3

What is the mean performance of male and female students taught mechanical engineering craft practice using multimedia and demonstration instructional methods?

Table 3 Mean and Standard Deviation of Demonstration and Multimedia				
Group	N=31	X	STD	REMARK
Demonstration	31	53.13	10.72	Passed
Multimedia	22	71.00	9.07	Passed

Key: N, Sample size; X, Mean; STD, Standard Deviation

The analysis in Table 3 indicated that students taught using multimedia methods of instruction had a higher mean performance score of 71.00 and a 9.07 standard deviation. While students were taught using the demonstration method, they had a mean performance score of 53.13 and a standard deviation of 10.72. Hence, the difference was 17.78 in favour of those taught with multimedia instruction.

H_{01} There is no significant difference between the mean performance of male and female students taught Mechanical Engineering Craft Practice using the demonstration method of instruction.

The analysis of hypothesis one, as indicated in Table 4, shows that at the 0.05 level of significance and 31 degrees of freedom, the calculated F was 0.26 with a P-value 0.62, which is greater than 0.05. Therefore, the null hypothesis is accepted. This analysis revealed that the mean performance scores of male and female students taught using the demonstration method of instruction are significantly the same. Hence, the mean difference in their performances occurred by chance.

Table 4	Mean Analysis of Male and Female taught using Demonstration Method of Instruction					
Source	SS	df	MS	F	P-value	Decision
Corrected Model	552.81 ^a	2	276.41	2.67	0.09	
Intercept	3942.81	1	3942.81	38.11	0.00	
Pre-test	282.81	1	282.81	2.73	0.11	
Male/Female	26.41	1	26.41	0.26	0.62	
Error	2896.67	28	103.45			
Total	90953.00	31				
Corrected Total	3449.48	30				

^aR Squared = .160 (Adjusted R Squared = 0.10)

Key: SS = Sum of Square; df = degree of freedom; MS = Mean of Square; F = Critical Value

H_{02} There is no significant difference between the mean performance of male and female students taught Mechanical Engineering Craft Practice using the multimedia instructional method.

Table 5	Mean analysis of male and female taught using multimedia instructional method					
Source	SS	Df	MS	F	P-value	Decision
Corrected Model	250.39 ^a	2	125.20	1.61	0.23	
Intercept	3628.34	1	3628.54	46.66	0.00	
Pre-test	213.12	1	213.12	2.74	0.11	
Male/Female	74.28	1	74.28	0.34	0.96	Accepted
Error	1477.61	19	77.77			
Total	112630	22				
Corrected Total	1728.00	21				

^aR Squared = .145 (Adjusted R Squared = 0.055)

Key: SS = Sum of Square; df = degree of freedom; MS = Mean of Square; F = Critical Value

The analysis of hypothesis two presented in Table 5 shows that at the 0.05 level of significance and 22 degrees of freedom, the calculated F was 0.34 with a P-value 0.96, which is greater than 0.05. This analysis indicated that the null hypothesis was accepted at the 0.05 level of significance. It follows that the mean performance scores of male and female students are hypothetically the same, despite the differences in their mean performance. These differences just occurred by chance. Hence, gender has no effect on the performance of students when taught using multimedia instruction.

H_{03} There is no significant difference between the mean performance of male and female students taught Mechanical Engineering Craft Practice using multimedia and demonstration instructional methods.

Table 6 Mean analysis of Analysis of Control and Experimental Group						
Source	SS	Df	MS	F	P-value	Decision
Corrected Model	4154.92 ^a	2	2077.46	20.24	0,00	
Intercept	10922.76	1	10922.76	106.41	0.00	
Pre-test	45.27	1	45.27	0.44	0.51	
Group	4107.20	1	4107.20	40.01	0.00	Rejected
Error	5132.21	50	102.64			
Total	203583.00	53				
Corrected Total	9287.13	52				

^aR Squared = .447 (Adjusted R Squared = .425)

Key: SS = Sum of Square; df = degree of freedom; MS = Mean of Square; F = Critical Value

The outcome of the analysis presented in Table 6 revealed the rejection of the null hypothesis at the 0.05 level of significance and 52 degrees of freedom. This follows from the fact that the calculated F is 40.01 with a p-value of 0.00, which is less than the significance value of 0.05. Consequently, the alternative hypothesis was upheld. Thus, there is a significant difference between the mean performances of students taught Mechanical Engineering Craft Practice in the GSTC of Yola, Adamawa State.

Results

The findings that emerged from this study are:

1. The demonstration method of instruction enhances the academic performance of both male and female students.
2. Multimedia instruction enhances the academic performance of both male and female students.
3. Students obtained a higher mean performance when taught using multimedia instruction than the mean performance of students taught using the demonstration method of instruction.
4. There was no significant difference between the performance of male and female students taught mechanical engineering craft practice using demonstration method instruction.
5. There was no significant difference between the performance of male and female students taught Mechanical Engineering Craft Practice using the multimedia instructional method.
6. There was no significant difference between the performance of male and female students taught mechanical engineering craft practice using multimedia and demonstration instructional methods.

Discussion of Results

The research findings one and two, as well as null hypotheses one and two, indicated that gender has no effect on students' mean performance when multimedia and demonstration instruction are used as mediums of instruction. Neither does it place male or female students in a disadvantageous situation as a result of its usage. The finding is consistent with the work of Nzewi (2010) and Udofia et al. (2012), who depict that the method of instruction does not deprive learners based on gender but improves their conceptual abilities, showing no disparity in male and female academic performance.

Although there are many research findings that reveal that there is no replacement for the demonstration method of instruction, as we can see from the findings of the study, higher mean performance was recorded by students taught using multimedia instruction. Similarly, the null hypothesis in line with this same research finding also proved a significant difference in the mean academic performance of students in the multimedia and demonstration groups. These findings agreed with Gertner (2011) and Robert (2011) and were supported by Haruna (2023) and Haruna (2022), who had similar findings that students perform better with multimedia than demonstration and lecture methods of instruction. .

Conclusion

This study concluded that demonstration and multimedia methods of teaching are effective for teaching mechanical engineering craft practice in technical colleges. Hence, both methods of teaching do not have any effect on the performance of male and female students. However, the mean performance of students taught using multimedia increased significantly compared to the mean performance of students taught using multimedia instruction.

Recommendation

This study recommended that demonstration and multimedia instruction should be blended for teaching and learning in technical colleges in Adamawa State.

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