

Effectiveness of Powerpoint Presentation On Students' Cognitive Achievement in Technical Drawing

Amosa Isiaka Gambari, [1], Hamdlat Taiwo Yusuf [2], Sherifat Adepeju Balogun [3]

[1] Federal University, Nigeria
gambari@futminna.edu.ng

[2] University of Ilorin,
Nigeria
hamdallat Yusuf@yahoo.com

[3] Intelligence Quotient Academy,
Nigeria
pejuadepeju@gmail.com

ABSTRACT

This paper discusses importance of technology education and evidence of declining performance of junior secondary school students in basic technology subject. Benefits of PowerPoint presentation in classroom instruction as a means to improve classroom teaching in the developing countries are also discussed. The effectiveness of PowerPoint Presentation (PPT) for teaching Technical Drawing concepts in Basic Technology was determined using a pretest-posttest, non-equivalent, non-randomized experimental group design. A 2x2x3 factorial design was employed. One hundred JSS 1 students (53 male and 47 female) categorized into 29 high, 54 medium and 17 low achievers from two secondary schools in Abuja Metropolis formed the sample. The schools were randomly assigned to experimental and control groups. The experimental group was taught some selected concepts from Technical Drawing using PowerPoint Presentation (PPT) while Chalkboard method (CB) was used for the control group. A validated Technical Drawing Achievement Test (TDAT) comprising a 25-item multiple-choice test was employed for data collection. The reliability coefficient of TDAT was .88 using Kuder-Richardson (KR-20). The hypotheses were tested using ANCOVA and Sidak post-hoc analysis. Results revealed that the students taught with PPT performed better than their counterparts taught with CB. Also, high achievers performed better than medium and low achievers respectively. The PPT was found also to be gender friendly. Based on the findings, it was recommended that the use of PPT should be encouraged in Nigerian schools.

Keywords: *PowerPoint Presentation, Technical Drawing, Cognitive Achievement, Gender, Achievement Levels*

INTRODUCTION

The instructional delivery mode employed by the teacher plays an important role in skills acquisition and meaningful learning. Huge and giant strides have been made in countries such as Hong Kong, Japan, Thailand, Singapore and others achieved in technology, economic empowerment and self reliance can be attributed to among others, effective teaching and learning. The importance of education and mode of instruction cannot be over stressed in this era of Science, Technology and Mathematics, driven by ICT.

Science, Technology and Engineering have much to offer in economic development and provision of modern conveniences to mankind. This is why governments, institutions and managements emphasize the need for a practically oriented technical education curriculum and the need also to provide effective media for teaching technical subjects in Nigerian schools and colleges (Abd-El-Aziz, 2014). Most of Nigerian classrooms from pre-primary to tertiary institutions are dominated by chalkboards and marker-boards. The limitations of these types of instructional delivery mode include: ineffectiveness for very large group instruction; inability to allow information storage for future use; inability to accommodate illustrations to support the teaching; health hazard for teachers from chalk particles; it makes learning uninteresting, among

other (Aliyu, 2003). To improve student achievement in technology related subjects in Nigeria, it is necessary to have a paradigm shift and join the developed world in embracing constructivist approach to teaching and learning. Such approach should be used in the country's educational system beginning from the basic school level up to the university. The use of PowerPoint slides for teaching is one of the right directions to achieve such shift (Uz, Orhan, & Bilgiç, 2010).

PowerPoint is part of the Information and Communications Technology (ICT) program developed by Microsoft in 1987. It is an application program of presentation bundled in Microsoft office (El-Ikhan, 2010). It consists of slides allowing the user to present messages (Asogwa, 2011). Information prepared on a computer could be better projected for larger audience using a Liquid Crystal Display (LCD) or DLP projector. PowerPoint presentation could be used in the classroom for supporting student learning by combining computer and projector to display slides for illustrating a lesson.

Potentials of Microsoft PowerPoint include: its ability to do spell check, allowing the user to add, correct, make changes to the lessons, and finally use printout materials for students' personal use (Teachology.com, 2007). PowerPoint gives the user the opportunity to incorporate visual and auditory aspects to a presentation. It permit variety of manipulations by editing or text modification, removal of existing slides and addition of new slides to make lesson more organized and flexible. PowerPoint presentations can be regarded as a good instructional medium and a key for facilitating an effective teaching-learning process. It would therefore not be out of place to explore such instructional medium in the field of Technical Drawing of Basic Technology at Junior Secondary Level.

Proponents of PowerPoint argued that it increases visual quality in the learning process. They also contend that it takes less time to present a subject matter; therefore, more materials can be covered in the classroom. Opponents of PowerPoint believe that it diminishes creativity and innovation besides elevating format over content, betraying an attitude of commercialism that turns everything into a sales pitch (Tufte, 2003). Supporters of Power Point believe that it helps to keep students' interest and attention on the lecture (Szabo & Hastings, 2000), improves student learning (Lowry, 1999), and aids explanations of complex illustrations (Apperson, Laws, & Scepanisky, 2006). On the other hand, Creed (1997) describes PowerPoint as a teacher-centered instructional tool that nourishes teacher-controlled lectures. Similarly, Tufte (2006) points out that PowerPoint reduces the analytical quality of a presentation, limits the amount of detail that can be presented, and often weakens verbal and spatial thinking.

Cognitive achievement connotes attainment in a school subject as symbolized by a score or mark on an achievement test (Okoro, 2002) while Anthonson (2003) contended that cognitive achievement depends on several factors among which are the instructional methods, learning environment and the learner. The brain does not pay attention to boring things. What makes PowerPoint presentations so effective is that they add complementary, multisensory events designed to spark an emotional response among audience members. This helps maintain audience attention and improves cognitive achievement. The most effective presentations are the ones that are informative, educational, and entertaining (Gallo, 2009).

In recent years, studies have indicated conflicting findings about PowerPoint effectiveness in improving student learning (Craig & Amernic, 2006; Lévasséur & Sawyer, 2006). For instance, Gier and Kreiner (2009) who studied the effectiveness of PowerPoint in a psychology class concluded that when students were actively engaged in the class using PowerPoint presentation, information retention increased. Another similar study conducted by Nouri and Shahid (2005) reported that students in a PowerPoint section of an Accounting Principles II class perceived higher understandability of the presented materials than their counterpart in another class. However, Daniels (1999) studied the effectiveness of PowerPoint in a college level economics class and found no significant difference in student performance. Another study on engineering students by Savoy et al. (2009) showed that there was no evidence that PowerPoint can enhance students' performance more than the traditional lectures. Similarly, Apperson et al. (2006); Bartsch and Cobern (2003); Beets and Lobingier (2001) Susskind (2005); and Szabo and Hastings (2000) found little effects of PowerPoint on students' academic achievement.

In Nigeria, and perhaps the whole of Africa, gender bias is still very prevalent (Arigbabu & Mji, 2004). Many researchers identified gender as one of the factors influencing students' performance in science and technology at the Secondary School level. On the contrary, some researchers reported no significant

difference in the cognitive, affective and psychomotor skill achievements of students by gender (Arigbabu & Mji, 2004; David & Stanley, 2000; Din, Ming, & Esther, 2004; Freedman, 2002; Sungur & Tekkaya 2003). Ogunkola and Bilesanmi-Awoderu (2000) carried out research on the effectiveness of two teaching methods on students' achievement in Biology and found that their achievement was not sensitive to gender. The findings of Yusuf and Afolabi (2010) and Oludipe (2012) showed that gender had no influence on the students' performance when they were taught biology and basic science respectively.

The issue of students' achievement level as a cause of differential learning outcome has attracted the attention of educational researchers. In Nigerian classrooms, students with different ability levels are mixed together in the same classroom and given the same treatment without considering their individual differences (Yusuf, 2004). Researchers have found that high ability students do perform better than the medium and lower ability students in such situations (Gambari, 2010). Studies on influence of achievement levels on student performance are inconclusive. For instance, Adegoke (2010) reported that only the high ability students benefit from the conventional method of teaching. Fajola (2000), Aluko (2004), Ige (2004), and Gambari and Olumorin (2013) found that high and medium achievers were favored than low achievers in cooperative learning. However, Yusuf (2004) revealed that achievement levels had no influence on learner academic performance. Part of this study examined the influence of achievement levels on students' performance in Technical Drawing.

The use of Microsoft PowerPoint presentation as an instructional medium for teaching Technical Drawing aspects of Basic Technology is novel in Nigerian public schools. Meanwhile, further exploration needs to be conducted to extend and optimize the benefits of Microsoft PowerPoint presentation to other technical and vocational subjects involving skills acquisition in order to make a paradigm shift to the new era of Information and Communications Technology. Much has not been done on the influence of PowerPoint presentation on students' achievement in Nigeria. Therefore, the purpose of the study was to examine the effectiveness of PowerPoint presentations on students' achievement in a Technical Drawing class at junior secondary school level in Nigeria.

Research Hypotheses

The following hypotheses were formulated to guide the study:

- (i) There is no significant difference in the mean achievement scores of students taught Technical Drawing using PowerPoint Presentation and those taught with chalkboard.
- (ii) There is no significant difference in the mean achievement scores of male and female students taught Technical Drawing using PowerPoint Presentation.
- (iii) There is no significant difference in the mean achievement scores of high, medium and low achievers students using PowerPoint Presentation.

METHODOLOGY

A quasi-experimental design using non-randomized, non-equivalent, pretest, posttest experimental group design was adopted for this study. Two levels of independent variables (experimental and control groups), two levels of gender (male and female) and three levels of academic achievement (high, medium and low) were investigated on students' performance in Technical Drawing. The research design layout is as shown in Table 1.

Table 1 Research Design of the Study

Groups	Pretest	Treatment	Posttest
Experimental	O ₁	PowerPoint	O ₂
Control	O ₃	Chalkboard	O ₄

Purposive sampling technique was used to select two schools in Abuja Municipal Area Council (AMAC) for the study. The schools were sampled based on facilities and manpower, school type (public schools),

gender composition (co-educational schools). The two schools were randomly assigned to experimental group (PowerPoint group) and control group (Chalkboard group) respectively. Intact classes of the students classified into gender (male and female) and achievement levels (high, medium and low). The distribution of sample for the study is shown in Table 2.

Table 2 Distribution of Sample for the Study

Groups	Gender		Achievement Levels		
	Male	Female	High	Medium	Low
PPT	22	23	14	21	10
CB	31	24	15	33	7

From Table 1, the groups comprised a total of 100 students; 45 students were taught Technical Drawing using PowerPoint presentation (PPT) (Experimental Group), and 55 students were exposed to Chalkboard method as a normal medium of instruction (Control group).

Research Instruments

The PowerPoint (PPT) with the Technical Drawing contents was presented using laptop and a Liquid Crystal Display (LCD) projector. The teacher presents information and displays animation of the contents in 2-dimensional view to the learners using PPT on each of the eight units in Technical Drawing. Technical Drawing Achievement Test (TDAT) was a researcher-developed instrument used in collecting data for the study. It consists of section 1 and 2. Section 1 elicited students' biodata such as name of school, class, gender, and level of students' achievement. Section 2 of the TDAT consists of 25-multiple-choice test items with five options (A-E). The TDAT was validated by experts in the Industrial and Technology Education Department, Basic Technology subject teachers, and Test and measurement specialists from the National Examinations Council (NECO, Minna). Its reliability coefficient was obtained as .84 using Kuder Richardson (KR-21).

The study lasted four weeks. The researcher administered the TDAT on sample students as pretest to ascertain the equivalence of the students before the treatment. Treatment followed immediately; thereafter TDAT was administered as posttest to measure the achievement of the sample students in each group. The scores obtained were analyzed based on the stated hypotheses, using ANCOVA. Where differences were established, Scheffe's post-hoc was used to locate the direction of the difference. Graphical representations were also used to show some illustrations. The significance of the statistical analyses was ascertained at .05 alpha level.

RESULTS

The results are presented in line with the formulated hypotheses:

Ho₁: There is no significant difference in the mean achievement scores of students taught Technical Drawing using PowerPoint Presentation and those taught with chalkboard.

To determine whether there was significant difference in the post-test mean scores of students exposed to PowerPoint and those taught with Chalkboard, data were analyzed using the analysis of covariance (ANCOVA). Table 3 shows the result of the analysis.

Table 3 ANCOVA posttest on experimental (PPT) and control (Chalkboard) groups

Source of Variation	Type III Sum of Squares	df	Mean Square	F	Significance of F
Covariate (Pre-test)	7449.383	1	7449.383	115.397	0.000
Main Effect (Treatment)	517.769	1	517.769	8.021	0.000
Model	7982.334	2	3991.167	61.826	0.000
Residual	6261.776	97	64.554		
Total	445499.000	100			

Table 3 shows that $F(1, 91) = 11.039, p = 0.001$ for the main effect (treatment) was significant, indicating that the method of instruction produced a significant effect on the achievement scores of students when covariate effect (pre-test) was controlled. The result indicates that there was significant difference between students exposed to PPT and those exposed to Chalkboard.

The performance of students in the two groups was further compared and the results are shown in Table 3 and graphically illustrated in Figure 1.

Table 3 Mean Gain Scores of Students Taught Technical Drawing Using PPT and Chalkboard

Group	Pretest	Posttest	Mean Gain Score
PPT	18.00	68.22	50.22
Chalkboard	9.98	63.58	53.60

Table 3 shows Chalkboard group (CB) had higher mean gain score of 53.60; followed by PowerPoint Presentation (PPT) with mean gain scores of 50.22. This shows both the groups benefited from the treatment, with PPT having the highest posttest performance mean than those taught with CB. However, those in CB group have higher mean gain than those in PPT.



Fig. 1. Graphical illustration of students exposed to PPT and Chalkboard.

Hypothesis Two: There is no significant difference in the mean achievement scores of male and female students taught Technical Drawing using PowerPoint Presentation.

To determine whether there was significant difference in the post-test mean scores of male and female students using PowerPoint (PPT), data were analyzed using the analysis of covariance (ANCOVA). The results of the analysis are shown in Table 4.

Table 4 ANCOVA Posttest on Male and Female Students in PPT Group

Source of Variation	Sum of Square	df	Mean Square	F	Significance (P)
Covariate (Pretest)	3279.717	1	3279.717	34.997	0.000
Main Effect (Gender)	159.013	1	0159.013	1.697	0.200
Model	3288.2979 ^a	2	1644.148	17.544	0.000
Residual	3936.014	42	93.715		
Total	178226.000	45			

Table 4 shows the result of the hypothesis three. The hypothesis was tested using the pretest mean scores of both male and female students taught using PPT as covariate for the analysis of Covariance. The *F* value of 1.697 was not significant at the .05 alpha level [$F(1, 42) = 1.697, p > .05$]. The result shows that there was no significant difference in the performance of male and female students taught using PPT. On this basis, the hypothesis two is not rejected. This shows that there is no statistical difference in the achievements of male and female students taught with PPT.

The mean gain scores between the pretest and posttest among male and female in the PPT group were tabulated and graphically illustrated as shown in Table 5 and Figure 2.

Table 5 Mean gain scores of male and female students taught Technical Drawing using PPT

Group	Pretest	Posttest	Mean Gain Score
Male	19.05	62.09	43.04
Female	17.00	61.22	44.22

Table 5 shows that female students had higher mean gain score of 44.22 while the male students had mean gain score of 43.04. This shows that all the groups benefited from the treatment, with female students having better performance and mean gain than the male students. The comparison in the mean scores between their pretest and posttest is shown in Figure 2.



Figure 2. Performances of male and female students’ taught using PPT

Hypothesis Three: There is no significant difference in the mean achievement scores of high, medium and low achiever students using PowerPoint Presentation.

To determine whether there was significant difference in the post-test mean scores of high, medium and low achievement students, data were analyzed using the analysis of covariance (ANCOVA). Table 5 shows analysis of the result.

Table 5 ANCOVA Posttest of High, Medium and Low Achievers in PPT Group

Source of Variation	Sum of Square	df	Mean Square	F	Significance (p)
Covariate (Pretest)	742.101	1	742.101	10.857	0.002
Main Effect (Ability)	1292.632	2	646.316	9.456	0.000
Model	4421961 ^a	3	1473.972	21.565	0.000
Residual	2802.395	41	68.351		
Total	178226.00	45			

Table 5 presents the result of the analysis of covariance using the pretest scores of students in the three achievement levels as covariates. The result shows that F-value of 9.456 for the main effect was significant at .05 alpha level [$F(2, 41) = 9.456, p < .05$]. This means that there is statistically significant difference in the posttest mean scores of the high, medium and low achievement levels students. On this basis, hypothesis three was rejected. Therefore, there is a significant difference in the performance of high, medium and low achievement levels students taught using PPT. Sidak post-hoc analysis was used to determine the direction of difference among the three Achievement levels. The result of the analysis is shown in Table 6.

Table 6 Sidak Post-hoc Analysis of Significant Difference in Mean Score Achievement Levels of Students Taught Using PPT

Variable (i)	Variable (j)	Mean Difference	Significance Level
High	Medium	7.740*	0.039
	Low	17.758*	0.000
Medium	High	7.740*	0.039
	Low	10.019*	0.017
Low	High	17.758*	0.000
	Medium	10.019*	0.017

Table 6 shows there are significant differences in posttest mean scores between the high and medium Achievement levels students in favor of high Achievement level students (mean diff = 7.740, $p = .039$) and between the high and low Achievement levels students favoring the high Achievement level students (mean diff = 17.758, $p = .000$). It also shows that there is a significant difference between the posttest mean scores of medium and low Achievement levels students taught using PPT in favour of medium achievers (mean diff =10.019, $p = .017$). Table 7 shows the main gain scores for the three Achievement levels.

Table 7 Mean gain scores of students taught with PPT on the basis of achievement levels

Group	Pretest	Posttest	Mean Gain Score
High	20.36	72.21	51.85
Medium	18.05	61.52	43.47
Low	14.60	47.10	32.50

Table 7 shows that high achievers had mean gain of 51.85, followed by the medium achiever with mean gain score of 43.47 and then the low achievers with mean gain score of 32.50. This shows that all the three levels of students benefited from the treatment but high achievement level students benefited more. The mean gain scores of the three achievement levels are graphically illustrated in Figure 3.

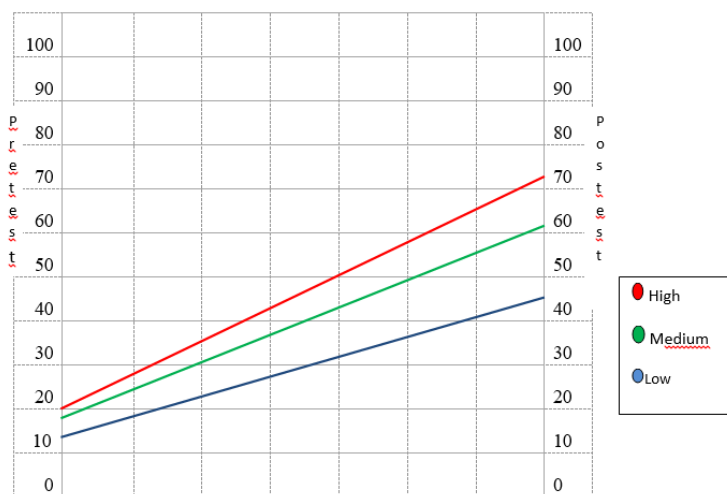


Figure 3. Achievement levels of students' taught Using PPT

DISCUSSION

The results of testing hypothesis one reveals that there is a significant difference in the learning achievements in favor of the group taught technical drawing concept using PowerPoint presentation. This result agrees with the findings of Gier and Kreiner (2009) who reported that PowerPoint increased students' retention in a psychology class. It also supported the findings of Nouri and Shahid (2005) that students in PowerPoint Accounting Principles II class perceived higher understandability of the presented materials than their counterparts in a non-PowerPoint class. However, the results of this study disagree with Savoy et al. (2009), Apperson et al. (2006), Bartsch and Cobern (2003), Beets and Lobingier (2001) Susskind (2005), and Szabo and Hastings (2000) who did not find any beneficial effects of PowerPoint on students' academic achievement.

The results of hypothesis two shows that there is no gender effect on the achievement of male and female students taught isometric and orthographic projection concepts with IWB. This finding is in agreement with the results of Ogunkola and Bilesanmi-Awoderu (2000) who carried out research on the effectiveness of two teaching methods on students' achievement in Biology and found that their achievement was not sensitive to gender. The findings also agree with [Gambari](#) (2010), Oludipe (2012) and Yusuf and Afolabi (2010) which showed that gender had no influence on students' performance in physics, biology and basic science respectively.

The results of hypothesis three test revealed that there is a significant difference in the mean achievements in favor of the high achievers taught technical drawing concepts with PPT. This result agrees with the findings of Adegoke (2010) and Gambari and Olumorin (2013) in physics, Aluko (2004) in chemistry, Fajola (2000) in biology, Gambari (2010) and Yusuf (2004) in social studies which revealed that high ability students do perform better than the medium and lower ability students. However, Yusuf (2004) revealed that achievement levels had no influence on learner academic performance.

CONCLUSION

The paper identified the needs to shift from traditional talk-and-chalk method of teaching to PowerPoint presentation based on its benefits to teachers and students. It was observed that students exposed to PowerPoint presentation (PPT) performed better than their counterparts taught with chalkboard method of teaching. The innovative technology using PPT seems to be the answer. It was found to be effective in teaching Technical Drawing and benefits high, medium and low achievers students, and is also gender friendly.

RECOMMENDATIONS

In this space age, Nigerian schools and educators are expected to be in the vanguard to propel the use of various ICT tools in promoting effective teaching and learning. Therefore, it is recommended that the use of IWB (PPT) should be encouraged in Nigerian schools especially for teaching technological based and other practical oriented courses. This could be achieved if government and other education stakeholders could provide IWB (PPT) to schools with adequate infrastructure and training of teachers on its usage.

Recommendations

1. Teachers should be encouraged to use IWB with PowerPoint presentation in teaching basic technology at junior secondary school.
2. Since the findings of this study show that low and medium achievers benefited and performed better when taught with PowerPoint presentation, therefore, Nigerian public schools should be equipped with necessary ICT facilities to leverage the potentials of PowerPoint presentation and improve student performance.

3. Further empirical studies should be carried out on the use of PowerPoint presentation for instructional purposes, on different subjects and at different levels to provide sound basis for the integration of PowerPoint in Nigerian schools.

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