

Assessment of the Efficacy of Information and Communication Technology Tool on Achievement of Students in Physics and Mathematics: A Case of Repeated Measures

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Abstract: The study assessed the efficacy of power point presentation as an information and communication technology tool on achievement of students in Physics and Mathematics. A lone null hypothesis was tested for the study. A one-group time series research design was adopted for the study using a sample of 86 SS 1 Physics students from two secondary schools. The one-group time series subjects were exposed to power point presentation mode of teaching. Identified extraneous variables which could pose threats to the internal validity of the findings of the study were controlled. The instrument used for data collection was Physics and Mathematics Achievement Test (PMAT). Items of PMAT were adopted from the Physics and Mathematics curricula of senior secondary school class one students. The instrument was trial tested and an internal consistency reliability coefficient of 0.85 and estimate of temporal stability of 0.79 were obtained. The subjects were pretested twice before the experiment and post tested twice after the experiment at 3 weeks interval. The data obtained were analyzed using mean and Standard Deviation (SD) and repeated measure Analysis of Variance (ANOVA) was used to test the lone null hypothesis at 0.05 level of significance. The findings revealed that power point presentation as an ICT tool had significant effect on achievement of students in Physics and Mathematics. It was thus, recommended that curriculum planners and teachers should consider the use of ICT tool as instructional mode in teaching and learning of Physics and Mathematics as well as other science subjects.

Key words: Assessment, power point, interest, achievement, Physics, Mathematics

INTRODUCTION

Physics is simply defined as the study of matter, energy and the relation between them. Physics is in some senses, the oldest and most basic pure science; its discoveries find applications throughout the natural sciences, since, matter and energy are the basic constituents of the natural world. However, Mathematics plays significant roles in the understanding of Physics concepts. The other sciences are generally more limited in their scope and may be considered branches that have split off from Physics to become sciences in their own right. According to Amjad (2012), objectives of teaching Physics at the secondary level are given below: to enable the students acquire scientific knowledge, to present

Physics to the students as a stimulating subject, intellectually satisfying and significantly related to their experiences of life, to develop in the students an awareness of the structure of Physics and an understanding of the fact that Physics is an expanding field, to familiarize the students with fundamental principles, theories and concepts of Physics in modern terms and with the scope of Physics among others.

Despite these laudable objectives of Physics and Mathematics teaching at secondary school level, the subjects have been seen as toughest subjects that ever existed and the evidence of this could be seen in the high number of student's failure in WAEC every year. Ogunniyi (2009) observed that many students have developed negative attitude towards the subject and

hence, find Physics difficult because they have to contend with different representations such as experiments, formulae and calculation, graph and conceptual explanations at the same time. Also, Oginni and Owolabi (2012) observed a general belief among students that Physics is an abstract subject and hence, too difficult to learn. Owolabi discovered that the rate of failure in the subject at the senior secondary school external examination is alarming and reduction in the number of students offering the subject over the years call for concern. Adenike attributed the ugly situation in Physics education to the following factors which include; inadequacy of materials and personnel with respect to teaching the subject, lack of laboratories and equipment, over usage of the traditional approach to teaching, non implementation of ICT in science teaching, among others. This situation needs to be assessed empirically especially in the area of pedagogy.

Assessment as a process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand and can do with their knowledge as a result of their educational experiences. According to Allen (2004) assessment is the use of empirical data on student learning to refine programs and improve student learning. In this study, the researchers assessed the efficacies of power point presentation mode of instruction and demonstration method on the interest and achievement of students in Physics.

Power point is one of the information technology tools that can be used to deliver lessons in the classroom. Technology is the collection of tools, including machinery, modifications, arrangements and procedures used by humans. Technologies significantly affect human as well as other animal specie's ability to control and adapt to their natural environments. The human specie's use of technology began with the conversion of natural resources into simple tools. Recent technological developments, including the printing press, the telephone and the internet have lessened physical barriers to communication and allowed humans to interact freely on a global scale. Information Technology (IT) is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. The term is commonly used as a synonym for computers and computer networks but it also encompasses other information distribution technologies such as television and telephones.

Communications technology refers to the activity of designing and constructing and maintaining communication systems. Information and

Communications Technology (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on as well as the various services and applications associated with them such as videoconferencing and distance learning. ICT tools in education include, computer assisted instruction, computer simulation, power point presentation, computer animation, etc.

Power point is a software tool that is used in over 30 million presentations a day and its software is on 250 million computers world-wide (Alley and Neeley, 2005). Initially, power point was developed to improve learning by providing the means to develop presentations that are more structured and interesting to audiences (Amare, 2006). PPPs can be as simple as consisting only of text on a coloured screen. Presentations can also be complex and include tables, pictures, graphs, sound effects, visual effects, clips, etc. The effectiveness of power point and other multimedia presentations may depend on the complexity of the material that is being presented. In fact, several researchers have demonstrated that material such as interesting but extraneous text, irrelevant sounds (Moreno and Mayer, 2000) and irrelevant pictures (Mayer, 2001) can reduce comprehension. Researchers have examined the benefit that these types of presentations bring to various audiences. Several studies point to the idea that graphics improve student recall.

Numerous studies have been conducted to determine whether or not PPPs affect the student's success in Physics instruction. Studies have revealed that the reason for success in Physics education have been associated with student's motivation, interest and the use of PPPs in the classroom setting (Craker, 2006; Normah and Salleh, 2006). Furthermore, studies have consistently indicated that students generally, believed that the use of PowerPoint facilitated their learning and retention (Mantei, 2000; Apperson *et al.*, 2008). Therefore, the use of the PPPs to increase student teacher's achievements should be considered as an important step in science education. Students who were exposed to teaching methods with PPPs emphasized that their interest and achievements were improved. Thus, PPPs enhanced their learning and success (Frey and Birnbaum, 2002; Rickman and Grudzinski, 2000) because they were able to see the notes (e.g., slides and texts) on the screen and easily follow the subject. Research in science education outside the country indicate that students prefer power point-type presentations to demonstrated lectures (Susskind, 2005; Gok and Silay, 2008).

However, research have indicated that the sole use of demonstration method has negative effects on student’s learning or comprehension of Physics and Mathematics concepts (Araujo and Veit, 2004; Susskind, 2005). So, one can conclude that there is need to integrate contemporary teaching methods, tools and technology (e.g., PPPs and computerized teaching) into Physics education in order to increase the level of student’s academic success. It is from this background that this work was necessitated. The following research question guided study; what are mean achievement scores of students taught Physics using power point presentation mode after some repeated measurement? The researchers hypothesized that achievement scores of students taught Physics and Mathematics using power point presentation mode will significantly improve after some repeated measurements.

MATERIALS AND METHODS

Research design and area: The researchers employed one-group time series research design. The one-group time series is the experimental group which allows researchers to pre-test the subjects in more than one occasion and post-test the subjects in more than one occasion as well. This study was carried out in Nsukka Local Government Area of Enugu State, Nigeria.

Participants: The population for the study comprised of all the 3,635 SS1 Physics and Mathematics students in 30 public secondary schools in Nsukka Local Government Area of Enugu State. The sample size comprised of 86 students. A simple random sampling technique was adopted for the sampling.

Measure: The instrument for data collection was Physics and Mathematics Achievement Test (PMAT). PMAT was a 30-item multiple choice questions developed by the researchers which were generated from Physics and Mathematics content areas of SSI. The instrument was both face and content validated by specialist in Physics, Mathematics and test development. Internal consistency reliability of PMAT was estimated to be 0.85 using Kuder-Richardson formular 20 while the measure of temporal stability of the same instrument was estimated to be 0.79 using Pearson product moment correlation. Before the commencement of the experiment, the instrument was administered to the subjects in two different occasions. These helped in determining the extent of student’s achievement in Physics and Mathematics before the experiment. The experiment lasted for 6 weeks within which extraneous variables were controlled. At the end of the 3rd week of the experiment, the same instrument was

administered to the subjects as post-test 1 while the post-test 2 was administered at the end of the 6th week of the experiment. Data collected were analysed using mean, standard deviation and repeated measures Analysis of Variance (ANOVA). Research question was answered using mean and standard deviation while repeated measure ANOVA was used to test the hypothesis at 0.05 level of significance.

RESULTS AND DISCUSSION

Data in Table 1 revealed that the pre-test mean achievement scores of students in the two different occasions differed ($\bar{x} = 11.72 \pm 1.59$; $\bar{x} = 14.16 \pm 2.26$). Similarly, the post-test achievement scores of the students in the two different occasions also differed ($\bar{x} = 50.96 \pm 6.79$; $\bar{x} = 53.96 \pm 6.58$).

Table 2 shows that the power point presentation had significant effect on the achievement of students in Physics and Mathematics, $F(3, 85) = 43.197$, $p = 0.000$. Besides, power point presentation had high effect on students’ achievement in Physics and Mathematics, $\beta = 0.958$.

The findings also showed that the students exposed to power point presentation mode improved greatly on their achievement in Physics and Mathematics. It was further confirmed that there is a significant effect of power point presentation mode on the mean achievement scores of students in Physics and Mathematics. It was no surprise, therefore, that students taught Physics and Mathematics with power point presentation improved on their achievement, since, the use of PPP appeared to stimulate and awaken the student’s interest in Physics and Mathematics learning. Thus, the use of power point presentation mode of teaching provided a basis for an improvement of learner’s attainment in Physics and Mathematics. This finding is in line with other studies whereby experimental groups taught with ICT methods achieved significantly better results than the control groups. Such studies include those of Nwakundu (2010) and Ogirigbo *et al.* (2011). All these studies showed the superiority of the ICT method over the non-ICT methods on student’s achievement.

For instance, Nwakundu (2010) found that those taught segment of a circle with the use of ICT materials

Table 1: Mean and standard deviations of achievement scores of the Physics and Mathematics students before and after treatment (N = 86)

Measures	Mean	SD
Pre-test 1	11.72	1.59
Pre-test 2	14.16	2.26
Post-test 1	50.96	6.79
Post-test 2	53.96	6.58

Table 2: Repeated measure analysis of variance for the effect of power point presentation on the achievement of students in Physics and Mathematics

Source	Type 3 sum of squares	df	Mean square	F-values	Sig.	Partial η^2 squared
Measures						
Sphericity assumed	982.942	3	994.314	43.197	0.000	0.958
Greenhouse-Geisser	982.942	1.932	971.175	27.170	0.000	0.582
Huynh-Feldt	982.942	1.976	911.477	26.082	0.000	0.320
Lower-bound	982.942	1.000	982.942	14.234	0.000	0.288
Error						
Sphericity Assumed	69.5580	255	23.018			
Greenhouse-Geisser	69.5580	164.210	35.744			
Huynh-Feldt	69.5580	167.959	34.946			
Lower-bound	69.5580	85.000	69.054			

performed better than those who were taught segment of a circle without the use of ICT materials. Ogrigbo *et al.* (2011) equally found that teacher’s use of ICT facilitates effective teaching and learning of Economics in secondary schools. This finding implies that the continuous use of demonstration method of teaching alone does not lead to an improved student’s achievement in Physics.

The outcome of this study is not far from the reality for the fact that student’s active participation during classes in which power point was used as mode of instruction may have spurred their interest into the business of learning thereby enhancing their achievement in the subjects. The findings of this study also corroborate those of previous researches by Kpolovie (2007), Subramaniam (2009) and Center (2014) that interest in an activity such as learning, could most probably be a very powerful affective psychological trait and a very strong knowledge emotion as well as an overwhelming magnetic positive feeling, a sense of being captivated, enthralled, invigorated and energized to cognitively process information much faster and more accurately to ensure good academic performance. Subramaniam (2009) concluded that the active participation of students in the learning context improves their interest. Thus, the implication of this finding is that when the students are not actively involved in an activity that concerns them their interest in such activity will not be enhanced and such will mar their achievement in such condition.

CONCLUSION

This study sought to find out the efficacy of the use of Information and Communication Technology (ICT) tool (power point) as a method of teaching on student’s achievement in Physics and Mathematics. The results showed that power point was efficacious in enhancing the achievement of students in Physics and Mathematics. Thus, students taught Physics and Mathematics with power point presentation had improved achievement.

RECOMMENDATIONS

Based on this, the researchers recommended that in view of the fact that power point presentation mode of

teaching was proved to be efficacious, it is recommended that the Ministry of Education should ensure that ICT tools are made available for teachers and students in secondary schools.

School administrators and government authorities should synergize in order to train serving Physics and Mathematics teachers on how to use and manipulate these ICT tools in other to be good facilitators of the learning process. This could be achieved through seminars and workshop for teachers in secondary schools.

Curriculum planners should revisit the Physics and Mathematics curricula in order to include the use of ICT tools as instructional materials for the teaching of the subjects.

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