

Effect of Simulation on Motor Vehicle Mechanics Work Students' Achievement and Retention in Science and Technical Colleges

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ABSTRACT

This study investigated the Effect of Simulation on Motor Vehicle Mechanics Work Students' Achievement and Retention in Science and Technical Colleges. Two research questions guided the study. The pre-test-post-test control group quasi-experimental research design was adopted. The study was carried out in Makurdi, the Benue State Capital, in which 59 Part 1 (SSS 1) students in Motor Vehicle Mechanics Work (MVMW) trade constituted the population for the study. Motor Vehicle Mechanics Work Achievement Test (MVMWAT) was used for data collection, and analysis made using the mean via the International Business Machine (IBM) Statistical Package for Social Science (SPSS), version 21. The study found that; those taught with simulation achieved higher in both post-test and retention test than those taught with the traditional lecture method. It was recommended that; (i) auto-mechanics technology teachers should endeavour to use of simulation in the teaching of MVMW, and (ii) due to the low sample size used in this study, further studies with larger population are suggested.

Keywords: Simulation, Achievement, Retention, and Motor Vehicle Mechanics Work (MVMW)

INTRODUCTION

Motor Vehicle Mechanics Work (MVMW) is one of the trades offered in the Science and Technical Colleges in Nigeria. Generally, MVMW trade offers procedural skills leading to the production of craftsmen/women, technicians, and other skilled personnel who will be enterprising and self-reliant (National Board for Technical Education; NBTE, 2001). The curriculum of the MVMW programme

is broadly divided into three components: namely; General Education, Trade Theory, and Supervised Industrial Training/Work Experience.

While the general education component of the curriculum aims at providing the students with complete secondary education in critical subjects like English Language, Economics, Physics, Chemistry, Biology, Entrepreneurial Studies, and Mathematics, the trade theory component exposes students to operational principles of various automobile systems and the technical know-how for their maintenance. Similarly, supervised industrial training/work experience provides students with opportunity of coming face-to-face with reality of the world of works. In order to translate the core aim of the MVMW trade into reality, teaching and learning becomes the sole pathway to acquisition of knowledge, skills, and attitude.

In light of the above, the training of MVMW students becomes the sole responsibility of the auto-mechanics technology teachers. Auto-mechanics technology teachers are the professionally qualified personnel with adequate knowledge of the subject matter, technical know-how, and sound pedagogical dexterity, who are capable of guiding the students towards acquisition of knowledge, skills, and attitude. Auto-mechanics technology teachers use various pedagogical techniques such as lecture, demonstration, discussion, and questioning in teaching MVMW trade under the auspices of a school system.

However, the traditional pedagogical techniques of lectures, demonstration, discussion, and questioning often fail to replicate the "real world" (Silvia, 2013). Although, auto-mechanics technology teachers often use sketches/diagrams to make illustrations in the course of teaching but, these only present static graphics which do not show how systems of the automobile operate. Furthermore, the traditional pedagogical techniques focuses most on the teacher thereby making students to be reproducers of knowledge, and passive learners, hence robbing them of the power of critical thinking. This scenario only creates a learning environment where rote learning is

encouraged, if the students indeed want to be successful. Besides, the traditional pedagogical techniques only benefit the auditory learners, while leaving behind, and creating boredom for the visual and kinaesthetic learners.

Unfortunately, students in the 21st century are not willing to go the extra mile by engaging into rigorous reading as it used to be with the students in centuries before. Perhaps, this is one of the reasons while mass examination failure is on the increase than it used to be. From the foregoing, Unongo, (2008) laments that MVMW graduates nowadays are neither employable nor possess the entry requirements for higher education. Earlier, Ames (1998) traced the menace to lack of interest on the part of students, and uninteresting teaching strategies used by teachers. Suffice it to say that, the 21st century students are indeed very different from what students used to be in the centuries before. The new generation ("the Millenarians") are born during the computer age, and are more fascinated by what appears on the screen than what appears on the paper or chalkboard. Supposedly, Mayer, Fennell, Farmer, and Campbell (2004) noted that science and technology need an application of information and communication technology (ICT) tools such as; multimedia and simulation into learning, teaching and assessment. According to Raines, as cited in Silvia, (2013 pp. 2), these visual enriched tools are capable of better helping an instructor "create a lesson plan that maximizes students' learning, encourages critical thinking, aids information retention, and allows students to apply key concepts and knowledge gained through simulation to real (or realistic) problems".

Simulation is a computer aided instruction (CAI) strategy that mirrors, anticipates, or amplifies real situations with guided experiences in a fully interactive way. Paul, (2010) considered simulation as a discipline of designing models of actual or theoretical physical systems, executing the models on a digital computer, and analysing the execution output. Simulation embodies the principle of "learning by doing". This implies that, learning about a system first requires building a model of some sort and then operating the model.

The use of simulation is an activity that is as natural as a child who role plays. Children understand the world around them by simulating (with toys and figurines) most of the interactions with other people, animals and objects. As adults, people lose some of this childlike behaviour but recapture it later on through computer simulation. To understand reality and all of its complexity, it is imperative to build artificial objects and dynamically act out roles with them. Simulation therefore is the electronic equivalent type of role playing and it serves to drive synthetic environments and virtual worlds. According to Kanneras cited in Silvia (2013 p.400), "simulations give students the chance to apply theory, develop critical thinking skills, and provide a welcome relief from the everyday tasks of reading and preparing for classes". An additional benefit of many of these simulations is the introduction of an aspect of realism into the students' experience. From the foregoing, it is worth investigating to see if simulation would influence interest, achievement and retention of MVMW students with visual, auditory, or kinaesthetic learning styles.

Achievement refers to intellectual and skills attained by a student in a particular subject, measured by a score obtained in a test. Achievement can be influenced by several factors including; teaching method, students' background, intelligence, interest, environment and motivation (Ryan, 2011). In a related development, a study carried out by Lowman (2006) to articulate the characteristics of good teaching and how it influences students' academic achievement found that, teaching method and teaching aids used by a teacher to present knowledge have significant influence on students' achievement irrespective of ability-level and gender.

Retention refers to the process of maintaining a replica of knowledge and skills already acquired. It can also be understood as the repeat performance by a learner of the behaviour earlier acquired, and elicited after an interval of time. When students are actively engaged in learning, as in the use of simulation, they have full grasp of the learning content with longer concentration span, and have better retention rate (Miller, 2006). Earlier, Demmert (2001) observed that

retention is affected by the degree of original learning, the learners' memory capacity, and the instructional strategy. Hence, it is imperative for auto-mechanics technology teachers to use instructional strategies that are interactive and ensures students' active participation in learning for enhanced achievement, and retention.

There are research evidences supporting effectiveness of computer simulation on students' learning in science and technology education. For instance, Parker, McNeill, Pelayo, Goei, Howard, and Gunter (2011) conducted a pilot project on "Paediatric Clinical Simulation" and found that using the simulation technique leads to satisfaction and self-confidence, whereas students' self-confidence has a significant impact on their understanding and feeling of success in clinical practices. Similarly, a study by Leila, Abolghasem, Eskandar, Shahrzad, and Bahareh (2013) on the "Effect of Simulation Teaching on Baccalaureate Nursing Students' Self-confidence Related to Peripheral Venous Catheterization in Children: A Randomized Trial" revealed a significant increase in self-confidence score of nursing students related to peripheral venous catheterization in paediatric patients by simulation. In a related development, Silvia (2013) revealed in a research on "The Impact of Simulations on Higher-Level Learning" that, role-playing simulations are effective means to give students the opportunity to engage in higher-level learning. Supposedly, Timur, and Gül (2015) showed in a study on "The Effect of Simulation-based Learning on Prospective Teachers' Inference Skills in Teaching Probability" that simulation-based probability teaching increased the prediction and related inference skills of the prospective teachers and generally influenced the success of the students in a positive way. Again, the results of Hursen, and Asiksoy (2015) on "The effect of simulation methods in teaching physics on students' academic success" gathered that students who were taught using simulations were more successful than their counterparts taught with the traditional approach. Finally, the findings of Adebayo, and Jimoh (2015) on Comparative Effects of Computer Tutorial and Computer Simulation on Achievement and

Retention of Motor Vehicle Mechanics Work Students showed that computer simulation is a more viable teaching method than the computer tutorial for teaching MVMW students.

In spite of studies cited in the literature where simulations were used for teaching (Parker et al., 2011; Leila et al., 2013; Silvia, 2013; Timur et al., 2015; Hursen et al., 2015; Adebayo et al., 2015), no study has examined the effect of simulation on students' achievement and retention where it is used as a tool for supporting theoretical lectures. It is therefore imperative to investigate if the use of simulation can enhance achievement and retention of MVMW students in science and technical colleges when compared with lecture method.

Statement of the Problem

The National Business and Technical Examination Board (NABTEB) results of students indicate high failure rate in various trades. In fact, the Chief examiner's report of NABTEB examination conducted in May/June, 2012 revealed that candidates recorded poor performance in MVMW (NABTEB, 2012). The consequences of poor achievement of MVMW students are not limited to; low academic advancement status, low productivity, unemployment, low income, low quality of living, and slow pace in national development. These critical points pose a problem that requires attention which if neglected; can lead to inter-generational cycle of poverty associated with high level of crime, violence, drug abuse and the rise of political extremism.

According to Federal Ministry of Education (FME) (2000), one of the contributing factors to students' poor achievement in the science and technical colleges is poor teaching. Adebayo et al (2015) also blamed the poor achievement of science and technical college graduates on the traditional methods of teaching which are teacher-centred, and makes students passive and repulsive to learning. However, since the ICT affords the opportunity of creating visually enriched learning environment such as simulation, it is imperative to investigate if the

use of simulation would influence better achievement and retention of MVMW students.

Purpose of the Study

The study specifically aimed at;

1. Comparing the mean achievement scores of MVMW students taught using simulation with those taught using lecture method.
2. Comparing the effect of simulation with lecture method on retention of MVMW students.

Research Questions

The following research questions were posed to guide the study;

1. What are the mean achievement scores of MVMW students taught using simulation and those taught using lecture method?
2. What is the comparative effect of simulation with lecture method on retention of MVMW students?

Research Method

The study adopted the quasi-experimental research design. Specifically, the non-randomized pre-test post-test control group design was employed. The study was conducted in the two sciences and technical colleges offering motor MVMW in Makurdi, the Benue State Capital. The population for the study comprised of 31, and 28 part one (SSS I) students of Benue State University Science and Technical College (assigned as control group), and Saint Joseph's Science and Technical College (assigned as experimental group) respectively, thus the population summed up to 59 respondents. No sampling was taken in order to ensure validity of the result, hence the population constituted the sample. A ten item multiple choice Motor Vehicle Mechanics Work Achievement Test (MVMWAT) was administered on both groups. All the items were randomly drawn from the NABTEB past questions on Auto-Electricity/Electronics for 2006 to 2012. A pre-test was conducted thereafter, the experimental group were taught ("Ignition System")

using simulation while the control group were taught ("Ignition System") using the lecture method. Finally, a post-test was administered on both groups, followed by a two weeks retention test on the experimental and the control groups. The tests scores of both groups were analysed using the mean to answer the research questions.

RESULTS

Table 1: Descriptive Statistics for Pre-test and Post-test of the Control and Experimental groups

Group	N	Minimum	Maximum	Mean
CGPRT	31	1.00	4.00	2.4839
EGPRT	28	1.00	4.00	2.5357
CGPT	31	2.00	5.00	3.7419
EGPT	28	5.00	10.00	6.9286
Valid N (listwise)	28			

Table 2: Descriptive Statistics for Retention Test of the Control and Experimental groups

Group	N	Minimum	Maximum	Mean
CGRT	31	2.00	5.00	3.5161
EGRT	28	5.00	9.00	6.4643
Valid N(listwise)	28			

Key:

CGPRT: Control Group Pre-Test; *EGPRT*: Experimental Group Pre-Test;

CGPT: Control Group Post-Test; *EGPT*: Experimental Group Post-Test;

CGRT: Control Group Retention Test; *EGRT*: Experimental Group Retention Test

The result presented in Table 1 shows that the control group and the experimental group had pre-test mean scores of 2.4839 and 2.5357

respectively. The difference in the pre-test of 0.0518 is negligible since it was not up to 1.00. However, the post-test mean scores for the control group and the experimental group were 3.7419 and 6.9286 respectively. The difference in the mean post-test score of the experimental group was 3.7419, indicating that the experimental group achieved higher than the control group. The difference noticed in the post-test is attributed to the treatment given to the experimental group. It implies therefore that, simulation has significant effect on MVMW students' achievement in science and technical colleges.

Similarly, the data presented in Table 2 demonstrates that the experimental group had retention mean score of 6.4643 while the control group had retention mean score of 3.5161. The difference in retention means score of 2.9482 is statistically significant thereby indicating that the experimental group, exposed to simulation had higher retention compared to the control group exposed to lecture method. Hence simulation is more effective compared to lecture method with regards to retention.

DISCUSSIONS

The finding from the results presented in Table 1 is consistent with Parker et al. (2011). According to them, simulation technique leads to satisfaction and self-confidence, whereas students' self-confidence has a significant impact on their understanding and feeling of success in their clinical practices. Similarly, the finding agrees with Leila et al. (2013) who earlier found that, there exists a significant increase in self-confidence score of nursing students related to peripheral venous catheterization in pediatrics patients by simulation. In the same way, the finding accords with Silvia (2013) that, role-playing simulations are effective means of giving students opportunity to engage in higher-level learning. Likewise, Timur et al. (2015) affirmed the result by revealing that simulation-based probability teaching increases the prediction and related inference skills of the prospective teachers and generally influenced the success of the students in a positive way. Comparably, the finding harmonizes with Hursen et al. (2015) that those students taught using simulations were more successful than

those taught with the traditional approach. On the other hand, finding from the descriptive statistics presented in Table 2 shows that, the experimental group had higher retention mean score than the control group. This equally agrees with the finding of Adebayo et al. (2015) that computer simulation is a more viable teaching strategy for enhancing retention of MVMW students when compared with computer tutorial.

CONCLUSION

The findings obtained from the study shows that the simulation significantly improved the learning content presented to the MVMW students, and positively affected students' achievement and retention in general. This impressive performance observed in the results of the study is due to the visually enriched learning environments created by simulation. On strength of the findings of this study, it is suggested that simulation should be used in teaching MVMW concepts that requires students to imbibe the operational principles. While promising however, simulation should not be seen as a panacea for achieving success in the teaching of MVMW. Rather, simulation should be used where the learning contents involve dynamic systems that are very complex with many interacting components or where the underlying operational sequences are nonlinear and are to be visualized in a three dimension (3D).

RECOMMENDATIONS

Based on the findings of this study, the following recommendations suffice:

- i. Auto-mechanics technology teachers should endeavour to use of simulation in the teaching of MVMW.
- ii. Due to the low sample size used in this study, further studies with larger population are suggested.

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