

## COMPARATIVE STUDY OF STUDENTS' PERFORMANCE ON THE USE OF TECHNOLOGY-BASED INSTRUCTIONAL MATERIALS IN LEARNING SCIENCE

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### Abstract

The study was concerned with the comparative analysis of the performance of students taught with or without technology-based instructional materials. Learning science subjects in secondary school is deemed to be deteriorating due to such factors as lack of interest or poor attitude and fear of the science subjects on the part of learners, and the use of inappropriate method of teaching and technology-based instructional materials by the teacher. The population of the study consisted of all JSS2 students in Mubi metropolis of Adamawa state. Three schools were randomly selected. A simple random sampling which involved diphattrick with replacement method was employed in selecting and grouping the subjects. The total sample for the study is 46 subjects for both the experimental and control groups. The instrument used for data collection was an objective test which consists of 15-multiple choice items with four options adapted from integrated science JSSCE developed by Adamawa State Educational Resource Centre, reliability coefficient at  $r=0.61$  and validated by the subject specialists. The tool employed for data analysis was t-test. The result showed that there is significant difference between the performance of experimental and control group. Based on this finding, it was recommended that the use of technology-based instructional materials should be promoted in our schools to enhance students' learning and comprehension.

Keywords: technology-based, instructional materials, students' performance and science subject

### INTRODUCTION

Researches have shown that learning science in our institutions is faced with problems ranging from the fear of the subject by the learners, lack of motivation, poor method of teaching and lack of using technology based instruction materials in teaching science (O'Neill and Polman, 2006). The practice of using technology to deliver course-work in educational institutions has seen a veritable explosion. The use of technology to enhance, optimize or maximize learning has not only created new opportunities within the traditional classroom, but has also served to expand learning experiences beyond the popular notion of classroom (Scott, Ken and Edwin, 1999). The

growing use of educational technology in today's schools has helped to release the teacher from the routine role of "information giving" (Sampath, Panneerselvan and Santhanam, 2006). Students may learn in lecture-based courses, but little or none of the learning beyond the simple factual recall happens in the lecture. Researchers in the field of educational technology have reported that technology integration in teaching and learning motivates students' interest in learning, increases students' learning such as problem-solving and complex reasoning skills and promotes significant students' learning (Teng and Allen, 2005).

Prior to advances in educational media and technology, presenting materials in varied and appealing ways to promote learning was not possible. Robert (2001) asserted that "the use of technology-based instructional materials allow organizations to manage (collect, filter and disseminate) such knowledge and expertise in ways that were not previously possible. Many instructional solutions arrived through the use of technology-based instructional materials requiring the employment of the instructional media such as slide projector, overhead projector, video recording and computer. There are educational software and technology that allow for the optimal presentation of lesson, aiding comprehension and decreasing cognitive load. The multimedia principle of Mayer states that students learn more deeply from narration and animation than from narration alone (Mitchell & Emily, 2005). Clearly, modern media and technology afford teachers the opportunities to deliver materials in varied ways that foster deeper learning and comprehension.

The concept of technology-based instructional materials is crucial to the advancement of teaching and learning. Technology-based instructional materials can afford a more efficient and effective control over learning situation as well as providing interest, meaning and enrichment to the whole learning experiences (Wodi, 2009). Technology based instructional materials refer to the tools such as slide projector, overhead projector, video recording, camera, television, photography, computer and its accessories. These are the electromechanical devices that are employed to mechanize or automate teaching and learning process. In this regard, the teaching and learning process has been mechanized through the production of teaching aids. These mechanized teaching aids transmit, amplify, distribute, record and produce stimuli materials with a consequent increase in teacher impact. At the same time, the teacher can deals with a large group of

students (Scott et al, 1999). A teacher that is using technology based instructional materials in his lesson would carefully choose the ones that contain formal feature that promote learning and would also be sure that these formal features are age-appropriate for achieving the intended learning goals.

The role of technology in teaching and learning is rapidly becoming the most important and widely discussed issue in the educational policy in Nigeria (Okafor & Umoinyang, 2008). The policy empowers National Information Technology Development Agency (NITDA) to collaborate with the private sectors to realise the specifics of the country's vision of making Nigeria an Information Technology (IT) capable country in Africa and a key player in the information society by the year 2005 through using IT as an engine for sustainable development and global competitiveness. Among the objectives are:

- To empower the youth with technological skills and prepare them for global competitiveness
- To integrate technology-based instruction into the mainstream of education and training
- To develop human capital with emphasis on creating and supporting a knowledge-based society (Okafor & Umoinyang, 2008).

When properly used it holds great promise to improve teaching and learning in our schools. Thus, there is need to expand the role of technology-based instructional materials in delivering instruction to secondary school students in Nigeria so that new opportunities for learning especially science subjects can be achieved. Thomas (2005) similarly asserted that technology-based instructional materials have a significant positive impact on achievement in all subject areas across all levels of study in regular class as well as those for special need students. It has positive effect on students' attitude and makes instruction more students centered, encourage cooperative learning and

stimulate student – teacher interaction. The need for the development of technology-based instructional materials for secondary schools is of great importance to our educational system. Specifically, access to computer is a fundamental step to make for automating teaching and learning. There is no doubt that computer can aid instructional process and facilitate students' learning. Many students have found positive impact associated with such technology aided instruction in science (Rivera & Rice, 2002).

The psychology of using technology-based instructional materials is based on the research findings that knowledge is through all the senses i.e. true knowledge is acquired through multi sensory approach to learning (Sampath et al, 2006). This is learning by direct experience in a natural way. Effective learning emphasizes the importance of first-hand concrete experiences involving sensory contact as the starting point. In this way, the teacher can make use of specific audio-visual aids to suit his purposes. A teacher using appropriate aid can make clear a difficult concept even to a below-average pupil very easily (ibid). Teachers' ability to use computer can also help in using other instructional aids such as overhead projector and slide projector which are used together with computer to enhance learning of a particular topic in science.

Concern about technology-based instructional materials opportunities have been addressed in most educational technology literature. Rivera et al (2002) found out in their study that student have less positive attitude towards technology-based instructional materials. They stressed that lack of novelty for using computer may account for this change in attitude towards computers. The use of the media in the classroom must be preceded by the learners' readiness for participating in the experience. The minds of the pupils must be prepared.

Gender issues have been linked with academic performance of students in several studies but without definite conclusion. Some

studies reveal that male students perform better than the female in sciences (Maliki, Agban & Ibu, 2009). Maliki, Agban and Ibu (2009) acknowledged the superiority of males over females when he noted that in the test, boys obtained higher score than girls and the findings reveals that boys clearly performed better than the girls in science due to gender difference. Spotts, Bowman and Mertz (1997) examined gender and the use of technology among university students, survey data were analyzed along gender lines. Results showed that males rated their knowledge and experience with some innovative technologies higher than did females.

Onasanya, Daramola and Asuquo (2006) investigated the effect of CAI package on gender. Their findings indicated that there was no significant gender difference on the performances of the students in experimental group.

#### Statement of the problem

Research findings have shown that learning science in secondary schools is deteriorating (O'Neill & Polman, 2006) due to such factors as lack of interest, poor attitude and fear of the science subjects by the learners as well as the use of inappropriate teaching methods and technology-based instructional materials by the teachers. Therefore, this study investigated if the use of technology based instructional materials would enhance learning integrated science in JSS.

#### Purpose of the study

The study compared the performances of students taught with technology based instructional materials and those taught without technology based instructional materials. The study aimed to find out if there is significant difference between the performance of students taught with and without technology-based instructional materials, and whether students' performance can be improved by using technology based instructional materials in learning integrated science.

**Research Question**

1. Is there any significant difference between the performances of students taught with technology based instructional materials and those taught without technology based instructional materials?
2. Is there any significant difference between the performances of male and female students taught with technology-based instructional materials?

**Hypothesis**

- There is no significant difference between the performances of student taught with technology based instructional materials and those taught without technology based instructional materials.
- There is no significant difference between the performances of male and female students taught with technology-based instructional materials.

**Instrument and Method**

The study is an experimental type which involved two groups of subjects, experimental and control groups. Both groups were taught the same topic at different time for four weeks. The experimental group however was exposed to technology-based instructional material developed by the Federal Government of Nigeria/UNICEF while the control group was not exposed to technology-based instructional material. Both groups were given the same test at the same time after instructions.

The population of the study consisted of all JSS 2 students in Mubi metropolis, Adamawa State.

Three schools were randomly selected out of six schools. A simple random sampling which involved Diphattricks with replacement method was employed in selecting 46 subjects as the sample. The same method was used in grouping the subjects into experimental and control groups.

For data collection, the instrument used was an objective test which consists of 15-multiple choice items with four options adapted from integrated science examination question (JSSCE) developed by Adamawa State Educational Resource Centre and validated by subject specialist before were administered to the respondents.

The reliability of the instrument was calculated using Kuder Richardson KR21 and which was found to  $r=0.61$

**Result**

The data from the test scores were analyzed using t-test to test the significance for an unrelated sample to determine the significant difference between the performance of the experimental and the control groups as shown in the table below:

Research Question: Is there any significant difference between the performances of students taught with technology based instructional materials and those taught without technology based instructional materials?

Table 1: Summary table of t-test calculated

| Groups       | N  | Df | Mean  | S <sup>2</sup> | t-value | t-crit(.05) |
|--------------|----|----|-------|----------------|---------|-------------|
| Experimental | 26 |    | 14.31 |                |         |             |
|              |    | 44 |       | 16.51          | 3.23    | 1.96        |
| Control      | 20 |    | 10.4  |                |         |             |

The table above shows that the calculated value of  $t= 3.23$  is greater than the table value 1.96 at 0.05 alpha level. Since the calculated value is greater than the table value, the decision is to reject the null hypothesis.

The result indicates that there is a significant difference between the performances of the students taught with technology based instructional materials and those who were taught without technology based technology based instructional materials.

Table 2: Summary table of t-test on gender difference for the experimental group

| Gender | N  | Df | Mean  | S     | t-value | t-crit(.05) |
|--------|----|----|-------|-------|---------|-------------|
| Male   | 15 |    | 13.2  |       |         |             |
|        |    | 24 |       | 22.75 | 0.0076  | 2.069       |
| Female | 11 |    | 11.82 |       |         |             |

The table above shows that the calculated value of  $t = 0.0076$  is less than the table value 2.069 at 0.05 alpha level. Since the calculated value is less than the table value, the decision is to accept the null hypothesis.

The result indicates that there is no significant difference between the performances of male and female students taught with technology based instructional materials.

#### Discussion

The focus of the study was to find out if there is any significant difference between the performances of students taught with technology based instructional materials and those taught without technology based instructional materials as well as gender. The result indicates that there is a significant difference between the performances of students taught with technology based instructional materials and those taught without technology based instructional materials. This proves that the use of technology-based instructional materials with appropriate teaching method and appropriate age-group enhance academic abilities of students at desirable level. When compared with the performance of control group, it is clear that experimental group outperformed the control group. This means that the use of technology-based instructional materials maximize, optimize and enhance students' learning and comprehension. This finding concurred with that of Hussain, Iqbal and Akhtar (2010) that "the students performed better when taught in technology-based environment and it helps students develop the abilities of knowledge, comprehension and application." Gutierrez (2005) also had a similar finding in his study that "the hybrid students i.e. students taught with ICT facilities outperformed the students in the traditional course by substantial margins." It has also

been found that there is no significant effect of technology-based instructional materials on gender, which shows that both males and females performed equally on the use of technology-based instructional materials. This finding is in line with Onasanya, Daramola and Asuquo (2006) on the effect of Computer Assisted Instruction (CAI) on gender which revealed non-significant effect between male and female students performance.

#### Conclusion

This study was an attempt to find the difference in performances of students taught with technology-based instructional materials and those taught without technology-based instructional materials. The result shows that the students who were exposed to technology-based instructional materials achieved more vi-a-vis students who were not exposed to technology-based instructional materials. The implication of this is that the use of technology-based instructional materials enhances students learning and comprehension in science. It also develops the mental resources of the learners. Based on this finding, this study therefore recommends that:

- the use of technology-based instructional materials should be promoted in our secondary schools to enhance students' learning and comprehension in science.
- Teachers should be encouraged to use technology-based instructional materials with appropriate method(s), so as to avoid waste of time and resources.
- Students should be encouraged to learn science through the use of technology based instructional materials.

- Teachers should improve learning science through the use of technology based instructional materials.
- Computer laboratories with Internet networking and other necessary facilities of technology should be provided in schools as a way to improve the teaching and learning process

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