International Journal of Advances in Engineering and Management (IJAEM)
Volume 7, Issue 02 Feb. 2025, pp: 491-497 www.ijaem.net ISSN: 2395-5252

Effects of Self-Instructionalmultimedia Packageon Students' Academic Performance Inmetalwork Technology Education Programmeinthe21st Century Intertiary Institutionsin Rivers State.

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Date of Submission: 10-02-2025 Date of Acceptance: 20-02-2025

ABSTRACT
The study investigated effect of self-instructional multimedia package on students' academic performance in metalwork technology education programmein the 21st century in tertiary institutions in Rivers State. A quasi-experimental design guided the study. The population of the study comprised 198 Year I-IV metalwork students in the three tertiary institutions in Rivers State that offer Metalwork technology. Year III students with a population of 69was selected. Two research questions and hypotheses were answered and tested at .05 level of significance. The researcher collected data for the study using teacher made test.The instrument was validated by two lecturers in the department of Industrial Technical Education, Ignatius Ajuru University of Education, Port Harcourt. The reliability of the instrument was established using test re-test method. The data achieved were analyzed with PPMC. The coefficient achieved was .84. Analysis of Covariance (ANCOVA) statistics were used to test the hypotheses at .05 levels of significance. Based on the findings of the study, it was concluded that experimental group taught with self-instructional multimedia package performed better than the control group taught with whiteboard. It was recommended that government should train teachers on how to develop and use self-instructional multimedia in addition to white board teaching methodsince it has proven to be effective.

Keywords: Self-Instruction, Multimedia Package, Academic Performance, Metalwork Technology Education, 21st Century

I. INTRODUCTION

Education is a veritable tool that is used in the development of a country. It is the process whereby the organized knowledge of the past generation is made available for the current or newer generation (Oluwalola, 2019). The Nigerian system of education is one of the systems in the continent of Africa that has made impact on human development. The system is designed to develop manpower in different areas of specialization that will help in all round development of the country.

Several educational programmes are offered in our tertiary institutions to provide manpower in different fields. One of the programmes designed is Metalwork technology education. This is a branch of technical education that is concerned with the development of competent worker in terms of acquisition of adequate knowledge and mechanical skills (Elobuike, cited in Ajie, Osoh and Thomas 2022).It is a training programmes that is offered or taught in tertiary institutions, which comprises of other courses such as foundry practices, fabrication, welding, forging, machine shop and equipment mechanic work (National Board for Technical Education in Bakare, Azian, Rosmah, Yusri, Muhammad, & Nor, 2019). Metalwork as a field is

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aimed at introducing and equipping her learners to an activity that they can make do with in their future occupation. In line with this,Beako, Flagg, Okorieocha, and Kooli (2018), states that in the field of metalwork technology, skills encompass everything that students need to succeed in the competitive and increasing complex world immediately after graduation. Therefore, objective of metalwork technology is to prepare her students to become independent and to increase their employability skill so that they will get accepted in the industries, become self-employed, or employers of labour which in turnresulting to the industrialization of the nation.

Rebecca, and Samuel cited in Ajie et al (2022) pointed that 21st Century is a period characterized by rapid technological advancement and innovation, our lifestyles and ways of interaction has advanced significantly as digital technologies turn ubiquitous in our life as sensitive machines are now used in our workshops for learning, people can stay in their comfort areas and learn with different learning gadgets and media.

Multimediais the combination of instructional methods that encourage learners to engage in active learning by mentally representing materials in words and pictures making connections between the pictorial and verbal representations. Kumar (2013) asserted that multimedia are instructional package and interactive application that integrate text, colour, graphic images, audio, animation, audio sound, and full motion video in a single application, multimedia package involves 2 or more-in-one computer software package (application) designed to integrate text, audio and video for teaching,

Self-instructional is a student centered activity, an oriented teaching/learning strategy where the teacher acts as a facilitator of learning, guiding the students through series of activities and problem solving for greater achievement (.Adebayo, 2019). This is different from the conventional teacher-dominated strategy of teaching that is teacher centered (Deborah in Adani, Eskay, and Onu, 2018).

Self-instructional strategy is based on braking down learning materials into small steps that are arranged sequentially from known to unknown otherwise known as simple to complex approach. Adebayo, (2019).Stated that self-instructional strategy enables each student to work at his own pace, thus accommodating both the fast and slow learners. This suggests that self-instructional strategy calls for individualized student attention. It also gives the learner an opportunity for self-evaluation, self-determination, and self-motivation towards academic performance (Anthony, Karrie, Burke, &Wehmeyer. 2018).

Academic performance is one of the factors that determine success in academic environment. It is an issue that concerns educators, families, and students themselves. According to Van den Aardweg and Van den Aardwegin Sikhwari (2016) academic performance could be described as a product which can be measured by means of achievement tests and is usually associated with mental success, it is on this premise that students are judged.

However, several research has been carried out with much attention on the effect of multimedia in different subject areas one which is a study by Amadi and Ochogba (2018) on the effect of multimedia on students' academic achievement in motor vehicle mechanics in technical colleges which found that students taught with multimedia performed better than students taught with conventional teaching strategies. Meanwhile, without many articles on metalwork technology education. Hence, this research is focused on examining the effect of self-instructed multimedia package on students' academic performance in Metalwork technology education in 21st Century in tertiary institutions in Rivers State.

PROBLEM OF THE STUDY

Tertiary institutions in Rivers State and Nigeria at large is in dire need of producing up-to-date skilled technologist for proper workplace relevance especially as it concerns production activities in the country, knowing fully aware that metalwork technology programmes is designed to produce competent and skilled graduates in various metalwork sections. A graduate in this field is expected to operate effectively the various machines and perform other metalwork skills like welding, foundry, casting, metal forming and fabrication, and be productively employed in private or public sectors/industries. Unfortunately, there is a controversy that most of the metalwork technology education graduates are incompetent. Attesting to this, Nnodim and Ochogba, (2018) opined that majority of craftsmen and graduates of technical education are not competent in handling skilled jobs in industries. According to Udofia, Ekpo, Nsa, and Akpan (2012), wrong approach to teaching and evaluation of practical courses in technical education rather than impart skills to students, produce graduates who are ill-equipped with practical skills, and inadequate creative power. On another note, Umar, Idris, Audu, Arah, Yusuf,

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and Beji (2015) opined that students' poor performance in technical education programmes is based on the fact that students do not participate actively in learning activities in these educational programmes, alsothat why they perform poorly is as a result of the use of chalkboard, and flip chat mostly in teaching which does not support students' full participation during instruction. Therefore, in order to remedy the problem of non-participation in metalworktechnology education, lecturers are expected to employ every possible means that will help build students' academic performance towards skills acquisition. It is on this premises that the researcher deemed it necessary to investigate effect of self-instructional multimedia package on students' academic performance in metalwork technology education programme in 21st century in tertiary institutions in Rivers State.

PURPOSE OF THE STUDY

The study investigated effect of self-instructional multimedia package on students' academic performance in metalwork technology education programme in the 21st century in tertiary institutions in Rivers State. Specifically, the study:

1. Investigated the effect of self-instructional multimedia packages on students' academic performance when taught ferrous metals in metalwork technology educationprogrammein the 21st century in tertiary institutions in Rivers State.
2. Determined the effect of self-instructional multimedia packages on students' academic performance when taught foundry tools and equipment in metalwork technology educationprogrammein the 21st century in tertiary institutions in Rivers State.

RESEARCH QUESTIONS

The following research questions guided the research:

1. What is the effect of self-instructional multimedia packages on students' academic performance when taught ferrous metal in metalwork technology education programme in the 21st century in tertiary institutions in Rivers State?
2. What is the effect of self-instructional multimedia packages on students' academic performance when taught foundry tools and equipment in mechanical technology education programme in the 21st century in tertiary institutions in Rivers State?

HYPOTHESES

The following null hypotheses were tested at .05 level of significance:

1. There is no significant difference between the mean scores of students taught ferrous metals in metalwork technology education in tertiary institutions in Rivers State using self-instructional multimedia packages and those taught with conventional (lecture) teaching strategies.
2. There is no significant difference between the mean scores of students taught foundry tools and equipment in metalwork technology education in tertiary institutions in Rivers State using self-instructional multimedia packages and those taught with conventional (lecture) teaching strategies.

II. METHODOLOGY

This study adopted a quasi-experimental design. It is a quasi-experimental study because the study was a non-randomized control group, pre-test post-test design. The independent variable was manipulated by the researcher under controlled conditions. This study exposed the experimental group to treatment. Intact classes were used for the research. The population of the study comprised 198 Year I-IV metalwork technology education students in the three higher institutions in Rivers State that offer the programme, namely: Rivers State University (RSU), Port Harcourt, Ignatius Ajuru University of Education (IAUE), Port Harcourt and Federal College of Education (Technical) (FCET), Omoku in affiliation with University of Nigeria, Nsukka. Out of the four levels, the researcher selected Year III for the study with a population of 69 students. This is because, they have spent more than two years in the programme and they were not occupied with project work, hence they were available for the research. The selected population was manageable; therefore, the entire population was adopted for the study. The researcher collected data for the study using teacher made test containing thirty items. The teacher made test was two multiple choice type of teacher made test, one for pre-test and the other for post-test. Two teaching strategies were used in the instruction delivery during this experiment. The two strategies were conventional strategy (lecture method) whereby whiteboard and flip charts were used in teaching and the self-instructional multimedia package. The control group were taught with the conventional strategy while the experimental group were taught with the self-instructed multimedia package. The teaching

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period lasted for a week. Content appropriateness of the instruments were face and content validated by expert two (lecturers) from department of industrial technical Education, Ignatius Ajuru University o education, Port Harcourt, The reliability of the instrument was established using test re-test method. Copies of the instrument were administered to 10 year III Mechanical technology education students in the Department of Vocational and Technology Education. Faculty of Education, Niger Delta University who were not part of the population. The data achieved were analyzed with Pearson Product Moment Correlation. The reliability coefficient achieved was .84. In order to collect data for the study, the researcher taught the experimental and control groups with two different lesson plans. The experimental group was taught using self-instructional multimedia package while the control groups were taught with lecture method. From the lesson plan the pre-test and post-test questions were constructed to collect data. The pre-test questions were administered to the two groups first before teaching process. The post test questions were administered on the two groups after teaching has taken place. The data collected were used for data analysis. The data was analyzed using mean to answer the research questions and to ascertain the homogeneity of responses with Standard Deviation. Analysis of Covariance (ANCOVA) statistics were used to test the hypotheses at .05 levels of significance.If mean gain is positive, the experimental method was regarded as positive; else it was regarded as negative. Also, if calculated p-value is less than a .05 level of significance, H0 was rejected. On the other hand, if p-value is greater than a .05 level of significance, H0 was accepted.

III. ANALYSIS OF DATA AND RESULTS

Research Question 1

What is the effect of self-instructional multimedia packages on students' academic performance when taught ferrous metal in metalwork technology education in tertiary institutions in Rivers State?

Answer to Research Question One is presented in Table 1.1

Table 1.1: Mean scores of Students' Academic Performance in Ferrousmetal when taught with Self-Instructional Multimedia Packages

Groups	N	Pre-test $\bar{X}_1$	Pre-test SD_1	Post-text $\bar{X}_2$	Post-test SD_2	Mean difference	Mean gain	Decision
Experimental	39	38.56	9.27	62.41	8.79	23.85	3.58	Positive
Control	30	31.20	7.72	51.43	4.50	20.27		

Source: Field Study, 2024 (Note: n= Sample Size)

Table 1.1 show that the pre-test mean and standard deviation for experimental group were 38.56 and 9.27 while that of control group were 31.20 and 7.72 respectively. The mean and standard deviation scores of pre-test for the two groups revealed that students in experimental group did better on the pre- test than those in the control group. Similarly, the post-test mean and standard deviation for experimental group were 62.41 and 8.79 while that of control group were 51.43 and 4.50 respectively. This revealed that students in experimental group did better on the post-test than those in the control group. Furthermore, the mean gain between the two groups was 3.58 which shows positive result; hence the experimental method was effective. Therefore, students taught ferrous metal with self-instructional multimedia instruction package performed better than those taught with the use of chalkboard and charts.

Research Question 2:

What is the effect of self-instructional multimedia instruction package on students' academic performance when taught foundry tools and equipment in mechanical technology education in tertiary institutions in Rivers State?

Answer to Research Question Two is presented in Table 2.1

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Table 2.1: Mean scores of Students' Academic Performance in Tools and Equipment when taught with Self-Instructional Multimedia Package.

Groups	N	Pre-test $\bar{X}_1$	Pre-test SD_1	Post-text $\bar{X}_2$	Post-text SD_2	Mean difference	Mean gain	Decision
Experimental	39	39.41	7.50	61.54	6.53	26.13	8.33	Positive
Control	30	41.06	7.80	58.86	5.36	17.80		

Source: Field Study, 2024 (Note: n= Sample Size)

Table 2.1 show that the pre-test mean and standard deviation for experimental group were 39.41 and 7.50 while that of control group were 41.06 and 7.80 respectively. The mean and standard deviation scores of pre-test for the two groups revealed that students in control group did better on the pre- test than those in the experimental group. Similarly, the post-test mean and standard deviation for experimental group were 61.54 and 6.53 while that of control group were 58.86 and 5.36 respectively. This revealed that students in experimental group did better on the post-test than those in the control group. Furthermore, the mean gain between the two groups was 8.33, which shows positive result; hence the experimental method was effective. Therefore, students taught foundry tools and equipment with self-instructional multimedia package performed better than those taught with the use of chalkboard and charts.

Hypothesis 1

There is no significant difference between the mean scores of students taught ferrous metals in metalwork technology education in 21st century in tertiary institutions in Rivers State using multimedia package and those taught with conventional teaching strategies (lecture method).

Table 3.1: Analysis of Covariance (ANCOVA) for Scores in Ferrous Metals

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2043.139[a]	1	2043.139	38.836	.000
Intercept	219762.676	1	219762.676	4177.283	.000
VAR00001	2043.139	1	2043.139	38.836	.000
Error	3524.803	67	52.609		
Total	234793.000	69			
Corrected Total	5567.942	68			

From Table 3.1, F-cal is 38.83 while the p-value is .00 at .05 level of significance. This result shows that p-value of .00 is less than .05 level of significance; hence the null hypothesis was rejected. Therefore, there was a significant difference between the mean scores of students taught ferrous metals in metalwork technology education in tertiary institutions in the 21st century in Rivers State using multimedia package and those taught with conventional teaching strategies.

Hypothesis 2:

There is no significant difference between the mean scores of students taught foundry tools and equipment in metalwork technology education in 21st century in tertiary institutions in Rivers State using multimedia package and those taught with conventional teaching strategies (lecture method).

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Table 4.1: Analysis of Covariance (ANCOVA) for Scores in Foundry tools and equipment

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	686.428[a]	2	343.214	11.960	.000
Intercept	5369.358	1	5369.358	187.105	.000
VAR00004	349.459	1	349.459	12.177	.001
VAR00005	563.049	1	563.049	19.620	.000
Error	1894.007	66	28.697		
Total	254231.000	69			
Corrected Total	2580.435	68			

From Table 4.8, F-cal is 19.62 while the p-value is .00 at .05 level of significance. This result shows that p-value of .00 is less than .05 level of significance; hence the null hypothesis was rejected. Therefore, there was a significant difference between the mean scores of students taught foundry tools and equipment in metalwork technology education in the 21st century in tertiary institutions in Rivers State using multimedia package and those taught with conventional teaching strategies.

MAJOR FINDINGS

From the analysis of data collected in respect to this study, the following findings were made:

1. Students in the experimental group taught ferrous metal using self-instructed multimedia package did better that those taught with chalkboard and charts with a mean gain of 52.60.
2. The students who were taught foundry tools and equipment using self-instructed multimedia package performed better than those taught with chalkboard and charts with a mean gain of 28.69.

IV. DISCUSSION AND CONCLUSION

The analysis of the results in the effect of self-instructional multimedia package on students' academic performance when taught ferrous metal showed that students in the experimental group taught ferrous metal using self-instructional multimedia packages did better that those taught with chalkboard and charts. Also, there was a significant difference between the mean scores of students taught ferrous metals in metalwork technology education in tertiary institutions in Rivers State using multimedia package and those taught with whiteboard and chart. This is conformity with Umar et al (2015) who stated that students' poor performance in technical education programmes is based on the fact that students do not participate actively in learning activities in these educational programmes, also that why they perform poorly is as a result of the use of chalkboard, and flip chat mostly in teaching which does not support students' full participation during instruction.

The analysis of the results in the effect of self-instructional multimedia packages on students' academic performance when taught foundry tools and equipment showed that students who were taught foundry tools and equipment using self-instructional multimedia package performed better than those taught with chalkboard and charts. Also, there was a significant difference between the mean scores of students taught foundry tools and equipment in metalwork technology education in tertiary institutions in Rivers State using multimedia package and those taught with conventional teaching strategies (use of whiteboard). This is also in line with Umar et al (2015) who stated that students' poor performance in technical education programmes is based on the fact that students do not participate actively in learning activities in these educational programmes, also that why they perform poorly is as a result of the use of chalkboard, and flip chat mostly in teaching which does not support students' full participation during instruction.

V. RECOMMENDATIONS

The following recommendations were put forward based on the findings:

1. Government should train lecturers on the development and use of self-instructional multimedia package so that they can be able to use this instructional strategy in teaching some course that does not really require practical learning in metalwork technology education since it has proven to be effective.
2. Self-instructional multimedia package strategy should be included in the metalwork technology education curriculum so that lecturers can adopt it for effective theoretical teaching.

3. Metalwork technology education lecturers should adopt the use of self-instructional multimedia strategy when teaching ferrous metal and foundry tools and equipment so as to enhance students' academic performance in metalwork technology education programmes

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