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# Effect of Audio-Visual Aids on Students' Academic Achievement in Mechanical Engineering Craft Practice in Technical Colleges in Rivers State

Okwelle P. Chijioke[1*], Orikoha Ekwueme[2]
Rivers State University
**Corresponding Author:** Okwelle P. Chijioke pcokwelle@gmail.com

A R T I C L E I N F O

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A B S T R A C T

This study investigated the effect of audio-visual aids on students' academic achievement in mechanical engineering craft practice in technical colleges in Rivers State. Two research questions were posed and two null hypotheses were tested in the study. Quasi-experimental design was adopted for the study. Purposive sampling technique was used to draw the three technical colleges offering Mechanical Engineering Craft Practice out of the four technical colleges in the state. A multi-choice test instrument tagged "Mechanical Engineering Craft Practice Achievement Test" was used for data collection. Research questions were answered using mean. Analysis of covariance (ANCOVA) statistics was used to test hypotheses at 0.05 level of significance. The study recommended that teachers of mechanical craft practice and other technical disciplines should vigorously adopt the use of audio-visual aids amongst other active instructional aids in the delivery of their day to day lessons.

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**INTRODUCTION**

Education is the imparting and acquiring of knowledge through teaching and learning, especially at a school or similar institution (Anchal, 2018). Education developed from the human struggle for existence and clarification. It may be formal or informal. Methods used in education and educating include teaching, training, storytelling, discussion and directed research. According to Ushie and Ogbulezie (2017), proper teaching and learning sustains a good standard of education, guarantees quality graduates who can compete favourably with their counterpart in other countries.To attain efficient science and technology education in Nigeria, emphasis should be on refashioning the science and technology curricula and a shift from content to processes of teaching science and technology.

This inadvertently will also lead to changes in instructional delivery strategies/methods (Omiko, 2016). Colors-newyork (2019) describes traditional teaching approaches as generally teacher-directed, where students are taught in a manner that is conducive to sitting and listening. The term "traditional teaching" relies mainly on a method that utilizes textbooks, lecture notes, memorization and recitation techniques.However, Aremu and Salami (2013) reported that various studies carried out by individual, governmental and non-governmental organizations revealed that teacher-centred method of teaching (direct instruction) is commonly teachers in Nigeria This methods have failed to produce technological students that are committed to technology and who can reason critically and be able to transfer what is learnt to new but similar situations.

Udu (2018), averred that researches in science and technology education have uncovered enhanced methods of teaching science and technical subjects that are not only superior to the traditional teaching methods but also have the potential to promote achievement and retention of what is learned and inculcate positive scientific interest in students. These innovative practices are tools that empower both students and teachers. By adopting these innovative practices, the learners' needs are met because it supports students' preference for learning by doing. Innovative practices are also promising for instructors because they support teachers to engage students with hands-on inquiry learning. Among these strategies is the use of audio-visual aids in the teaching and learning process. This method uses aids that are appealing to both the senses of hearing and seeing simultaneously.

Audiovisual education is the educational instruction by means of materials that use the senses of sight and hearing to stimulate and enrich learning experiences.(Sandbox Networks Inc, 2021). In this system of education, audio-visual aids are the most prominent tools. According to the Webster dictionary (2020), audio-visual aids is defined as training or educational materials directed at both the senses of hearing and the sense of sight, films, recordings, photographs, etc. used in classroom instructions, library collections or the likes. They are those devices which are used in classrooms to encourage the teaching and learning process and make it easier and interesting. Rasul et al.,(2011) describes audio -visual aids as the best tools for making teaching

effective and the best means of disseminating knowledge Examples of audio - visual aids are LCD project, Film projector, TV, Computer, VCD player, Virtual Classroom, Multimedia etc.Audio-visuals effective usage can be vital to the success of any TVET programme especially in relating with the outside world.

Okoye and Okwelle (2013) described TVET as the form of education that advocates development of the head (knowledge), training of the hand (dexterity) and enriching the heart (conscientiousness and painstaking),-the 3Hs. TVET programmes in Nigeria are provided in institutions such as Universities, Polytechnics, Monotechnics and Technical Colleges leading to the production of technologists, technicians and craftsmen. It is a planned programme of courses and learning experiences that begins with exploration of career options, support basic academic and life skills, and enable achievement of high academic standards, leadership, and preparation for industry-defined work (Kukoyi (2009) in Oviawe, 2018). TVET prepares learners for career that are based on manual or hands-on activities, usually non-academic and totally related to a specific trade, occupation or vocation. TVET is mostly carried out in technical colleges. The National Business and Technical Education Board (NABTEB) awards National Technical Certificates (NTC) to students who have completed their post-primary education in technical colleges.The trades offered in the technical colleges in Nigeria include the following trades; building, beauty culture, computer craft practice, electrical/electronics trade, wood work, printing work, textile work, hospitality and mechanical engineering craft practice.

The NTC curriculum for metal work craft trade among others is aimed at training skilled technical manpower equipped with the necessary technical knowledge and practical skills in operation and use of furnaces, metals, forging, machining, welding and fabrication among others. Welding is an operation whereby two or more parts are united by means of heat or pressure or both (The Welding Institute, 2020). It is a fabrication process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool, causing fusion. According to Bright Hub Engineering (2009), the process of welding doesn't merely bond the two pieces together as in brazing and soldering, but, through the use of extreme heat and sometimes the addition of other metals or gases, causes the metallic structures of the two pieces to join together and become one. While many welding applications are done in controlled environments such as factories and repair shops, some welding processes are commonly used in a wide variety of conditions, such as open air, underwater, and vacuums (such as space). Aside welding, other activities carried out in mechanical craft practice include machining, refrigeration and air conditioning.

Machining is a technical and detail-oriented process in which material is cut into a final shape and size to create parts, tools, and instruments. Machining is typically used to shape metals, though it can also be used on a variety of other raw materials (Arzt, 2021). Machining is any of various processes in which a piece of raw material is cut into a desired final shape and size by a controlled material-removal process. To perform machining, relative motion is

required between the tool and the work. Drills and threading tools are attached to compatible machinery such as a lathes, drill presses, or CNC machines to perform machining operations on the work-piece. According to Deeco Metals (2018), the three principal machining operations are classified as turning, drilling, milling and miscellaneous operations.

The aims of discovering and adopting audio-visual learning aids in Technical colleges is to reform the teaching-learning activities from teacher-centered to student-centeredgeared towards enhancing students' academic achievement. McCoy, et al. (2020) defined academic achievement as learned proficiency in basic skills and content knowledge. This refers to a student's scholastic standing. In order words, it refers to a students' academic performance at any given time with respect to the cognitive, affective and psychomotor domains. Academic achievement is often measured through examinations or continuous assessments.It may be measured through students' grade point average, whereas for institutions, achievement may be measured through graduation rates. In order to develop skills, abilities, understanding, attitude, and work habit needed by students to excel academically and by extension their entry and progress in employment on a useful and productive basis, the best teaching aids and materials should be utilized.

**THEORETICAL REVIEW**

The continued existence of any engineering outfitbe it mechanical or civil is majorly dependent on the caliber of its available craftsmen. Craftsmen actualize the plans and designs of the mechanical engineer. Most craftsmen are products of Technical Colleges.They are skilled and extremely talented persons in their selected discipline. According to Dubey (2016), craftsmanship helps us build better products and better engineers. Furthermore, he stated that craftsmanship is one of the most fundamental drivers of career transformation for engineers. However, National Business and Technical Examinations Board (NABTEB) Chief Examiner's report (2017) reported that there is a decline in students' academic achievement in General metalwork. The Chief Examiner's report shows that students who sat for General metalwork examination performed poorly. Students recorded 30 percent failure in sheet metal practice, 60 percent failure in forging and 65percent failure in foundry.

Moreover, the report shows that only 2 percent of the students who sat for General metalwork attempted the questions on furnaces of which they performed poorly. Also, NABTEB Chief Examiner's report of 2016 cited in Bala et al. (2018) noted a 46 percent failure of students who sat for General metalwork examination. The result showed a failure rate of 42.5% for heat treatment and 45.5% for soldering.The Board is of the opinion that this persistent poor achievement and interestsstems mainly from the inappropriate instructional aids adopted by technical teachers amongst others. This calls for speedyremedy. Therefore, to seek for proficient instructional aids for the teaching and learning of mechanical craft practice, this study investigated the effect of audio-visual aids on students' academic achievement in mechanical craft practice in technical colleges in Rivers State.

*Purpose of the Study*

The aim of the study is to ascertain the effect of audio-visual aids on student's academic achievement in Mechanical Engineering Craft Practice in Technical Colleges in Rivers State. Specifically, the study determined;

1. The effect of audio-visual aids on students' academic achievement in welding practice in Technical Colleges in Rivers State
2. The effect of audio-visual aids on students' academic achievement in machining in Technical Colleges in Rivers State

*Research Questions*

Two research questions were posed to guide the study:

1. What is the effect of audio-visual aids on students' academic achievement in welding practice in Technical Colleges in Rivers State?
2. What is the effect of audio-visual aids on students' academic achievement in machining in Technical Colleges in Rivers State?

*Hypotheses*

The following null hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference between the mean scores of students taught welding practice using audio-visual aids and those taught with printed materials.
2. There is no significant difference between the mean scores of students taught machining practice using audio-visual aids and those taught with printed materials

**METHODOLOGY**

The research design for the study was quasi-experimental design. According to Thomas (2020), quasi-experimental design aims to establish a cause-and-effect relationship between an independent and dependent variable. Specifically, the type of quasi-experimental design used for the study was the non-equivalent control type which involves two groups (control and experimental). Quizlet (2019) describes a non-equivalent control group as a control group that is matched upon certain preexisting characteristics similar to those observed in a treatment group but to which participants are not randomly assigned. The study was carried out in Rivers State, one of the states in Niger Delta region in Nigeria. The population of the study consisted of 87 senior technical year two students in the Department of Mechanical Engineering Craft Practice in Technical Colleges in Rivers State. There was no sampling as the entire population was of manageable size so the entire population was used for the study.The selected Technical College were GTC Port Harcourt with 32 Voc $II^A$ students and 29 Voc $II^B$ students, GTC Ahoada with 10 Voc $II^A$ students and 9 Voc $II^B$ students, GTC Eli-Ogu divided into Voc $II^A$ and Voc $II^B$ with 4 and 3 students respectively for the purpose of experimentation.

The instrument for data collection for this study was a multiple choice teacher made achievement tests which was carefully constructed using a lesson plan and a table of specification. To ascertain the validity of the instrument, the

test items were drawn from a table of specification that was based on the specific objectives on the lesson plan. The content appropriateness was face validated by 3 experts in Technical Education. The reliability of the instrument was determined using test-retest. Copies of the instrument were administered to 10 mechanical engineering craft practice students outside the sample which were randomly selected by the researcher.The pretest consisted of 40 items used in testing general knowledge on welding practice and machining administered to the 2 groups of students used for the study.Data collected in the first administration served as pre-test scores of the study.

The experimental group was taught with audio-visual aids while the control group was taught using printed materials like charts, pictures etc.At the expiration of the treatment which lasted for ten weeks, consisting of twenty lesson periods, the instrument was reshuffled and re-administered on the students immediately after the last period of teaching both groups.The post-test consisted of 40 test items on welding practice and machining. Data collected in the secondadministration served as pre-test scores of the study.The data generated from the research questions of this study were analyzed using mean. The pretest mean scores were compared with the posttest mean scores and in respect of those taught with audio-visual aids and those taught with the printed materials. Analysis of covariance (ANCOVA) statistics was used to test hypotheses at 0.05 level of significance. The ANCOVA was used for easy comparison of the mean of the two groups. Decision was taken after ANCOVA test and analysis technique based on statistical rule as follows: If f-calculated (f-cal) is less than the f-critical (f-crit), $H_0$ should be accepted. On the other hand, if f-calculated (f-cal), is greater than or equal to f-critical (f-crit), $H_0$ should be rejected. Directed by this statistical rule, decisions were taken in respect of the hypotheses tested in the course of this study.

## RESULTS

*Research Question 1*

What is the effect of audio-visual aids on students' academic achievement in Welding practice in Technical Colleges in Rivers State?

Table 1. Mean Scores of Students' Academic Achievement in Welding Practice

| Groups | Pre-Test (N) | Post-Test (N) | Pre-Test Mean $(\overline{X_1})$ | Post-Test Mean $(\overline{X_2})$ | Mean Gain |
|---|---|---|---|---|---|
| Experimental | 46 | 46 | 20.50 | 59.78 | 39.28 |
| Control | 41 | 41 | 20.20 | 35.30 | 15.10 |

Results from Table 1 show that the pre-test mean score for experimental group was 20.50 while that of the control group was 20.20. The pre-test mean scores for the two groups show that students in the audio-visual aids group did better than their colleagues in the demonstration group on the pre-test exercise. On the other hand, the post-test mean score for experimental group was 59.78 while that of the control group was 35.30. The mean gain on the basis of the

differences between the pre-test mean scores and post-test mean scores of each group indicated 39.28 for experimental group and 15.10 for control group and also a mean gain of 24.18 as shown in Table 1. The results apparently show that students taught with audio-visual aids were better than their equivalents taught with printed materials in welding practice.

*Research Question 2*

What is the effect of audio-visual aids on students' academic achievement in Machining in Technical Colleges in Rivers State?

Table 2. Mean Scores of Students' Academic Achievement in Machining

| Groups | Pre-Test (N) | Post-Test (N) | Pre-Test Mean $(\overline{X_1})$ | Post-Test Mean $(\overline{X_2})$ | Mean Gain |
|---|---|---|---|---|---|
| Experimental | 46 | 46 | 24.20 | 48.60 | 24.40 |
| Control | 41 | 41 | 22.00 | 27.50 | 5.50 |

Results from Table 2 show that the pre-test mean score for experimental group was 24.20 while that of the control group was 22.00. The pre-test mean scores for the two groups show that students in the audio-visual aids group did better than their colleagues in the demonstration group on the pre-test exercise. On the other hand, the post-test mean score for experimental group was 48.60 while that of the control group was 27.50. The mean gain on the basis of the differences between the pre-test mean scores and post-test mean scores of each group indicated 24.40 for experimental group and 5.50 for control group and also a mean gain of 18.90 as shown in Table 2. The results apparently show that students taught with audio-visual aids were better than their equivalents taught machiningwith printed materials.

*Hypothesis 1*

There is no significant difference between the mean scores of students taught welding practice using audio-visual aids and those taught with printed materials. The test of this hypothesis was made in respect of appropriate date gathered and presented in Table 3.

Table 3. Analysis of Covariance (ANCOVA) for Scores in Welding Practice

| Source of Variation | Sum of Squares | df | Mean Square | F-cal | F-crit | P-value | Decision |
|---|---|---|---|---|---|---|---|
| Between groups | 4717.23 | 1 | 4717.23 | 13.13 | 3.96 | 0.0003 | Significant |
| Within groups | 24246.7 | 84 | 288.65 | | | | |
| Total | 28963.93 | 85 | | | | | |

From the result in Table 4, F-calculated is 13.13, F-critical 3.96 at 0.05 significant level, degree of freedom (df) 1 and 84. Since the F-calculated is greater than F-critical (F-cal> F-crit), the null hypothesis is rejected. This indicates that there is a significant difference in the mean achievement scores

between students taught welding practice with audio-visual aids and those taught using printed materials.

*Hypothesis 2*

There is no significant difference between the mean scores of students taught machining practice using audio-visual aids and those taught with printed materials. The test of this hypothesis was made in respect of appropriate date gathered and presented in Table 4.

Table 4. Analysis of Covariance (ANCOVA) for Scores in Machining

| Source of Variation | Sum of Squares | df | Mean Square | F-cal | F-crit | P-value | Decision |
|---|---|---|---|---|---|---|---|
| Between groups | 13143.89 | 1 | 13143.89 | 30.09 | 3.96 | 0.0000 | Significant |
| Within groups | 31097.55 | 84 | 370.20 | | | | |
| **Total** | **44241.44** | **85** | | | | | |

From the result in Table 5, F-calculated is 30.09, F-critical 3.96 at 0.05 significant level, degree of freedom (df) 1 and 84. Since the F-calculated is greater than F-critical (F-cal> F-crit), the null hypothesis is rejected. This indicates that there is a significant difference in the mean achievement scores between students taught machining with audio-visual aids and those taught using printed instructional aids.

**DISCUSSIONS**

The analysis of the results on welding practice showed that audio-visual aids in instruction group performed better than the printed materials group with pre-test mean scores of 20.50 and 20.20 as well as post-test mean scores of 59.78 and 35.30 respectively. Also, the finding showed a significant difference between the effects of audio-visual aids in instruction and use of printed materials only in teaching on students' academic achievement in welding practice. The finding also support the view of Kunari (2006) who stated that using audio-visual aids in teaching is one way to enhance lesson plans and give students additional ways to process subject information. They concretize the knowledge to be presented and help in making learning experience apple real, living and vital. According to him, they supplement the work of the teacher and help in the study of the text books.

The analysis of the results on machining showed that audio-visual aids in instruction group performed better than the printed materials group with pre-test mean scores of 24.20 and 22.00 as well as post-test mean scores of 48.60 and 27.50 respectively. Also, the finding showed a significant difference between the effects of audio-visual aids in instruction and printed materials use in teaching on students' academic achievement in machining. The finding is in support of Mallick (2019) who asserted that audio- visual make the audio and visual sense organs of the pupils activated and they understand minute and difficult ideas of the lesson very conveniently.The finding is also in line with IPL (2021) who stated that audio -visual aids are the best tool for making

teaching effective and the best dissemination of knowledge. So, there is no doubt that technical devices have greater impact and dynamic informative system.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the study, it was concluded that audio-visual aids is more effective than the use of chalkboard and printed materials in the teaching of welding practice and machining which are vital aspects of mechanical engineering craft practice in technical colleges. Its role cannot be underestimated in the skill acquisition process and overall academic achievement of students. Based on the findings of this study, the following recommendations are made:

1. Teachers of mechanical craft practice and other technical disciplines should adopt more the use of audio-visual aids amongst other active instructional aids in the delivery of their day to day lessons.
2. Governments at all levels should declare a state of emergency on the improvement of learning aids in technical colleges within their domain.
3. Teachers of mechanical engineering craft practice and other technical disciplines should be retrained by the state government and relevant bodies in order for them to possess the ICT skills needed to effectively utilize audio-visual aids in the teaching and learning process. This will help keep them informed on the innovation in the technology education sector.

## FURTHER STUDY

The following study could be investigated for further study

1. Effect of multimedia aids on the academic achievement of students mechanical engineering craft practice in Rivers State.
2. Effect of audio-visual to students' academic retention in mechanical engineering craft practice

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