



Effectiveness of the Developed Sand Casting Instructional Video Package on Students' Achievements in Technical Colleges in Bauchi and Gombe States, Nigeria

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ABSTRACT

The study was on testing the effectiveness of the developed sand casting instructional video package on students' achievement in technical colleges in Bauchi and Gombe states. Three research questions were raised and three null hypotheses were formulated and tested at 0.05 level of significance. Related literature was reviewed. Quasi-experimental pretest-posttest non-equivalent group design was used for the study. Sixty-seven (67) NTC II Mechanical Engineering crafts practice trades students in two intact classes from two co-educational colleges were used from the two States. One group of the intact class was taught using developed sand casting instructional video package and the other group taught using the conventional method. Sand Casting Achievement Test (SCAT) with a reliability coefficient of 0.89 used to measure students' achievement before and after treatment and there manifested enough evidence in the study to prove that the developed instructional video package and SCAT are of high validity and reliability. Data obtained were analyzed using Mean and Standard Deviation was used to answer the research questions and t-test to test the hypothesis. Findings revealed that: the experimental group performed relatively the same with the control group before the treatment; students taught sand casting using developed instructional video package (Experimental Group) achieved better than those taught using the conventional method (control group); the post-test mean scores of the experimental group taught using the developed instructional video package was higher than their pre-test scores; the effect of developed instructional video package was significant on students' achievement in the experimental group taught with a developed instructional video package. Based on the findings of this study, it was concluded that developed instructional video package was very effective in enhancing students' achievement.

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INTRODUCTION

Technical Vocational Education and Training (TVET) programmes are faced with the challenges of finding innovative ways to accommodate the growing interest in the programs

(Aloraini, 2012). Technical colleges are not exceptional in this context for a common fact that, the traditional face to face method, demonstration method, lecture method, field trip e.t.c has been used primarily in TVET schools and



colleges as the major method of teaching. The difficulties associated with conventional methods have contributed to low levels of academic achievement related to improper teaching and learning strategies used to teach technical courses at technical schools and colleges (Nwanekezi & Kalu, 2012; Oshinaike and Adekunmes, 2012 & Rober, 2011). Udofia, Ekpo, Nsa, & Bilyaletdino, 2012) pointed out that insufficient didactic techniques do not enhance students acquisition of skills and development of self-concepts as well as interest.

Technical Colleges are institutions usually vested with the responsibility for the training of skilled technical personnel for the technological and economic development of the country (the Federal Republic of Nigeria, 2012). To achieve these goals, technical colleges were established to run programs leading to the award of National Technical Certificate (NTC). They are also considered as the major institutions in Nigeria offering full vocational training to prepare students for entry into various occupations in industries or for self-employment.

Poor achievement in mechanical engineering craft practice students can be attributed to many factors such as unavailability of workshop facilities, lack of instructional materials, inadequate time allocation, large class size and poor instructional delivery approaches. According to Etukudo (2009) the fall in the standard of achievement in mechanical engineering craft practice. Specifically, sand casting is incontrovertibly attributed to the poor instructional delivery approach adopted by teachers in technical colleges. To support this assertion, Salau (2012) submitted that many researchers have adduced that poor achievement in public examinations is traceable to instructional delivery approaches adopted by teachers. The resultant effect is the low achievement in students' outcome both in internal and external examinations.

This implies that the mastery of sand casting concept might not be fully achieved without the use of a good instructional delivery approach that utilizes instructional materials.

According to the Federal Republic of Nigeria (FGN, 2012), a cardinal factor that has been found to contribute to the poor achievement of students in the technical colleges in Nigeria is poor teaching. Commenting on the poor quality of teaching in the technical colleges in Nigeria Oranu (2012) observed that the teaching methods which are teacher-centred are the main teaching methods used by technical teachers to teach both theory and practical aspect of the curriculum. Currently, the use of a teacher-centred method which predominantly is focused on the theoretical way of transmitting knowledge from the teacher to passive students and encourages rote learning that makes students apathetic and repulsive to learning should be discouraged (Boyle, Duffy & Dunleavy, 2012).

Instructional materials are in various categories, such as sound or audio, visual or auditory. Thus, audio instructional materials refer to those devices that make sense of hearing only, such as radio, a recorded audiotape. Visual material, on the other hand, is a teaching material that appeals to the sense of sight just like Blackboard and outline, slides, and film. An audio-visual instructional material, however, is a combination of devices that appeal to both the senses of listening and watching such as the TV film and computer. Among the instructional materials used by the teacher in the classroom, the visuals outnumbered the combination of the audio and audio-visual (Paiko, 2014).

Teaching without adequate instructional materials make students have their imagination stretched too far due to the teacher's excessive use of words to convey the meanings, techniques, or procedures, a practice that



is boring and demoralizing especially in Technical Education aspect (Nafees, Farouq, and Tahirkheli (2012). It is established that traditional teaching strategy is deeply teacher-dominated as the teacher serves as the source of knowledge while learners turn out to be passive receivers (Kuzu, 2008). Previous researches have again shown that students are performing poorly in practical projects. The poor performance was blamed on poor quality technical teachers, overcrowded classroom, and lack of adequate and suitable technology equipment, facilities, materials and hand tools (Jegede, 2012 and Nwoji, 2013).

Consequently, the conventional teaching strategy may make students lose interest, perform poorly, promote negative attitude and encourage poor retention of learned materials and this will ultimately result in loss of employment opportunities in industries or make it impossible for graduates to be self-employment. Hitherto, the rising youth unemployment rate over the years in Nigeria may not be unconnected with the widespread use of the conventional approach in teaching technical courses. Over the years, the government has introduced several reforms in educational policy to improve the quality of technical education in Nigeria. However, the government's efforts remain unfruitful as the quality continues to dwindle. The conventional method of instruction has failed, we need a change in instruction, but we can't throw away the traditional instruction method, we just have to supplement it with another technique that is acceptable to the world. Developed sand casting instructional video package may be an improved way of instructional strategy that may be effective, the study, therefore, finds it worthwhile to test the effect of the developed sand casting instructional video for teaching at NTC II technical college level in Bauchi and Gombe States.

Objectives of the Study

The main objective of the study is to test the effect of the developed sand casting instructional video package for teaching at NTC II Technical College level in Bauchi and Gombe States. Specifically, the study sought to:

- i. Determine the difference in the achievement of the students at pre-test in sand casting before the treatment between the experimental and control group?
- ii. Determine the difference in the achievement between the students taught developed sand casting using video instructional package and those taught using conventional method after the treatment?
- iii. Determine the difference in achievement between the pre-test and post-test of the students taught using developed sand casting instructional video package.

Research Questions

- i. What is the difference in the achievement of the students at pre-test in sand casting before the treatment between the experimental and control group?
- ii. What is the difference in the achievement between the students taught developed sand casting using video instructional package and those taught using conventional method after the treatment?
- iii. What is the difference in achievement between the pre-test and post-test of the students taught using developed sand casting instructional video package.

Hypotheses

The null hypotheses formulated for the study were tested at 0.05 level of significance

H₀₁: There is no significant difference between the mean achievement of students in the experimental and control group before the treatment in a sand casting operation



H₀₂: There is no significant difference between the mean achievements of students taught with a developed instructional video package and those taught with a conventional method on sand casting operation

H₀₃: There is no significant difference between pre-test and post-test mean achievement of students taught sand casting operation with the developed instructional package.

METHODOLOGY

The study adopts quasi-experimental design; specifically, the pretest-posttest non-equivalent group design. The major characteristic of this design is the use of two or more already existing or intact groups randomly assigned for the study (Fraenkel & Wallen, 2000).

A graphic representation of this design is as follows:

G ₁	P ₁	X	O ₁
G ₂	P ₂		O ₂

Where: G₁ Experimental group
 G₂ Control group
 P₁ Pre-test of the experimental group
 P₂ Pre-test of the control group
 O₁ Post-test of the experimental group
 O₂ Post-test of the control group
 X Treatment

The area of the study was Bauchi and Gombe States. Bauchi State lies between longitude 9.84°E and latitudes 10.31°N with an elevation 616m. The target population for the study comprises all the NTC II level students of mechanical engineering craft practice trade in Government Science Technical Colleges in Bauchi and Gombe States. The reason for choosing NTC II is because the students have experienced in their present study and they are not new in the college system.

The sample for the study was using a two-stage random sampling technique. This involved the selection of two each Government Science Technical Colleges randomly from the list of eight and seven technical colleges in Gombe and Bauchi states respectively that are offering mechanical engineering craft practice at the NTC II level in the states and having current NBTE accreditation. Thereafter, one arm of year II from each of the two colleges was used as a sample of the study. The choice of the Year II students was based on the fact that the NBTE (2007) syllabus for Mechanical Engineering Craft Practice prescribes that the aspect of Sand Casting operations which is the focus of this study is taught in the second year in technical colleges. Finally, of the two arms selected one represent the experimental group and the other one was assigned, control group. The experimental group had 36 students while the control group had 31 students respectively; hence the total sample size for the study was 67.

Table 1 The schools and sample for the study are as follows:

Group	School	Location	Sample Size	Sampling Tech.
Experimental Group	GDTC Bauchi	Bauchi State	19	Simple random
	GSTC Gombe	Gombe State	17	
Control Group	GSTC Burumde	Gombe State	17	Simple random
	GDTC K/Madaki	Bauchi State	14	
	Total			

(Source: NBTE, 2007; School Records, 2017)



The draft copy of the instrument that was used to develop the video package from it, contained 60 multiple choice question on knowledge. The face and content validation was carried out by three experts from Vocational and Technology Education Department, ATBU Bauchi. The experts examined the structure of the items, determined the extent to which the items helped to achieve the objectives of the topic, determined the extent to which the table of specification is correct concerning the topic covered and also they were asked to reword, reviewed, restructure or delete where necessary.

The pilot testing was carried out by showing the developed sand casting instructional to the sample students after watching the video the research assistant administered the test items to a sample of 15 students in one intact mechanical engineering craft class of NTC II students at Government Science Technical College, Yola. This subject was not involved in the main study but was equivalent samples of the group for which the instrument was developed for and tested and the test covered the lessons on the topic chosen from the developed sand casting instructional video. Trial testing was done to determine the reliability of the instrument. The scripts were scored and the scores were recorded. To estimate the reliability coefficient of the instrument, the data collected from the SCAT was subjected to a reliability test and analyzed using Cronbach alpha reliability coefficient. Thus, the reliability test yielded a coefficient of 0.89.

The instruments used for testing the effect were developed instructional video package and Sand Casting Achievement Test (SCAT). The developed instructional package was used to teach sand casting (treatment) while the SCAT items were used to test the effect of the developed package. Specifically, some questions were drawn from Foundry Shop Safety Precautions, Sand Casting Tools and Equipment, Pattern and pattern

making, Mold and core making, and Sand Casting Production of foundry technology content. SCAT was used for both Pre-test and Post-test. This consisted of 74 items of multiple-choice tests. Each objective question had 4 options A, B, C, D, with scores of 1 mark each with a total of 60 marks, This test was designed to measure students' cognitive achievement in the sand casting operations and also determined the extent to which the experimental groups differed in remembering the contents taught and it was administered 2 weeks after the Pre-test. The Pre-test is the same as the Post-test, except for the fact that the items in the Post-test were re-organized and printed.

This study involved two groups of subjects which are the treatment group and the control group. The group taught with the developed instructional video named was experimental group 1 and the other group taught with the conventional method was named control group (group 2).

On the first day of the experiment, the test instrument SCAT was administered as Pre-test to all the students in the sample schools. After this, both the treatment and control groups were taught on sand casting operations for two weeks. The treatment group was taught using the Developed Sand Casting Instructional Video CD-ROM played from a laptop and projected on a screen using a projector for a better and clearer view while the control group was taught using the conventional method. A total of 5 lessons were used and each lesson period lasted for 40 minutes for each group.

At the end of the lessons, the Post-test was administered to the students. The researcher scored and recorded the scores personally.

The Students' scores in the first administration of test items served as the Pre-test scores of the study. The topics treated consist of Foundry Shop Safety Precautions, Sand Casting Tools and Equipment, Pattern and pattern making,



Mold and core making and Sand Casting Production all were taught for two weeks after which the test items were rearranged and re-administered to the students as Post-test. The scores obtained from the second administration served as Post-test scores in the study. After 2 weeks, the items were re-arranged, printed on a paper, and re-administered.

SCAT data were analyzed using mean and standard deviation to interpret the results of the effect of developed sand casting instructional video package. This was similarly carried out using SPSS software package which computed group means of pretest and posttest, and thereafter the results were compared with each other to indicate the effectiveness of the developed instructional video for teaching sand casting to the students.

Finally, the study tested hypotheses using student t-test based on the popular level of significance of 5 per cent (0.05). This was conducted by comparing the probability value (P-value) of t-test to the level of significance.

If the group mean of the experimental group was found to be higher, then the developed instructional

video was to be adjudged as effective; if however the group mean of the experimental group was found to be lower, then the developed instructional video was to be adjudged as ineffective.

The t-test was used to test the null hypothesis at the 0.05 level of significance. If p-value was found to be less than 0.05, then there was a significant difference, otherwise, there was no significant difference.

RESULTS

Research Question one

What is the difference in the achievement of the students at pre-test in sand casting before the treatment between the experimental and control group?

Table 2 contains the pretest results. The result shows that the performance of students during the pre-test on Sand Casting Achievement Test (SCAT) of the experimental group 15.28 group mean and a standard deviation 2.42 whereas control group performance was 15.13 groups mean with a standard deviation 1.73. The experimental group performed almost similar to the control group in the pre-test.

Table 2: Mean and Standard Deviation of the pre-test scores for the experimental and control group.

Group	N	X	SD
Experimental	36	15.28	2.42
Control	31	15.13	1.73

Key

N - Number of Students

X - Mean

SD - Standard Deviation

Research Question Two

What is the difference in the achievement between the students taught developed sand casting using video instructional package and those taught using conventional method after the treatment?

Table 3 contains the post-test results. In the table, the groups mean scores of students' achievement in (SCAT) by the experimental group were 28.36, with a standard deviation 5.04 whereas the control group was 19.25, with a standard deviation 1.81. Therefore the



experimental group performed higher than the control group.

Table 3: Mean and Standard Deviation of the Post-test scores for students taught with a developed instructional video package and those taught with conventional method control.

Group	N	X	SD
Experimental	36	28.36	5.04
Control	31	19.25	1.81

Research Question Three

What is the difference in achievement between the pre-test and post-test of the students taught using developed sand casting instructional video package?

The result on the difference in achievement between the pre-test and post-test of the students taught using sand casting instructional video package

is presented in table 4. The scores of students at pre-test in the experimental group have the group mean of 15.28 with a standard deviation of 2.42 whereas Post-test scores had a group mean of 28.36 with a standard deviation of 5.04. The Post-test score of the students is higher than the Pre-test scores.

Table 4: Mean and Standard Deviation of the Pre-test and Post-test scores for students in the experimental group

Experimental Group	N	X	SD
Pre-Test	36	15.28	2.42
Post-Test	36	28.36	5.04

Hypothesis One

H₀₁: There is no significant difference between the mean achievement of students in the experimental and control group before the treatment in a sand casting operation.

Result of the test of this hypothesis is presented in table 5. The group mean achievement of students in the experimental group 15.13 with a standard deviation of 2.42, whereas, it

was 15.13 with a standard deviation of 1.73 in the control group. Therefore, the table also reveals that there was no significant difference between the mean achievement of students in the experimental and control group before the treatment, since the p-value is greater than the confidence level (P>0.05). For that reason, the null hypothesis was accepted.

Table 5: T-test result of Pre-test for the experimental and control group.

Group	N	X	SD	Df	T	P
Experimental	36	15.28	2.42	65	0.28	0.78
Control	31	15.13	1.73			

Key

- N - Number of Students
- X - Mean
- SD - Standard Deviation
- df – degree of freedom
- t- Value of t-cal.
- p-Value of p



Hypothesis Two

H₀₂: There is no significant difference between the mean achievements of students taught with a developed instructional video package and those taught with a conventional method on sand casting.

Result of the test of this hypothesis is presented in table 6. The groups mean achievement of students taught with developed instructional package (Experimental group) was 28.97

and standard deviation 4.39 whereas; those taught with the conventional method (Control group) had the mean achievement of 19.26 with a standard deviation of 1.81. Therefore, the table also reveals that the difference of means was statistically different ($p < 0.05$). For that reason, the null hypothesis was rejected; this indicated that there was a significant difference between the performance of students in the experimental and control group.

Table 6: T-test result of Post-test for the experimental and control group.

Group	N	X	SD	Df	T	P
Experimental	36	28.97	4.39	65	9.53	0.00**
Control	31	19.26	1.81			

Hypothesis Three

H₀₃: There is no significant difference between Pre-test and Post-test mean achievement of students taught sand casting operation with the developed instructional package.

Result of the test of this hypothesis is presented in table 7. The groups mean achievement of the students taught with the developed instructional package in the Pre-test was 15.33 with a standard deviation of 2.66.

Whereas the Post-test group mean was 28.97 and a standard deviation of 4.39. Therefore, the table also reveals that the difference in mean was statistically significant ($p < 0.05$). For that reason, the null hypothesis was rejected; this indicated that there was a significant difference between the performances of the experimental students in the Posttest and Pretest on the sand casting achievement test.

Table 7: T-test result of the Pre-test and Post-test for experimental group students

Exp. Grp.	N	X	SD	Df	T	P
Pre – test	36	15.33	2.66	75	14.04	0.00**
Post – test	36	28.97	4.39			

SUMMARY OF THE MAJOR FINDINGS

- i. The students' achievement was not statistically different before the treatment among the experimental and control group.
- ii. The effect of instructional video was significantly different on students achievement in the experimental group taught using instructional video;
- iii. The effect of instructional video package was significant in the post-

test when compared with the pre-test for students taught using instructional video.

DISCUSSION OF RESULTS

The findings revealed that the experimental group performed relatively the same with the control group at the pre-test before the treatment. The relatively same performance obtained from both group can be attributed to the similar characteristics they have such as

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age limit, day technical colleges and co-education. The finding is in agreement with the finding of Anita, (2014). But, the finding disagreed with the study of Dangana, (2011). The findings of this study also revealed that the developed instructional video delivery approach enabled students to better retain what was learnt over some time than the conventional instructional delivery approach. This means that the type of instructional delivery approach used in teaching students the sand casting techniques resulted in a significant increase in the retention of knowledge.

The study also revealed that the students' performance was not statistically different before the treatment among the experimental and control group.

The finding also revealed that the effect of instructional video was significant on students' achievement in the experimental group taught using instructional video. The null hypothesis was rejected. The researchers describe the emergence of this result to the inability of the conventional method to fulfil the needs of the students and the absence of real specimen to attract students in teaching practical sand casting. The difference obtained may be as a result of the nature of the instruction used in teaching the experimental group (instructional video package) which yields significant effect on students. The above exposed to the conventional teaching method.

The findings also revealed that the effect of instructional video was significant in the post-test when compared with a pre-test in the group taught using instructional video. The null hypothesis was rejected. This shows that there was a significant difference between pre-test and post-test performance of students taught using video instruction. The implication confirmed that the performance of students in post-test differ significantly when compared to the pre-test. This is in

support by Chinna & Dada (2013), who observed that there was a significant difference between the performance of students who received similar treatment but pretested before treatment. The finding revealed that the experimental group students after the treatment significantly better, than before the treatment. It disagrees with that of Ayodele (2009), who examines location as a factor that influences students' failure in basic science. The finding explained that there was no significant difference between the performance of students in the pretest and posttest in the experimental group.

CONCLUSION

The use of developed instructional video package as an instructional strategy in teaching practical sand casting is effective as the real object because the developed sand casting instructional package produce a significant effect on students' achievement in sand casting. Moreover, the developed sand casting instructional video package can be replayed or downloaded from YouTube depending on students' need.

RECOMMENDATIONS

Based on the findings of this study the following recommendations were made;

- i. Teachers should learn how to develop valid and effective instructional video package, especially practical oriented courses/subjects in technical colleges
- ii. Teachers in the technical colleges should adopt teaching practical courses using instructional video since it indicates a significant effect on the students' achievement and also saves time and energy over the use of the conventional method
- iii. Seminars and workshops should be organized so that all teachers can



be abreast with current challenges in using the multimedia package for teaching.

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