



Development and Evaluation of an Instructional Video for Teaching Sand Casting at Technical College Level in Nigeria

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ABSTRACT

Mechanical Engineering Craft Practice (MECP) is one of the trades taught at Technical Colleges leading to the award National Technical Certificate (NTC) in Nigeria. Sand casting is among the contents covered by the NTC curriculum. However, due to inadequate material resources such as teaching aids, the objectives of MECP trade has not been fully achieved. Therefore, in order to complement the instructional resources, a video for teaching sand casting was developed and evaluated. Therefore this paper reports the findings of the study as a result of developing and evaluating sand casting instructional video package. Four research questions guided the study. Both the instructional video and test instruments were validated by a team of experts. Primary data collected using video and still camera and its accessories, and the Province Princes Edwards Island Department of Education DVD/Video Evaluation form. The data collected were analysed using Multi stage approach, Frequency count and Mean. The results from the study revealed that the developed sand casting instructional video was appropriate and suitable for use in teaching and learning in technical colleges in Nigeria. Hence it was recommended that government should assist TVET teachers/instructors with the necessary materials including funds to develop and evaluate instructional video for teaching and learning technical courses in Nigeria.

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INTRODUCTION

Education plays a crucial role in improving the economy and overall development of a nation. As new technologies continue to emerge, knowledge of how countries can tap on the best of these developments and improve their education systems matters. Didactic tools play very important roles as medium of communication for learning. Moreover, it

makes learning more effective and real for the students and at the same time helps to clarify the concepts for better understanding (Yalams, Martin, & Lewis, 2012).

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 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 training of skilled technical personnel for technological and economic development of the country (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. Mechanical engineering craft practice is one of the core trades or programmes offered in almost all the technical colleges in the country. The aim of this programme is to train and graduate a sub-professional mechanical engineer biased in production engineering (manufacturing). The NBTE curriculum calls them craftsmen. Yalams (2001) in describing the mechanical engineering craftsmen said they are sub-professional production and maintenance engineers. They work in the manufacturing industries, which ranges from electronics to pharmaceuticals and from plastics to food processing.

Foundry technology can be seen as a method of producing metal components by melting the metal, pouring it into prepared

cavity called mould made using a pattern which is a copy of the item to be produced and allowing it to solidify to take the shape of the pattern. The process is called casting and also it is the name given to the part produced.

Development of an instructional model , material, software package or instrument for teaching plays a significant role in supplementing conventional method of instruction in our educational system particularly in TVET schools as the Information Communication Technology (ICT) is one of technology that is revolutionizing today's classroom activities. Tremendous growth is being witnessed in the use of information technology for teaching and learning, and in no doubt, the trend will continue and will change the ways teachers view teaching. It is important for every technology teacher to acknowledge and appreciate the use of developed instructional video in teaching. Therefore instructional model are guidelines or sets of strategies on which the approaches to teaching by teachers or instructors are based Mayer (2012). Also, Braxton et al. (2009) pointed out that instructional model are model that prescribe how combinations of instructional strategy components should be integrated to produce a course of instruction. The use of valid and reliable developed instructional video package for teaching sand casting at the technical college level in mechanical engineering craft practice will ensure that students are taught the proper or effective way of carrying out the tasks and involved in sand casting.

Objectives of the Study

1. Develop an instructional video package that will aid the teaching of sand casting at technical college level
2. Evaluate the developed instructional video package for effective teaching and learning

sand casting at technical college level

Research Questions

1. What are the steps involved in developing instructional video package for effective teaching and learning sand casting at technical college level
2. Does the developed instructional video package for effective teaching and learning sand casting at technical college level is appropriate in terms of its content?
3. Does the developed instructional video package for effective teaching and learning sand casting at technical college level is appropriate in terms of its instructional design?
4. Does the developed instructional video package for effective teaching and learning sand casting at technical college level is appropriate in terms of its technical design?

CONCEPTUAL FRAME WORK

Instructional Package

Development of an instructional model, material, software package or instrument for teaching plays a significant role in supplementing conventional method of instruction in our educational system particularly in TVET schools as the Information Communication Technology (ICT) is one of technology that is revolutionizing today’s classroom activities. Tremendous growth is being witnessed in the use of information technology for

effective teaching and learning, and in no doubt, the trend will continue and will change the ways teachers view teaching. It is important for every technology teacher to acknowledge and appreciate the use of developed instructional package in teaching.

In the light of the conceptual literatures reviewed, this study therefore came up with its own unique conceptual framework of instructional model or package and named it IDLEA, which stands for Identify the goals, Design, Develop, Implement, Evaluate, and Analyze Instructional Video package.

- a) **Identify the goals:** this is a phase whereby a design activity always occurs in response to a human need.
- b) **Design:** thus deals with the learning objectives, assessment instruments which may involve writing a design document or concepts to aid final development.
- c) **Develop:** this has to do with instructional developer which will assemble the content described in the design.
- d) **Implement:** this where all the activities mentioned was implemented properly.
- e) **Evaluate:** this has to do with expected result.
- f) **Analyze:** this is the final phase that assesses the final result to see whether the developed instructional video package is effective or ineffective.

The model was shown below:

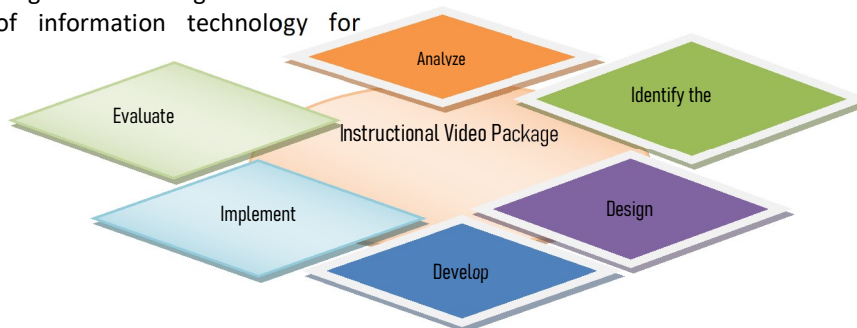


Figure 1: IDLEA Instructional video conceptual frameworks

Development Procedure of Sand Casting Instructional Video Package

The procedure adopted in the development of Sand Casting Instructional

video is thus multi-stage approach as shown in fig. 2

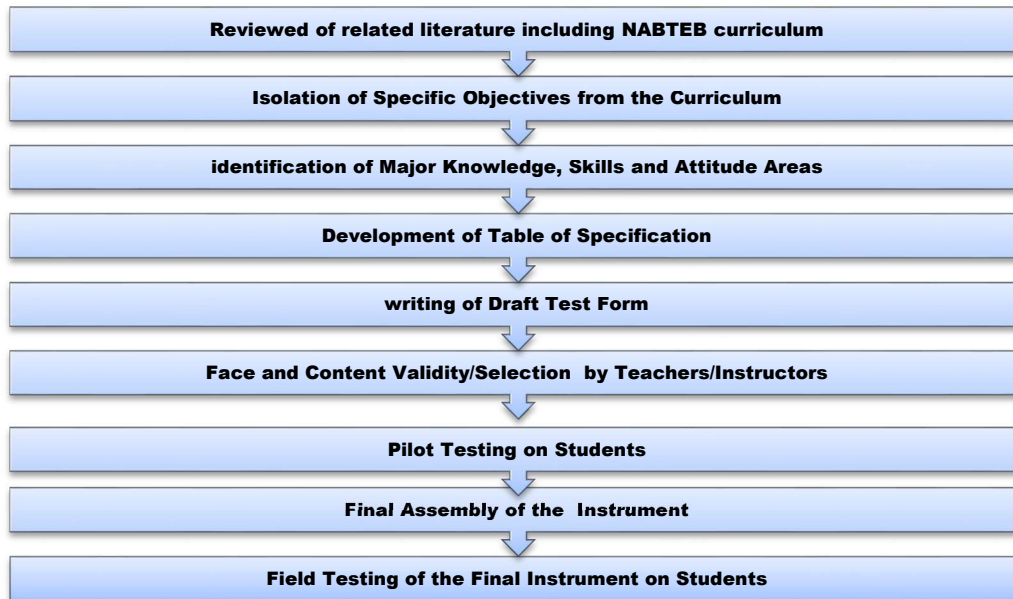


Figure 2: Flow chart for the Development of the Instrument

Criteria for Evaluating Sand Casting Instructional Video Package

According to Province Edwards Island Department of Education (2008), the following specific criteria has been grouped under Four (4) main headings which include: content; instructional design; technical design; and social considerations. These criteria are intended to motivate the evaluators to think critically on the resource and evaluate some of its detail aspect. The evaluation form will reflect these. For instance, by examining the content of an instructional video, evaluators can judge if it's in line with the stated objectives of the instructional video and also if the content supports the prescribed learning outcomes of the curriculum. Therefore, these criteria were adopted for this study.

The goals and objectives of technical education in Nigeria remain to

equip the graduates of technical colleges with practical skills so as to be employable in the industries or self-employed, producing and servicing industrial and domestic goods as specified in the National Policy on Education (FGN, 2012). By so doing, there should be improvements in the graduates' quality, rate of production, reduced human labour and errors in delivery time and rate of turnover. To accomplish these goals and objectives, it is imperative to introduce pragmatic and demonstrative teaching approaches using some sorts of technologies that are simple and effective in impacting knowledge to students. Ayonmike, Okwelle and Okeke (2014) posit that applying modern instructional process, especially, video-based tools, boost and motivate students' creativity thereby creating distinctive context for their learning experience. Conversely, the conventional

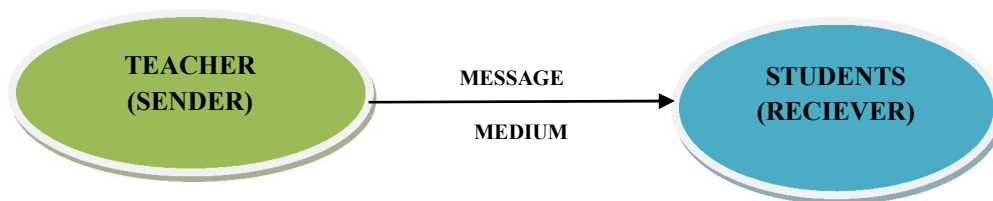
instruction process of developing practical skills among technical college students has been found to be ineffective and as such, has failed to yield the desired result.

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 turnout 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 (Jegade, 2012 and Nwoji, 2013).

Consequently, the conventional teaching strategy may make students to 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 conventional approach in teaching technical courses. Over the years, government has introduced several reforms in educational policy with a view 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 really 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, hence the development of instructional video package for teaching and learning sand casting at NTC II technical college level.

TRADITIONAL METHOD – A ONE WAY FLOW



MULTIMEDIA LEARNING – AN INTERACTIVE LEARNING PROCESS

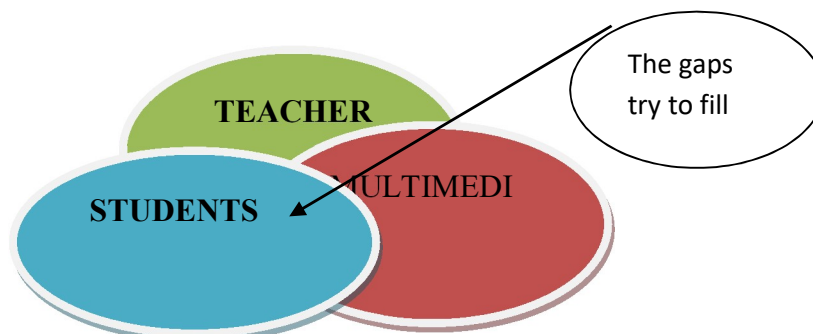




Figure 3: Traditional and Multimedia Learning Process

METHODOLOGY

Instrumentation research design was used in this study. The instrumentation research design is appropriate for use when introducing new procedures, technologies or instruments for educational practices (Garba, 1993; Gay, 1996). Three types of data were collected for this study; the draft copy of the instrument that was used to develop the video package contained 60 multiple choice questions on knowledge and 15 items on attitude, with 20 items for each of the 3 practical task areas which produced 60 process skill test items. Based on the suggestion of Benson and Clark (1982) and Unesco (2002) and Cluzeau (2002) the procedure adopted in the development of the instrument is multi-stage approach.

The researcher adopted Province Edward Island Department of Education (2008) DVD/Video Evaluation form or questionnaire for evaluation. The questionnaire contained 8 items on content, 15 items on instructional design and 10 items on technical design

There were two forms of data collections in this study; the first was the preliminary data collected from the 3 experts for content validity of the draft copies of related review including NABTEB and other related literature and the second data was from 3 technical college teachers and 2 workshop instructors who determined the appropriateness of the test items for inclusion in the instruments before developing the sand casting instructional video package

Data collected was analyzed using frequency count, mean and standard deviation for individual respondents. For selecting the multi-choice task and skills considered appropriate for inclusion in the knowledge, affective domain and psychomotor/process skill test, a mean of

2.50 and above was utilized. Any item with 2.50 and above was appropriate and any item with a mean of less than 2.50 was not appropriate for the inclusion.

RESULTS:

Research Question One: What are the steps involved in developing instructional video package for effective teaching and learning sand casting at technical college level?

To answer research question one, the study adopted multistage approach for the procedure of developing sand casting instructional video package based on the suggestions of Benson and Clark (1982) and Unesco (2002) and Cluzeau (2008) (See fig. 2). The study gathered and critically analyzed the literatures including NABTEB curriculum in foundry technology aspect of mechanical engineering crafts practice and other related literatures. A draft video production scripts was generated, a draft test instrument from which would represent the video package since the video package is an instrument for teaching and learning sand casting was also generated and submitted to three university experts after carefully and thorough review, then they made a comments in some areas where the specific objectives from the curriculum should be focused. Then, the researcher effected the corrections and sent it to the technical college teachers and workshop instructors to go through it to identify which major areas in knowledge, skills, and attitude are supposed to be included in the sand casting instructional video production and they indicated the areas and made satisfactory comments in some areas. A table of specifications was constructed based on the outcome of the experts where the table shows the representation of items based on the knowledge, affective and psychomotor objectives and weight of each topic. Then the writing of the draft test that was used to produce the actual sand casting instructional



package would come based on the table of specification, the face and content validity of the experts was carried out. Pilot testing was conducted where the students would watch the video and give them the items to answer it. The research assistants collected the scripts and marked it, after effecting the corrections. The researcher, his supervisor's videographer developed the final sand casting instructional video and sent it to panel of three experts. Two from Educational Technology Department and One from Metal Work Technology Education of Federal College of Education Technical

Gombe to criticize it and assess the instructional package based on Province Edward Department of Education (2008) criteria for validating DVD/Video which focused on content, instructional design and technical design. The experts criticized some areas and made satisfactory comments in some areas; from there the final sand casting instructional video package was developed.

Research Question Two: Does the developed instructional video package for teaching sand casting at technical college level is appropriate in terms of its content?

Table 1: Mean responses of experts on sand casting video instructional package on content

S/No.	Item Statement	Freq. Count				Mean	Remark
		SA	A	D	NA		
1	Content is current	1	2	0	0	3.33	Agreed
2	Accuracy of the content	0	3	0	0	3.00	Agreed
3	Scope and depth of topics are appropriate to students need	1	2	0	0	3.33	Agree
4	Content support NBTE curriculum	2	1	0	0	3.67	Agreed
5	Scope (range) and depth of topics are appropriate to students need	1	1	1	0	3.00	Agreed
6	Materials has significant to Nigerian content	1	2	0	0	3.33	Agreed
7	Level of difficulty is appropriate for intended audience	1	2	0	0	3.33	Agreed
8	Contents integrate "real world" experience	1	2	0	0	3.33	Agreed

Research Question Three: Does the developed instructional video package for teaching sand casting at technical college

level appropriate in terms of its instructional design?

Table 2: Mean responses of experts on sand casting video package on instructional design

S/No.	Item Statement	Freq. Count				Mean	Remark
		SA	A	D	NA		
9	Instructional goals and learners objectives are clearly stated	2	1	0	0	3.67	Agreed
10	Resources is suitable for a wide range of teaching/learning styles	2	1	0	0	3.67	Agreed
11	Resources promote students engagement	1	2	0	0	3.33	Agreed
12	Methodology promotes student active learning	1	2	0	0	3.33	Agreed
13	Resources encourages group interaction	0	3	0	0	3.00	Agreed
14	Resources encourage student creativity	1	1	0	0	2.33	Disagreed
15	Concepts are clearly introduced	0	3	0	0	3.00	Agreed
16	Concepts are clearly developed	2	1	0	0	3.67	Agreed
17	Concepts are clearly summarized	0	3	0	0	3.00	Agreed
18	Material are well organized	2	1	0	0	3.67	Agreed
19	Non-technical vocabulary is appropriate	0	3	0	0	3.00	Agreed



S/No.	Item Statement	Freq. Count				Mean	Remark
		SA	A	D	NA		
20	Technical terms are consistently explained/introduced	2	1	0	0	3.67	Agreed
21	Pedagogy is innovative	1	1	1	0	3.00	Agreed
22	Adequate/appropriate pre-teaching and follow-up activities are provided	1	0	1	1	2.33	Disagreed
23	Adequate/appropriate assessment/evaluation are provided	1	0	1	1	2.33	Disagreed

Research Question Four: Does the developed instructional video package for teaching sand casting at technical college level is appropriate in terms of its technical design?

Table 3: Frequency Count and Mean responses of experts on sand casting video package on technical design

S/No.	Item Statement	Freq. Count				Mean	Remark
		SA	A	D	NA		
24	Appropriate support materials are provided	1	2	0	0	3.33	Agreed
25	Visual design is interesting/effective	1	2	0	0	3.33	Agreed
26	Illustration/visuals are effective/appropriate	2	1	0	0	3.67	Agreed
27	Character size/typeface is appropriate	3	0	0	0	4.00	Agreed
28	Layout is logical and consistent	2	1	0	0	3.67	Agreed
29	Packaging/design is suitable for the classroom/library	1	2	0	0	3.33	Agreed
30	User can easily employ the resource	1	2	0	0	2.67	Agreed
31	Resources make effective use of various medium	1	1	0	0	2.33	Disagreed
32	DVD/video extends or builds upon students' knowledge	1	2	0	0	2.67	Agreed
33	Sequencing (chunking) allows for appropriate contextual pauses in viewing	1	1	0	1	2.66	Agreed

DISCUSSION OF FINDINGS

The result of data analysis in table 1-60 on knowledge, 61- 74 on affective and 1-60 on psychomotor skills appropriate for inclusion in the rating scale in sand casting instructional video package in foundry shop safety precautions, sand casting tools and equipment, pattern and pattern, mold and core making and sand casting techniques reveals that the respondents rated as appropriate 15 (items) sub task of foundry shop safety precautions, 9 (items) sub task of sand casting tools and equipment, 11 (items) sub task of pattern and pattern, 13 (items) sub task of mold and core making and 12 (items) sub task of sand casting techniques

while 60 (items) on psychomotor skill consisting of 29 pattern making, 21 mold making and 10 sand casting making; and 15 (items) on attitude reveals that the respondents rated as appropriate for inclusion in sand casting video package instrument for teaching at the technical college level.

Furthermore, the content validation of knowledge, skill and attitude rating scales are the instruments with content valid for teaching and assessment of both the knowledge, affective and practical skills of students in mechanical engineering craft practice in technical colleges. These findings are in agreement with those of



Mehrens and Lehmann (1984) ; McCallum and Smith (2000) and Badmus (2005) that the essential steps for developing a valid achievement and performance assessment instrument involves determining appropriate items for inclusion in the test. i.e the achievement, performance and attitude rating scale through task analysis procedure and validation by subject matter experts. Okoro (2002) suggests that an item is described as content valid when half of the experts deem it essential for inclusion in the test, in the same vein, the findings was also in agreement with the views expressed by Wierma and Jurs (1988) and Woodworth (1985) that a consensus in opinion among experts and examiners is an indication that a test is technically valid in terms of content area.

Also, 3 experts, 2 from the Educational Technology Department and 1 from Metal Work Department examined the developed sand casting instructional video package based on Province Edward Department of Education (2008) DVD/Video validation criteria in terms of three important areas content, instructional design and technical design where 8 items on content, 15 items on instructional design and 10 items on technical design. The results show that content is current, accurate, support NABTEB foundry curriculum scope and depth of the topics are appropriate to student's needs; materials have significant Nigerian content, concepts are clearly introduced, non-technical vocabulary is appropriate, technical terms are consistently explained/introduced volume and quality of sound are appropriate, narration, music, and sound are effective and appropriate to instructional purposes, visual effects and transitions are use appropriately. This signified the adequacy of sampling areas in the curriculum in which sand casting instructional video designed to teach and assess. These results were consistent with the views of Woodworth (1998) that a test if

the achievement, attitude and performance test it assesses corresponds to the objectives it is supposed to assess.

CONCLUSION

Based on the findings of this study, it was concluded that the developed sand casting instructional video package meets up with the evaluation criteria and also enhance students' interest, performance and motivate them to study sand casting in government technical colleges when integrated. This implies that the developed instructional video is appropriate for effective teaching and learning sand casting in technical colleges in Nigeria.

RECOMMENDATIONS

Based on the findings the following recommendations were made:

1. Government should assist teachers and instructors with the necessary materials including funds to develop instructional video for teaching and learning courses in their respective technical colleges in Nigeria.
2. Government should provide enabling environment for in-service training programmes for TVET teachers and instructor on how to develop instructional packages
3. Government should set up a regulate body that will be responsible for development and evaluation of instructional video and other related instructional package
4. Government also should ask the TVET curriculum planners to integrate instructional video in implementing process
5. Finally, Government, NGOs, and philanthropist should assist technical colleges with the visual lecture room.

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