Development and Validation of Instructional Module for Teaching Bamboo Composite Door Production to NDDC Skills Trainees in Akwa Ibom State

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Abstract
The study developed and validated instructional module for teaching bamboo composite door production to Niger Delta Development Commission (NDDC) trainees in Akwa Ibom State, Nigeria. Six research questions and One hypothesis guided the study. Research and Development design was adopted for the study. The population of the study was 175 respondents, comprising of 36 bamboo composite experts, 67 NDDC furniture making and woodwork skills trainees in Ikot Ekpene and 72 in Uyo skills acquisition centres. Simple random sampling technique was used to select 26 bamboo composite experts and 82 NDDC furniture making and woodwork skills trainees comprising of 67 in Ikot Ekpene and 72 Uyo skills acquisition centres. A 180-item questionnaire was used for data collection. Cronbach alpha statistics was used to determine the reliability coefficient of the instrument which yielded overall reliability index of .78 indicating that the instrument was reliable. Mean and standard deviation was used to answer the research questions while independent t-test was used to test the hypothesis at .05 level of significance. Findings of the study identified 91 specific tasks, 13 specific objectives, 37 instructional materials, 29 instructional methods and 10 evaluation techniques for teaching bamboo composite door production. It was recommended among others that NDDC should adopt the training module and engage experienced professionals from the bamboo industry as instructors to enhance the quality of training and provide real-world perspectives to the trainees.

***Keywords**: Instructional Module, Bamboo Composite, Door Production, NDDC Trainees, Akwa Ibom State.*

Introduction

The history of construction spans the entirety of human existence, evolving from early cave dwellings to tower skyscrapers, and more recently, to intelligent structures capable of adaptive responses to the environments. According to Zhong et al. (2017), the construction industry is pivotal in addressing the requirements of human settlements. Over the centuries, building materials and techniques have transformed significantly to meet evolving human needs and advancements in development. As the availability and quality of large timber diminishes, construction systems relying on extensive wood members are becoming less available and more expensive (Xiao et al., 2013), resulting in a growing global interest in bamboo in both developed and developing countries for its versatile applications in construction (Ameh & Shittu, 2021). Bamboo according to Quoc-Bao et al. (2017), Ameh and Shittu (2021), is a wood-like plant that is a part of the grass family, consisting a cylindrical hollow shoot or culm that are coated with a waxy surface to retain moisture. Similarly, Yuxiang et al. (2019), posited that bamboo is characterized by its internal hollow structure with longitudinal fibers embedded in a lignin matrix. Bamboo nodes, along the culm give rise to branches intermittently and fibers are slender, tapering at both ends, and vary in density from the outer to the inner culm wall (Ameh, Soyingbe & Oyediran, 2019).

Bamboo possesses environmental benefits such as renewability, biodegradability, and carbon sequestration (Xie et al., 2013; Ameh & Shittu, 2021). It also boasts excellent mechanical properties and a growth rate comparable to wood (Yu et al., 2015). Rittironk and Elnieire (2018), pointed out that bamboo poles exhibit a strength-to-density ratio that is 2.5 times higher than wood and three times higher than steel, indicating superior material efficiency. Bamboo grows on nearly every continent at a significantly faster rate compared to hardwood and softwood species commonly used in construction (Liu, 2016). Its rapid growth allows for rapid harvesting, typically every two to three years, which reduces the land and resources required for sustainable timber production and management (Roslan et al., 2015). Developed nations according to Mohanty, Sujatha and Uday (2015), Asmah, Daitey and Steiner (2016), Rittironk and Elnieiri (2018), utilize bamboo for high-value applications such composite board production for flooring and furniture while developing nations like Nigeria utilize bamboo as structural elements, scaffolding, weaving strips, and roofing supports.

In Nigeria, approximately five species of bamboo have been identified including Bambusa Vulgaris, Bambusa Arundinacea, Bambusa Tulda, Dendrocalamus Giganteus, and Oxynanthera Abyssinica (Oyewole et al., 2013). These species share similar morphological characteristics (Onyekwere & Igboanugo, 2018). According to Okwori and Chado (2013), bamboo is especially abundant in the rainforest belt of Nigeria, thriving along riverbanks and other marshy areas. Ogunwusi and Onwualu (2011), Ameh and Shittu (2021), note that bamboo is widely distributed in the southern and middle belt regions of Nigeria. In States such as Ogun, Oyo, Osun, Ondo, Edo, Delta, Rivers, Akwa-Ibom, Cross River, Abia, Ebonyi, Enugu, Anambra, and Imo, bamboo constitutes at least 10% of the natural vegetation (Onyekwere & Igboanugo, 2018). In Nigeria, bamboo is primarily used for scaffolding in the building industry, as ornaments, as source of energy, and for yam staking in agriculture (Onyekwere & Igboanugo, 2018, Ameh & Shittu, 2021).

Several studies revealed that youths in developing country like Nigeria needs the necessary skills and knowledge to either create new jobs or enhance existing ones with added value (Ekong & Ekong, 2016; Telbowei & Osusu, 2017; Awogbele & Iwamadi, 2017; Uranta & Nlerum, 2017; Oboqua & Charles, 2019; Osarumwense & Aideyan, 2020). Emmanuel (2017), Ubiebi and Ogbonna (2020), explained that the Federal Government of Nigeria established the Niger Delta Development Commission (NDDC) in 2000 to focus on developing the Niger Delta region through skill acquisition programs that also serve as entrepreneurship initiatives. Uranta and Ulerum (2017) noted that NDDC commenced its skills training programs in 2006 with the goals of alleviating poverty in the region and training youths in various skills such as welding and fabrication, furniture making, woodwork, catering, food processing, computer technology, programming, solar power maintenance, fashion design, and tailoring. They reported that NDDC has successfully trained over 50,000 participants in these skill acquisition programs since its inception. Unfortunately, Okumagba and Okinono (2016), Dudafa (2017), Uranta and Ulerum (2017), Oscar and Ngozi (2021), stated that the NDDC skills training programme is facing challenges such as inadequate instructional resources for training in furniture making, woodwork, welding and fabrication, solar power maintenance, and food processing.

Alshahad (2013), argues that effectively designed program capable of providing structured instructional events is essential to bridge the skills gap and combat unemployment among trainees. Orikpe (2013), Umeh (2013) and Nardo (2017) emphasize that instructional modules enable trainees to progress through training materials at their own pace. Ezeabii and Ohagwu (2019), define instructional modules as organized sets of learning opportunities centered around well-defined topics, incorporating essential elements of instruction that systematically builds skills and knowledge through discrete units. Orikpe (2013), Umeh (2013), Ezeabii and Ohagwu (2019) further elaborate that instructional modules empower students to make informed decisions and take responsibility, provide continuous feedback to foster ongoing development, recognize individual differences in learners' intellectual levels, promote interaction between students and teachers, cultivate skills such as creativity, innovation, and research, offer flexibility for learning anytime and anywhere, support the concept of lifelong learning, enhance student satisfaction, and mitigate feelings of failure or apprehension.

The process of developing an instructional module, according to Okwelle and Okeke (2012), Alshahad (2013), Orikpe (2013) and Umeh (2013), consists of ten sequential steps. These steps include defining the target population for training, identifying tasks to be performed by the target population, using input from individuals currently in similar roles, listing the knowledge, skills, and other requirements necessary to accomplish these tasks, selecting the specific knowledge and skills to be taught, along with defining training objectives, organizing the chosen knowledge and skills into a coherent and teachable unit, known as the instructional module, including appropriate training methods, drafting expanded outlines of the instructional module, which encompass instructional objectives, main content, textual descriptions of training methods, examples, and exercises, engaging experts to provide realistic examples and information for inclusion in the exercises, compiling the instructional module, facilitator’s guidelines, and materials for use in exercises, field-testing the instructional module to gather feedback and assess its effectiveness, revising and finalizing the training materials based on the field test report or received feedback. This structured approach ensures that the instructional module is well-designed, effectively meets training objectives, and aligns with the needs of the target audience.

Additionally, Alshahad (2013) opined that the initial four steps constitute research task analysis, followed by six development tasks necessary for designing and creating instructional modules. The use of instructional modules enhances the trainer's ability to address diverse trainee needs without compromising instructional quality (Nardo (2017; Ezeabii & Ohagwu, 2019). This capability allows trainers to assess each trainee individually, ensuring that incorrect learning is avoided through proper assessment of independent work. These activities provide valuable feedback on how well trainees have absorbed the content covered in these instructional modules. Given the depletion of wood resources in Nigeria (Ameh & Shittu, 2021), there is a pressing need to explore alternative materials like bamboo, which offers significant developmental potential (Aliyu, 2014). Therefore, this study aims to develop and validate instructional module for teaching bamboo composite door production to Niger Delta Development Commission (NDDC) trainees in Akwa Ibom State.

Statement of the Problem

With the escalating demand for building materials in today's modern industrialized world, there has been an increased need for timber products in construction industries. Studies conducted by Saulawa (2019), Moses and Egboh (2021) concluded that despite the avalanche of programmes being initiated by government and even the private sector in Nigeria in terms of skill acquisition and entrepreneurship among youths, lack of adequate employability skills rate continues to soar among the youths' trainees in furniture making and woodwork. Saulawa (2019), Ameh and Shittu (2021), posited that the ability to execute specific tasks in woodwork and laminated bamboo board poses significant challenges for trainees in furniture making and woodwork in the Nigeria. Consequently, the NDDC trainees are unable to meet the expectations of employers in Nigeria, resulting in unemployment and a search for alternative careers unrelated to their chosen field of woodwork and building technology. Addressing this problem necessitates the development of a structured and comprehensive instructional module tailored to the specific needs of the NDDC trainees in Akwa Ibom State. Such a module would provide systematic training in bamboo composite door production, equipping trainees with the necessary skills and knowledge to participate effectively in construction industry. Thus, this study aims to develop and validate instructional module for teaching bamboo composite door production to Niger Delta Development Commission (NDDC) trainees in Akwa Ibom State.

Purpose of the Study

The study sought to determine the:

1. Specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming, sanding and dyeing of bamboo composite door for teaching of NDDC skill trainees
2. Specific objectives of the instructional module for teaching bamboo composite door production to NDDC skills trainees.
3. Instructional materials appropriate for teaching bamboo composite doors production to NDDC skill trainees.
4. Instructional methods appropriate for teaching bamboo composite door production.
5. Evaluation techniques/activities appropriate for teaching bamboo composite door production to NDDC skill trainees.
6. Skill acquisition of NDDC skill trainees taught with the bamboo composite door production instructional module and taught without the instructional module.

Research Questions

The following research questions were adopted to guide the study:

1. What are the specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming, sanding and dyeing of bamboo composite door for teaching of NDDC skill trainees?
2. What are the specific objectives of the instructional module appropriate for teaching bamboo composite door production to NDDC skills trainees?

3. What are the instructional materials appropriate for teaching bamboo composite doors production to NDDC skill trainees?
4. What are the instructional methods appropriate for teaching bamboo composite door production to NDDC skill trainees?
5. What are the evaluation techniques appropriate for teaching bamboo composite door production to NDDC skill trainees?
6. To what extent are NDDC skill trainees taught with the instructional module and NDDC skill trainees taught without the instructional module acquire skills in specific tasks in bamboo composite door production to NDDC skill trainees?

Null Hypothesis
One null hypothesis was formulated to guide the study:

$H0_1$: There is no significant difference in the mean responses of NDDC trainees taught with the instructional module and NDDC trainees who are not taught with instructional module.

Methodology
This section describes the design of the study, area of the study, population of the study, validation of the instrument, reliability of the instrument, method of data collection, method of data analysis and decision used in the study. The study adopted Research and Development (R&D) design. Gall, *et al.* (2003), stated that R & D is the use of research methods to design new products and procedures followed by the use of research methods to field test, evaluate and refine the products and procedures until they meet specified criteria of effectiveness, quality or similar standards. Nworgu (1999), noted that R & D is aimed at developing and testing more efficacious educational products that could be textbook, equipment and curricula. These products according to Nworgu are trial tested in the field to measure their effectiveness. Nworgu further stressed that R & D provides valuable means of achieving educational improvement and that it equally ensures that educational products in use are of proven quality. Hence, the study adopted R&D as it seeks to develop new instructional module for teaching bamboo composite door.

This study was carried out in Bamboo Dry Tissue Paper Factory located at Dakadda Industrial Estate in Afaha Itam, Itu Local Government Area in Akwa Ibom. Akwa Ibom State was created on the 23rd September 1987, out of the old Cross River State by then Military Government under General Ibrahim Babangida State (AKSMI, 2021). It is one of the 36 States in Nigeria with its capital in Uyo with a total land mass of 8.412 square kilometers with a population of 3,902,051 and population consisting of 1,983,202 Male and 1,918,849 females (Ibok & Daniel, 2013; AKSMI, 2014)). It is located in the coastal southern part of the country. It lies between latitudes $4^0$32N and $5^0$33N and longitudes $7^0$25E and $8^0$25E. Akwa Ibom is bordered on the east by Cross River State, and on the south by the Atlantic Ocean and the southernmost tip of cross river state. The state is made up of three ethnic groups: Ibibio, Annang and Oron. It has 31 Local Government Councils and 31 Senatorial Districts (AKSMI, 2014). Apart from civil service, its foremost occupation includes farming, fishing, craft and skills work. This study is carried out in Akwa Ibom State to enable the utilization of the bamboo plant available in large quantity and to improve the economic status of the state.

The population of the study was 175 respondents, comprising of 36 bamboo making experts, 67 NDDC furniture making and woodwork skills trainees in Ikot Ekpene and 72 in Uyo skills acquisition centres. According to Bornstein, Jager and Putnick (2013), the entirety of all elements under observation, which constitutes all things in any field of investigation, is the study population. Simple random sampling technique was used to sample 26 bamboo making experts and 82 NDDC furniture making and woodwork skills trainees comprising of 67 in Ikot Ekpene and 72 Uyo skills acquisition centres. A sample refers to a section or subset of the study population chosen for investigation through a sampling process (Taherdoost, 2016). In the same vein, Nardi (2018), stated that sampling technique is essential for estimating the required data volume and comprehending the data gathering process within a population to fulfill the study objectives. Yamane formula was used for calculating the sample size. According to Islam (2018), the Yamane formula provides a simplified formula to calculate sample sizes.

The researchers developed a 179-item instrument titled "Bamboo Composite Door Task Sheet and Instructional Support Questionnaire (BCDTSISQ) and Bamboo Composite Door Achievement Test (BCDAT) used for data collection. The instrument was divided into sections A, B, C, D, E and F. Section A comprised of items eliciting information on staff demographic data, Section B was devoted to specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming and sanding and dyeing for inclusion in the instructional module. Section C was on instructional objectives of the instructional module. Section D was on instructional methods appropriate for teaching bamboo composite door and section E was on the instructional materials appropriate for teaching bamboo composite door. Section F was on evaluation techniques appropriate for teaching bamboo composite door. The instrument was designed with a 5-point rating scale of Very Highly Appropriate (VHA = 4.50-5.00), Highly Appropriate (HA = 3.50-4.49), Moderately Appropriate (MA = 2.50-3.49), Lowly Appropriate (LA = 1.50-2.49) and Not Appropriate (NA = 1.00-1.49) to answer the research question 1 to 5 while Strongly Agreed (SA= 4.50-5.00), Moderately Agreed (MA = 3.50-4.49), Lowly Agreed (LA=2.50 - 3.49), Not Agreed (NA=1.50 - 2.49) and Undecided (U=1.00-1.49) was used answer research question 6.

Face validity of the developed instructional module was carried out by five bamboo experts. To ensure the reliability of the instrument, 5 copies of the instrument were administered to bamboo experts from the population who were not part of the sample for the study. The validators examined the contents of the instrument with respect to their constructs, how well they depicted the tasks and sequencing. They also ensured that clarity, appropriateness of language, ability to elicit accurate information and suitability in line with the objectives of the study and research questions. The expert comments, corrections and modification were incorporated into the final copy of the instrument. Their suggestions led to adjustment in the instrument, especially in terms of ambiguous statements, excessive wordiness, difficult vocabulary and numbers of items. Cronbach alpha statistics was used to determine the reliability coefficient of the instrument which yielded overall reliability index of .78 comprising of .71, .76, .83, .79 and .80 for Section B, C, D, E and F respectively indicating that the instrument was reliable. Cronbach's alpha test according to Taber (2017) is the most commonly used method to assess the accuracy of scales with value between 0 and 1. Cronbach's alpha coefficient should be between 0.7 and above to demonstrate the scale's reliability (Cronbach, 1951).

The researchers administered the instrument with the help of three research assistants who were briefed before administration of the instrument to the respondents. The researchers and the assistants visited the NDDC skills acquisition centres in Uyo and Ikot Ekpene Senatorial Districts and Bamboo Dry Tissue Paper Factory located at Ibom Industrial Layout, Itu all in Akwa Ibom State to administer the instrument for a period of three weeks. A letter of information and consent were part of the information provided to the respondents. Since the questionnaire was distributed face to face, the participants read the letter of information and consent form and confirmed their voluntary participation. The one hundred and seventy-five (175) copies of the questionnaire administered were all retrieved, indicating a 100% instrument retrieval. Mean scores and Standard Deviation were used in answering the research questions while t-test statistics was used to test the three null hypotheses at .05 level of significance. The data collected were analyzed using Statistical Module for the Social Sciences 26 (SPSS). Mean and standard deviation were used in answering the research questions while independent t-test was used to test the null hypotheses at 0.5 level of significance.

Presentation and Analysis of Results

The data analysis and interpretation of results are presented according to the research questions and hypothesis formulated for the study. Data of each research question are presented on a separate table to aid comprehension of the analysis and interpretation of results.

Research Question 1: What are the specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming, sanding and dyeing of bamboo composite door for teaching of NDDC skill trainees?

Table 1: *Mean response of bamboo making experts on the specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming, sanding and dyeing of bamboo composite door for teaching NDDC skill trainees.*

SN	**Section B:** Specific Tasks in Bamboo Composite Door Production	$\bar{x}$	Remark
a.	**Specific tasks in truncation**		
1.	Identify and select mature bamboo pole that are straight	4.11	HA
2.	Bamboo is cut down	4.16	HA
3.	Remove the rough portion from the cut ends of the bamboo pole using kmife or sandpaper to ensure smooth surfaces	4.32	HA
4.	Bamboo is cut off ends	4.43	HA
5.	Measure and mark out the desired length of bamboo pole using measuring tools	4.37	HA
6.	Use sharp tools like machete, saw or specialized bamboo cutting tools to cut the bamboo pole to the marked length	4.46	HA
7.	Use workbench during cutting large diameter	4.48	HA
8.	Position over the edge of workbench	4.53	VHA
9.	Grasp with clamp during cutting	4.46	HA
10.	Wrap with towel to prevent the clamp from affecting the surface	4.31	HA
	Sub-Mean Response	**4.36**	**HA**
b.	**Specific tasks in drying**	$\bar{x}$	**Remark**
11.	Remove infected cum from the drying area	4.44	HA
12.	Dry bamboo in a well-ventilated area	4.47	HA
13.	Dry vertically	4.46	HA
14.	Dry horizontally for large quantity	4.39	HA
15.	Dry on raised platform to avoid soil contact and fungal attack	4.43	HA
16.	Use separator between each row for better ventilation	4.53	VHA
17.	Should not pile up too high	4.54	VHA

18.	Regularly turn and rotate bamboo culms to ensure even exposure to sunlight and airflow, promoting uniform drying.	4.37	HA
19.	Use a moisture meter to regularly monitor content of bamboo culms until they reach the desired level.	4.27	HA
20.	Tie wire round the ends to prevent splits	4.1	HA
	Sub-Mean Mean Response	**4.40**	**HA**
c.	**Specific tasks in heat treatment**	$\bar{x}$	**Remark**
21.	Choose a non-flammable surface	4.39	HA
22.	Store horizontally	4.40	HA
23.	Store in ventilated area	4.27	HA
24.	Treat bamboo of 4 to 7 years	4.40	HA
25.	Boil culm boric/borax compound for preservation	4.35	HA
26.	Cover with roof	4.35	HA
27.	Gradually raise the temperature inside the treatment chamber or kiln to ensure uniform exposure to heat.	4.33	HA
28.	Wear eye goggles	4.43	HA
29.	Punch holes through all the nodes	4.41	HA
30.	Use blow torch open flame	4.71	VHA
31.	Turn heat to high	4.30	HA
32.	Rotate the bamboo over the flame continuously to avoid overheating	4.54	VHA
33.	Use cloth to hold the bamboo when rotating	4.33	HA
34.	Torch the bamboo slowly section by section until it loses its green colour	4.44	HA
	Sub-Mean Mean Response	**4.40**	**HA**
d.	**Specific tasks in splitting**	$\bar{x}$	**Remark**
35.	Split from thinner end	4.25	HA
36.	Position matchet in the center of the cane and split	4.21	HA
37.	Strike the blade of the matchet on the back with a mallet	4.13	HA
38.	Use hand gloves	3.96	HA
39.	Clean the surface before splitting	4.12	HA
40.	Keep the culm away from direct soil to avoid infection	4.27	HA
41.	Press the bamboo against workbench	4.44	HA
42.	Sharpen matchet with file before splitting	4.28	HA
43.	Position bamboo vertically	4.44	HA
44.	Position bamboo horizontally	4.42	HA
45.	Split along divided portion	4.44	HA
	Sub-Mean Mean Response	**4.27**	**HA**
e.	**Specific tasks in planning bamboo**	$\bar{x}$	**Remark**
46.	Observe machines safety precautions	4.35	HA
47.	Secure bamboo culms firmly in place using clamps or a vice to prevent movement during planning.	4.33	HA
48.	Select appropriate planning tools based on the bamboo hardness and desired smoothness.	4.43	HA
49.	Regularly check the surface for uniformity in thickness and smoothness during the planning process.	4.41	HA
50.	Use winding stick and try square to test for flatness and squareness	4.71	VHA
51.	Take and transfer correct measurement using marking gauge	4.43	HA
52.	Remove dirt, debris and outer sheath layers from bamboo culms using a brush or cloth.	4.37	HA
53.	Observe daily or routine maintenance on machines before use	4.46	HA
54.	Use finer grits of sandpaper or finishing tools to achieve a smooth polished surface after planning.	4.48	HA
	Sub-Mean Mean Response	**4.44**	**HA**
f.	**Specific tasks in gluing and pressing**	$\bar{x}$	**Remark**
55	Ability to press the adhesive-coated surfaces of the bamboo pieces together firmly to ensure intimate contact and squeeze out excess adhesive.	4.29	HA

56.	Ability to inspect the glued joints thoroughly for uniformity, strength and any signs of adhesive failure or defects before further processing or use.	4.48	HA
57.	Sand the glued joints to smooth out any rough edges or excess adhesive residues.	4.53	VHA
58.	Clean the surfaces of the bamboo pieces thoroughly to remove dirt, dust and any contaminants that could affect the adhesion.	4.46	HA
59.	Select the right adhesive suited for bamboo, considering factors such as bonding strength, flexibility and moisture resistance.	4.31	HA
60.	Ability to maintain appropriate temperature and humidity levels during curing to optimize adhesive performance and bond quality	4.35	HA
61.	Conduct bond strength tests such as shear or tensile tests, to ensure that adhesive has formed a strong bond between the bamboo pieces.	4.33	HA
62.	Ability to spread the adhesive evenly over the entire bonding surface to ensure uniform coverage and optimal bond strength.	4.43	HA
63.	Ability to ensure that the bamboo fit together tightly without gaps.	4.41	HA
64.	Ability to select and use correct cramps and scrap blocks when assembling projects	4.71	VHA
65.	Ability to immediately clean off any excess adhesive that squeezes out from the joint using a damp cloth or scraper.	4.48	HA
	Mean Response	**4.43**	**HA**
g.	**Specific tasks in trimming and sanding**	$\bar{x}$	**Remark**
66.	Use scraper/sand paper in removing dry adhesive from the surface	4.46	HA
67.	Remove grease and oils from the surface before applying glue finishes	4.31	HA
68.	Apply wood filler to patch nails holes	4.48	HA
69.	Scratches and cracks with right materials	4.53	VHA
70.	Sand work with abrasives using proper grades of sanding paper	4.43	HA
71.	Remove dust by brushing or by using air blower	4.37	HA
72.	Apply sanding sealer on the surfaces	4.46	HA
73.	Replace or recondition worn out tools	4.48	HA
74.	Use spray gun with finish and ability to store tools in the right place	4.53	VHA
	Mean Response	**4.45**	**HA**
h	**Specific tasks in dyeing**	$\bar{x}$	**Remark**
75.	Place bamboo vertically or horizontally	4.21	HA
76.	Wear rubber gloves	4.37	HA
77.	Wear mask before mixing dye	4.41	HA
78.	Read manufacturers instruction before use	4.33	HA
79.	Sand the bamboo surface	4.35	HA
80.	Clean the surface of bamboo with cloth	4.30	HA
81.	Spray or sponge a light coat of water on the bamboo and allow it to dry for 30minutes	4.23	HA
82.	Mix dye with water	4.47	HA
83.	Apply pre-conditioner	4.56	VHA
84.	Stir the dye	4.42	HA
85.	Test the colour on similar surface	4.35	HA
86.	Use natural-bristle brush	4.50	VHA
87.	Dip brush in dye for 2-3 seconds	4.36	HA
88.	Start dyeing from top to bottom	4.35	HA
89.	Apply dye in the direction of the grain	4.26	HA
90.	Remove excessive dye with rag	4.35	HA
	Sub-Mean Mean Response	**4.36**	**HA**
	Total Mean Response	**4.39**	**HA**

NOTE: VHA=4.50-5.00, HA=3.50-4.49, MA=2.50-3.49, LA=1.50-2.49, NA=1.00-1.49

The analyzed data in Table 1 shows item analysis and Mean responses of experts on 90 specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming and sanding and dyeing of bamboo composite door. The result of analysis shows that the Mean response for specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming and sanding and dyeing of bamboo composite door was 4.36, 4.40, 4.40, 4.27, 4.44, 4.43, 4.45 and 4.36 respectively. This implies that all the experts agreed that the identified tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming and sanding and dyeing of bamboo composite door are highly appropriate to be included in the instructional module.

Research Question 2: What are the specific objectives of the instructional module appropriate for teaching bamboo composite door production to NDDC skills trainees?

Table 2: *Mean response of bamboo making experts on the specific objectives appropriate for teaching bamboo composite door production to NDDC skills trainees.*

S/N	**Section C:** Specific objectives of instructional module Trainees should be able to:	$\bar{x}$	SD	Remark
1.	Introduce trainers to bamboo door making as an alternative to wooden doors.	4.28	.64	HA
2.	Provide practical guidelines to bamboo harvesting and truncation techniques	4.96	.72	VHA
3.	Provide practical steps to bamboo splitting techniques	4.39	.76	HA
4.	Provide practical guidelines on bamboo heat treatment and preparation techniques	4.72	.65	VHA
5.	Demonstrate bamboo drying techniques	4.37	.63	HA
6.	Provide practical guidelines on bamboo dyeing techniques	4.05	.74	HA
7.	Provide practical guidelines to bamboo harvesting and truncation techniques	4.73	.80	VHA
8.	Demonstrate practical process of making bamboo composite door.	4.47	.64	HA
9.	Demonstrate the application of safety wears and precautions necessary for undertaking tasks in each stage of development of bamboo composite door	4.19	.74	HA
10.	Assist technical trainers acquire skills in bamboo composite door making process	4.27	.69	HA
11.	Demonstrate to the teacher alternative assessment methods suitable for technical training in bamboo composite door making.	4.60	.63	VHA
12.	Ascertain the instructional methods suitable for teaching bamboo composite door to trainers at the centre.	4.04	.81	HA
13.	Develop an instructional module in a bamboo composite door making as a guide for technical trainers seeking to teach bamboo products	4.46	.64	HA
	Overall Mean and Standard Deviation	**4.43**	**.70**	**HA**

NOTE: VHA=4.50-5.00, HA=3.50-4.49, MA=2.50-3.49, LA=1.50-2.49, NA=1.00-1.49

The analyzed data in Tables 2 shows 13 item statements and mean responses of bamboo composite door making experts on the specific objectives of the instructional module for teaching bamboo composite doors production to NDDC skill trainees. The response shows that the mean range of the respondents is 4.04 and 4.96 with corresponding standard deviation of 0.53 and 0.98 and overall mean and standard deviation of 0.63 and 0.81. The mean response shows that the experts agreed that all the objectives are highly appropriate for inclusion in the instructional module. The range of the standard deviation of the indicates how close the responses were to the Mean, indicating that the responses were not dispersed, but revolved around the mean.

Research Question 3: What are the instructional materials appropriate for teaching bamboo composite doors production to NDDC skill trainees?

Table 3: *Mean response of Bamboo making experts on the instructional materials appropriate for teaching bamboo composite doors production to NDDC skill trainees.*

S/N	**Section D:** Instructional materials appropriate for teaching bamboo composite door production	$\bar{x}$	SD	Remark
1.	Bamboo	4..53	.87	VHA
2.	Straight edge	4.80	.68	VHA
3.	Scriber/pencil	4.76	.85	VHA

4.	Panel saw	4.74	67	VHA
5.	Jack plane	4.71	.88	VHA
6.	Smooth plane	4.67	.73	VHA
7.	Brush	4.79	.57	VHA
8.	Ponal glue	4.65	.89	VHA
9.	Nails	4.73	.54	VHA
10.	Hammer	4.78	.78	VHA
11.	Try square	4.75	.74	VHA
12.	Hand drill	4.68	.58	VHA
13.	Tape measure	4.54	.86	VHA
14.	Jig saw	4.56	64	VHA
15.	Circular saw	4.64	48	VHA
16.	Framing square	4.57	.75	VHA
17.	Claw hammer	4.63	.67	VHA
18.	Power drill (Electric drill)	4.72	.84	VHA
19.	Dust mask	4.49	.53	VHA
20.	Screw driver	4.61	.54	VHA
21.	Blue print	4.74	.77	VHA
22.	Mitre saw	4.66	.68	VHA
23.	nail pincers	4.79	.55	VHA
24.	Tenon saw	4.82	.84	VHA
25.	Key hole saw	4.55	.98	VHA
26.	Sharp knife	4.66	.64	VHA
27.	Utility knife	4.53	87	VHA
28.	Screw gun	4.62	.93	VHA
29.	Regular saw	4.57	.65	VHA
30.	Table vice	4.61	.78	VHA
31.	Chisel	4.76	.85	VHA
32.	Jack plane	4.84	.68	VHA
33.	G-clamp	4.72	.65	VHA
34.	Ledgers	4.75	.73	VHA
35.	Wood glue	4.49	.57	VHA
36.	Matchet	4.71	.54	VHA
37.	Dye bucket	4.82	.71	VHA
	Overall Mean and Standard Deviation	**4.68**	**.83**	**SA**

NOTE: VHA=4.50-5.00, HA=3.50-4.49, MA=2.50-3.49, LA=1.50-2.49, NA=1.00-1.49

The analyzed data in Table 3 shows 37 item statements and mean responses of bamboo composite door making experts on the instructional materials for teaching bamboo composite doors production to NDDC skill trainees. The response shows that the mean range of the respondents is 4.49 and 4.84 with corresponding standard deviation of 0.53 and 0.98 and overall mean and standard deviation of 4.68 and 0.83. The mean response shows that the experts agreed that all the instructional materials are highly appropriate for inclusion in the instructional module. The range of the standard deviation of the indicates how close the responses were to the Mean, indicating that the responses were not dispersed, but revolved around the mean.

Research Question 4: What are the instructional methods appropriate for teaching bamboo composite door production to NDDC skill trainees?

Table 4: *Mean response of bamboo experts on the instructional methods appropriate for teaching bamboo composite door production to NDDC skill trainees*

F.	**Section E:** Instructional methods appropriate for teaching bamboo composite door production	$\bar{x}$	**SD**	**Remark**
1.	Use lecture-based teaching to explain the principles and importance of each task in bamboo composite door production.	4.38	.64	HA
2.	Use problem-based learning to present students with real-world scenarios to solve specific problems related to bamboo composite door production.	4.26	.72	HA
3.	Use hands-on-laboratory session to provide practical sessions where students can practice specific tasks in bamboo composite door production.	4.39	.76	HA
4.	Use simulation to demonstrate the effect of different drying and heat treatment methods on bamboo properties.	4.72	.45	VHA
5.	Use peer teaching to organize sessions where students demonstrate and explain the different tasks in bamboo composite door production to their classmate.	4.37	.63	HA
6.	Develop interactive modules covering step-by-step procedures, safety precautions and troubleshooting tips for each task in bamboo composite door production.	4.05	.74	HA
7.	Use interactive lecture method to incorporate quizzes and discussions during lectures to reinforce understanding of the principles behind specific tasks in bamboo composite door production.	4.73	.58	VHA
8.	Use field trip to visit bamboo processing facilities or manufacturers specializing in bamboo composite materials to observe firsthand tasks in bamboo composite door production.	4.47	.64	HA
9.	Use debates and discussion to engage students on the tasks involved in bamboo composite door production.	4.19	.74	HA
10.	Use role playing exercise to stimulate scenarios where students play role in bamboo processing and quality control in tasks	4.27	.69	HA
11.	Use collaborative learning to plan and execute the entire process of bamboo composite door production.	4.60	.63	VHA
12.	Use mind mapping to create visual maps to illustrate the sequential steps and factors influencing each task in bamboo composite door production.	4.04	.81	HA
13.	Use concept mapping to develop diagrams showing the relationship between the specific tasks and their impact on final product quality.	4.46	.64	HA
14.	Use demonstrations methods for teaching specific tasks involved in bamboo composite door production.	4.17	.81	HA
15.	Use questioning to guide students in exploring the rationale behind selecting specific tasks in bamboo composite door production.	4.26	.74	HA
16.	Introduce gamified activities to reinforce learning about specific tasks in bamboo composite door production.	4.35	.73	HA
17.	Use microlearning to deliver concise learning modules covering specific tasks in bamboo composite door production.	4.42	.72	HA
18.	Use Augmented Reality and Virtual Reality to provide immersive experiences where students can practice and refine specific tasks without using actual material.	4.58	.61	VHA
19.	Use flipped labs to provide pre-lab materials online that cover theoretical knowledge and safety guideline for specific tasks in bamboo composite door production.	4.46	.72	HA
20.	Use lecture method to teach step by step procedures involved in drying of bamboo	4.50	.69	VHA
21.	Use lecture method to teach step by step procedures involved in dyeing of bamboo	4.17	.82	HA
22.	Apply problem solving approach during heat treatment of bamboo	4.23	.78	HA
23.	Apply problem solving approach during drying of bamboo	4.13	.76	HA
24.	Apply problem solving approach during dyeing of bamboo	4.01	.78	HA
25.	Give practical projects to trainees such as prototype for dyeing	4.25	.72	HA
26.	Use sketches to illustrate the gluing and pressing	4.41	.71	HA
27.	Use sketches to illustrate the various terms and parts of bamboo composite door	4.59	.63	VHA

28.	Adopt meta learning approach instruction during heat treatment of bamboo	4.41	.78	HA
29.	Adopt meta learning approach instruction during dyeing of bamboo	4.46	.73	HA
	Overall Mean and Standard Deviation	**4.36**	**0.88**	**HA**

NOTE: VHA=4.50-5.00, HA=3.50-4.49, MA=2.50-3.49, LA=1.50-2.49, NA=1.00-1.49

The analyzed data in Table 4 shows 29 item statements and mean responses of bamboo composite door making experts on the instructional methods for teaching bamboo composite doors production to NDDC skill trainees. The response shows that the mean range of the respondents is 4.01 - 4.73 with corresponding standard deviation of 0.53 and 0.98 and overall mean and standard deviation of 4.36 and 0.88. The mean response shows that the experts agreed that all the instructional methods are highly appropriate for inclusion in the instructional module. The range of the standard deviation of the indicates how close the responses were to the Mean, indicating that the responses were not dispersed, but revolved around the mean.

Research Question 5: What are the evaluation techniques appropriate for teaching bamboo composite door production to NDDC skill trainees?

Table 5: *Mean response of bamboo experts on evaluation techniques appropriate for teaching bamboo composite door production to NDDC skill trainees.*

S/N	**Section F:** Evaluation techniques for teaching bamboo composite door production	$\bar{x}$	SD	Remark
1.	Formative evaluation technique	4.20	.73	HA
2.	Summative evaluation technique	4.36	.83	HA
3.	Diagnostic evaluation technique	4.04	.75	HA
4.	Criterion-referenced evaluation technique	4.32	.62	HA
5.	Norm-referenced evaluation technique	4.49	.51	HA
6.	Performance-based evaluation technique	4.28	.71	HA
7.	Portfolio evaluation technique	4.04	.77	HA
8.	Dynamic Assessment	4.65	.59	VHA
9.	Self-assessment	4.43	.81	HA
10.	Peer assessment	4.46	.84	HA
	Overall Mean and Standard Deviation	**4.33**	**0.72**	**HA**

NOTE: VHA=4.50-5.00, HA=3.50-4.49, MA=2.50-3.49, LA=1.50-2.49, NA=1.00-1.49

The analyzed data in Table 5 shows 10 item statements and mean responses of bamboo composite door making experts on evaluation techniques for teaching bamboo composite doors production to NDDC skill trainees. The response shows that the mean range of the respondents was 4.04 and 4.65 with corresponding standard deviation of 0.59 and 0.84 and overall mean and standard deviation of 4.33 and 0.72. The mean response shows that the experts agreed that all the evaluation techniques are highly appropriate for inclusion in the instructional module.

Research Question 6: To what extent are NDDC skill trainees taught with the instructional module and NDDC skill trainees taught without the instructional module acquire skills in specific tasks in bamboo composite door production to NDDC skill trainees?

Table 6: *NDDC skill trainees taught with the instructional module and NDDC skill trainees taught without the instructional module.*

S/N	**Item Statement:** Specific tasks in bamboo composite door production	NDDC skill trainees taught with		NDDC skill trainees taught without	
A.	**Specific tasks in truncation**	$\bar{x}$	**SD**	$\bar{x}$	**SD**
1.	I can identify and select mature bamboo pole that are straight	4.47	1.81	2.81	0.17
2.	Bamboo is cut down	4.98	1.65	2.69	0.24

3.	I can remove the rough portion from the cut ends of the bamboo pole using knife or sandpaper to ensure smooth surfaces	4.59	0.97	3.43	0.14
4.	I can cut off bamboo ends	4.66	1.75	2.54	0.19
5.	I can measure and mark out the desired length of bamboo pole using measuring tools	4.74	1.83	2.66	0.18
6.	I can use sharp tools like machete, saw or specialized bamboo cutting tools to cut the bamboo pole to the marked length	4.68	1.65	2.72	0.15
7.	I can use workbench during cutting large diameter	4.55	0.86	2.62	0.27
8.	I can position bamboo over the edge of workbench	4.57	1.68	2.87	0.14
9.	I can grasp bamboo with clamp during cutting	4.59	1.87	2.94	0.18
10.	I can wrap bamboo with towel to prevent the clamp from affecting the surface	4.54	1.69	2.87	0.29
11.	I can clean the surface of bamboo	4.72	1.74	2.46	0.18
	Sub-Mean and Standard Deviation	**4.64**	**1.59**	**2.78**	**0.19**
B.	**Specific tasks in drying**				
12.	I can remove infected cum from the drying area	4.83	1.78	2.98	0.14
13.	I can dry bamboo in ventilated area	4.58	1.85	3.57	0.26
14.	I can dry bamboo vertically	4.64	1.74	2.75	0.26
15.	I can dry bamboo horizontally for large quantity	4.58	1.68	3.24	0.28
16.	I can dry bamboo on raised platform to avoid soil contact and fungal attack	4.53	1.74	2.57	0.14
17.	I can use separator between each row of bamboo for better ventilation	4.66	1.82	3.16	0.17
18.	I can pile up bamboo at normal high	4.74	1.67	2.93	0.15
19.	I can rotate bamboo while drying	4.59	1.76	2.47	0.19
20.	I can use a moisture meter to regularly monitor content of bamboo culms until they reach the desired level.	4.50	0.73	2.26	0.29
21.	I can tie wire round the ends to prevent bamboo splits	4.63	1.77	3.18	0.16
	Sub-Mean and Standard Deviation	**4.63**	**1.65**	**2.91**	**0.20**
C.	**Specific tasks in heat treatment**				
22.	I can choose a non-flammable surface for heat treatment of bamboo	4.68	1.65	3.22	0.17
23.	I can store bamboo horizontally	4.62	0.74	3.45	0.14
24.	I can store bamboo in ventilated area	4.78	1.67	3.58	0.19
25.	I can treat bamboo of 4 to 7 years	4.83	1.73	3.10	0.21
26.	I can boil culm boric/borax compound for bamboo preservation	4.51	1.69	2.87	0.11
27.	I can cover bamboo with roof	4.73	1.71	2.63	0.26
28.	I can gradually raise the temperature inside the treatment chamber or kiln to ensure uniform exposure to heat.	4.77	1.76	2.95	0.29
29.	I can wear eye goggles during heat treatment	4.82	1.65	3.22	0.28
30.	I can punch holes through all the nodes during heat treatment	4.76	1.83	2.36	0.19
31.	I can use blow torch open flame during heat treatment	4.84	1.77	3.03	0.16
32.	I can turn heat to high	4.75	1.74	2.85	0.21
33.	I can rotate the bamboo over the flame continuously to avoid overheating	4.70	1.68	2.47	0.24
34.	I can use cloth to hold the bamboo when rotating during heat treatment	4.58	1.87	3.32	0.28
35.	I can torch the bamboo slowly section by section until it loses its green colour	4.54	1.75	2.84	0.16
	Sub-Mean and Standard Deviation	**4.71**	**1.66**	**2.99**	**0.21**

D.	**Specific tasks in splitting**				
36.	I can split from thinner end of bamboo	4.83	1.73	3.10	0.21
37.	I can position matchet in the center of the cane and split	4.60	0.74	2.74	0.23
38.	I can strike the blade of the matchet on the back with a mallet	4.59	0.86	3.62	0.19
39.	I can use hand gloves during splitting of bamboo	4.91	1.78	3.37	0.25
40.	I can clean the surface before splitting of bamboo	4.89	1.75	2.93	0.22
41.	I can keep the culm away from direct soil to avoid infection	4.67	1.82	2.89	0.20
42.	I can press the bamboo against workbench	4.53	1.68	2.46	0.28
43.	I can sharpen matchet with file before splitting of bamboo.	4.58	1.63	2.67	0.18
44.	I can position bamboo vertically	4.88	1.84	3.26	0.20
45.	I can position bamboo horizontally	4.63	1.65	2.43	0.26
46.	I can split along divided portion	4.69	1.76	2.68	0.14
	Sub-Mean and Standard Deviation	**4.71**	**1.57**	**2.92**	**0.21**
E.	**Specific tasks in planning bamboo**				
47.	I can observe machines safety precautions	4.59	0.73	2.79	0.26
48.	I can secure bamboo culms firmly in place using clamps or a vice to prevent movement during planning.	4.84	1.88	2.96	0.19
49.	I can select appropriate planning tools based on the bamboo hardness and desired smoothness.	4.55	1.75	2.53	0.24
50.	I can regularly check the surface for uniformity in thickness and smoothness during the planning process.	4.67	1.81	2.89	0.20
51.	I can use winding stick and try square to test for flatness and squareness	4.53	1.68	2.46	0.18
52.	I can take and transfer correct measurement using marking gauge	4.83	1.80	2.98	0.14
53.	I can remove dirt, debris and outer sheath layers from bamboo culms using a brush or cloth.	4.58	1.85	3.57	0.26
54.	I can observe daily or routine maintenance on machines before use	4.73	1.79	2.75	0.28
55.	I can use finer grits of sandpaper or finishing tools to achieve a smooth polished surface after planning.	4.56	1.75	2.83	0.14
	Sub-Mean and Standard Deviation	**4.65**	**1.67**	**2.86**	**0.21**
F.	**Specific tasks in gluing and pressing**				
56	I can press the adhesive-coated surfaces of the bamboo pieces together firmly to ensure intimate contact and squeeze out excess adhesive.	4.69	1.64	3.27	0.26
57.	I can inspect the glued joints thoroughly for uniformity, strength and any signs of adhesive failure or defects before further processing or use.	4.82	1.82	3.13	0.12
58.	I can sand the glued joints to smooth out any rough edges or excess adhesive residues.	4.75	1.76	2.87	0.25
59.	I can clean the surfaces of the bamboo pieces thoroughly to remove dirt, dust and any contaminants that could affect the adhesion.	4.71	1.93	2.95	0.10
60.	I can select the right adhesive suited for bamboo, considering factors such as bonding strength, flexibility and moisture resistance.	4.84	1.79	3.33	0.27
61.	I can maintain appropriate temperature and humidity levels during curing to optimize adhesive performance and bond quality	4.76	1.84	2.68	0.24

62.	I can conduct bond strength tests such as shear or tensile tests, to ensure that adhesive has formed a strong bond between the bamboo pieces.	4.58	1.86	3.46	0.28
63.	I can spread the adhesive evenly over the entire bonding surface to ensure uniform coverage and optimal bond strength.	4.61	1.69	2.73	0.23
64.	I can ensure that the bamboo fit together tightly without gaps.	4.83	1.88	2.98	0.24
65.	I can select and use correct cramps and scrap blocks when assembling projects	4.58	0.85	3.57	0.16
66.	I can immediately clean off any excess adhesive that squeezes out from the joint using a damp cloth or scraper.	4.73	1.74	2.75	0.28
	Sub-Mean and Standard Deviation	**4.72**	**1.71**	**3.07**	**0.22**
G.	**Specific tasks in trimming and sanding**				
67.	I can use scraper/sand paper in removing dry adhesive from the surface	4.63	0.75	2.49	0.29
68.	I can remove grease and oils from the surface before applying glue finishes	4.69	1.86	3.27	0.26
69.	I can apply wood filler to patch nails holes	4.82	1.72	3.13	0.22
70.	I can scratch and cracks with right materials	4.75	1.91	2.87	0.15
71.	I can sand bamboo with abrasives using proper grades of sanding paper	4.71	1.75	2.95	0.10
72.	I can remove dust by brushing or by using air blower	4.84	1.81	3.33	0.17
73.	I can apply sanding sealer on the bamboo surfaces	4.76	1.77	2.68	0.24
74.	I can replace or recondition worn out tools	4.58	1.69	3.46	0.28
75.	I can use spray gun with finish and ability to store tools in the right place	4.61	1.89	2.73	0.23
	Sub-Mean and Standard Deviation	**4.71**	**1.68**	**2.99**	**0.22**
H.	**Specific tasks in dyeing**				
76.	I can place bamboo vertically or horizontally	4.58	1.85	3.57	0.26
77.	I can wear rubber gloves	4.73	1.64	2.75	0.28
78.	I can wear mask before mixing dye	4.56	1.68	2.83	0.24
79.	I can read manufacturers instruction before use	4.63	1.71	2.49	0.19
80.	I can sand the bamboo surface	4.69	1.76	3.27	0.26
81.	I can clean the surface of bamboo with cloth	4.82	1.85	3.13	0.22
82.	I can spray or sponge a light coat of water on the bamboo and allow it to dry for 30minutes	4.75	1.89	2.87	0.15
83.	I can mix dye with water	4.71	1.77	2.95	0.20
84.	I can apply pre-conditioner	4.84	1.82	3.33	0.17
85.	I can stir the dye	4.76	1.78	2.68	0.24
86.	I can test the colour on similar surface	4.58	1.82	3.46	0.28
87.	I can use natural-bristle brush	4.61	1.80	2.73	0.23
88.	I can dip brush in dye for 2-3 seconds	4.83	1.73	2.98	0.14
89.	I can dye from top to bottom	4.64	1.88	2.68	0.27
90.	I can apply dye in the direction of the grain	4.77	1.91	2.73	0.25
91.	I can remove excessive dye with rag	4.62	1.74	3.42	0.12
	Sub-Mean and Standard Deviation	**4.70**	**1.79**	**2.99**	**0.22**
	Overall Mean and Standard Deviation	**4.68**	**1.67**	**2.94**	**0.21**

NOTE: SA= 4.50-5.00, MA = 3.50-4.49, LA=2.50 - 3.49, A=1.50 - 2.49

The analyzed data in Table 6, shows grand mean and standard deviation of 4.38, 0.62 and 2.86, 0.27 respectively on NDDC skill trainees taught with the instructional module and NDDC skill trainees taught without the instructional module acquire skills in specific tasks in bamboo composite door production. The result indicates that the NDDC skill trainees taught with the instructional module acquire skills in specific tasks in bamboo composite door production than NDDC skill trainees taught without the instructional module.

Null Hypothesis One: There is no significant difference in the mean responses of NDDC trainees taught with the instructional module and NDDC trainees who are not taught with instructional module for inclusion in the instructional module for teaching requisite skills in the development of bamboo composite door to NDDC trainees in Akwa Ibom State.

Table 7: *Independent t-test of Mean Response of NDDC trainees taught with the Instructional Module and NDDC trainees who not taught with t instructional module*

Variable	N	$\bar{x}$	SD	Mean Diff.	df	t-cal.	t-crit.	Dec.
Students taught with instructional module	42	4.68	1.67					
				1.46	80	1.70	1.69	S
Students taught without instructional module	40	2.94	0.21					

NOTE: S= Significance

The analyzed data in Table 7 indicates that the mean score of NDDC furniture making and woodwork trainees taught with instructional module for the production of bamboo composite door (experimental group, 4.68) was greater than the mean score of NDDC furniture making and woodwork trainees who were taught without bamboo composite door instructional module (control group, 2.94). Table 14 also indicate that the t-cal was 1.70 while the t-crit. was 1.69 at 80 degree of freedom and mean difference of 1.46 at 0.05 level of significance. Hence, since the t-cal. was greater than t-crit., hypothesis of significance difference between the mean response of students taught who were taught with the bamboo composite door instructional module and those who were taught without the bamboo composite door instructional module was upheld.

Discussion of Findings

The data analysis of research question 1 identified 90 specific tasks for inclusion in the instructional module for teaching bamboo composite door production. The result showed that all the experts agreed that the identified specific tasks in truncation, drying, heat treatment, splitting, planning, gluing and pressing, trimming and sanding and dyeing of bamboo composite door are highly appropriate for inclusion in the instructional module. The result of this study is in line with the findings of Yu (2012), Guan, *et al.* (2012) stated that truncation technique is used to shorten the bamboo by cutting off apart, cut short with the use of matchet, removal of branches, cleaning of surface and use of hand gloves. Huang, *et al.* (2018) also agreed that marking out required length with measuring tape, use of sharp hacksaw to cut off ends and grasping of bamboo. The finding of this study is in agreement with findings of Nugrho and Ando (2018) who stated that the number of splitting pieces of bamboo is determine by the diameter of the bamboo, the larger the diameter of the bamboo, the more the splitting pieces are and that bamboo should be splitted from the thinner end. In the same vein, the study aligns with the findings of Javadian, *et al.* (2016) and who stated that the steps needed for heat treatment of bamboo is to choose a non-flammable area, store bamboo horizontally or vertically, treat bamboo of 4 to 7 years, cover treatment area with roof, punch holes through the nodes, use blow torch open flame, turn heat to high and rotate the bamboo continuously until it loses its green colour.

Similarly, the study is in agreement with the findings of Li, *et al.* (2015), Zhu, *et al.*, (2015) who believes that some important factors to be considered during drying of bamboo are removal of infected cum from the drying area, drying in ventilated area, drying vertically, use of separator between each row for better ventilation and that bamboo should not be piled up too high. Furthermore, the study support Hu, *et al.* (2016) who maintained that the procedures to be observed during dying of bamboo are, place bamboo vertically, wearing of rubber gloves and mask before mixing dye, sand the bamboo surface, clean the surface of bamboo with cloth, mix dye with water, applying pre-conditioner stir the dye, start dying from top to bottom and removal of excessive dye with rag.

The data analysis of research question 2 identified 13 objectives for inclusion in the instructional module for teaching bamboo composite door production. The mean response of the experts showed that the 13 objectives are highly appropriate for inclusion in the instructional module. The finding of this study agreed with Alshahad, (2013), Orikpe (2013) and Umeh (2013), who noted that the task for which the skills or knowledge is needed is important to the learner's outcome and different methods to teaching is required to achieve the specific objectives of the instructional module.

The data analysis of research question 3 identified 37 instructional materials for teaching bamboo composite doors production to NDDC skill trainees. The mean response of the experts showed that the 37 instructional materials are highly appropriate for inclusion in the instructional module. The finding of this study is in agreement with the findings of Alshahad, (2013), Orikpe (2013) and Umeh (2013), who stated that instructional materials involve those of the set objectives which depends on the topic to be taught.

The data analysis of research question 4 identified 29 instructional methods for teaching bamboo composite doors production to NDDC skill trainees. The mean response of the experts showed that the 29 instructional methods are highly appropriate for inclusion in the instructional module. This finding is in support of Orikpe (2013) and Umeh (2013), who identified several instructional approaches suitable for self-tutor and teacher adoption. The approaches are similar to the ones adopted for this study. This includes, self-tutor, demonstration, problem-solving, project based and discussion method.

The data analysis of research question 5 identified 10 evaluation techniques for teaching bamboo composite doors production to NDDC skill trainees. The mean response of the experts showed that the 10 evaluation techniques are highly appropriate for inclusion in the instructional module. The findings of the study are in line with the study of Alshahad, (2013), Orikpe (2013) and Umeh (2013), who noted that at the end of teaching and learning exercise, trainees should be able to perform or demonstrate they have learnt or grasp what has been taught. Alshahad, (2013) stated that evaluation guide helps to access trainees' ability as far the lesson or topic taught is concerned hence evaluation guide closely test the performance objectives.

The finding of research question 6 and corresponding research hypothesis 1 showed that trainees taught with the developed instructional module was greater than the trainees who were taught without the bamboo composite door instructional module. This study is in support of Robles and Acedo (2019), who stated that there was a significant difference between the pre-test and the post-test recorded video for teaching in Araling Panlipunan. The finding confirms with that of Chawla and Deshwal (2013) who in their studies stated that students who used CAI performed better than the students who did not use CAI.

Conclusion

The development and validation of instructional module for teaching bamboo composite door production to Niger Delta Development Commission (NDDC)trainees in Akwa Ibom State represents a significant step towards addressing both educational and economic challenges. The NDDC has outlined objectives for furniture making and woodwork, aiming to prepare trainees for effective participation in society. This implies that trainees in woodwork should acquire fundamental skills and knowledge in woodwork technology to equip them for careers in industries or self-employment. However, these objectives have not been fully realized due to the generalized nature of woodworking skills taught in the skill acquisition centers, which lack specific step-by-step procedures for training experts in furniture making and woodwork on bamboo composite door production.

To achieve the NDDC objectives in furniture making and woodwork, it is crucial to enhance the curriculum by integrating the essential knowledge and practical skills necessary for trainees on bamboo composite door production. In contributing to this goal, this study identifies the specific tasks, materials, and methods required to produce bamboo composite doors. The validation process has ensured that the module is not only comprehensive and effective but also tailored to the specific needs and capabilities of the trainees.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. NDDC should adopt the training module and monitor trainees' progress throughout the program and identify areas for improvement to ensure that trainees are mastering the necessary skills effectively.
2. NDDC should engage experienced professionals from the bamboo industry as instructors to enhance the quality of training and provide real-world perspectives to the trainees.
3. NDDC should emphasize hands-on practical sessions where trainees can apply theoretical knowledge to real-world scenarios to enhance skill acquisition and confidence in producing bamboo composite doors.
4. NDDC should establish a system for regular evaluation and updating of the instructional module to continuously improve the content and relevance of the training program.

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