Puissant (ISSN print: 2719-0153; ISSN online: 2719-0161)
Vol. 2, pp. 160-184
https://puissant.stepacademic.net

Long Paper

Development and Validation of Tiling Craft Training Module for N-Power Build Apprenticeship Programme: A Delphi study

Mohammed A. Auta
Department of Technology and Vocational Education, Nnamdi Azikiwe University, Awka, Nigeria
ma.auta@unizik.edu.ng
https://orcid.org/0000-0002-2935-5169
(corresponding author)

Musibau Giwa
Department of Building Technology, Federal College of Education (Technical), Asaba, Nigeria

Eric K. Gowon
Department of Vocational and Technical Education, Benue State University, Makurdi, Nigeria

Aishatu Buba
Department of Technology Education, Modibbo Adama University, Yola, Nigeria

Tukur Tafida
Department of Technology Education, Modibbo Adama University, Yola, Nigeria

Date received: June 23, 2021
Date received in revised form: July 23, 2021
Date accepted: July 23, 2021

Recommended citation:

Auta, M. A., Giwa, M., Gowon, E. K., Buba, A. & Tafida, T. (2021). Development and validation of tiling craft training module for N-Power build apprenticeship programme: A Delphi study. *Puissant*, *2*, 160-184.

Abstract

The sharp decline in the adoption and haphazard operations of apprenticeship system in Nigeria calls for concern; this therefore, is a report on a Delphi study on development and validation of Tiling Craft Training Module for N-power build

apprenticeship programme. Thirty-eight participants drawn from Association of Vocational and Technical Educators of Nigeria (AVTEN) and Nigeria Institute of Building (NIOB) voluntarily participate in the study. During the first round of Delphi study, all 38 panellists from the two associations participated. In the first round, 32 out of the 38 participants responded to the open-ended questionnaire. While in the second and third rounds, only 31 and 29 participants respectively participated. The panellists identified 106 items of concerns in the first stage in line with the research questions. The items were narrowed down to 95 at the second Delphi round and the 95 items were ranked, and a moderate consensus was obtained. In the follow-up interview, only seven participants agreed to take part in the interview session. This is to obtain a deeper understanding of the issues under consideration. The findings shows that 95 items categorized under the four major constituents of a training module were found to be appropriate for inclusion. The paper was concluded with key recommendations and implications for future studies.

Keywords – tiling, craft, training, module, n-power, apprenticeship

INTRODUCTION

An apprenticeship training programme is considered to be an excellent model for acquisition of 21st-century vocational skills (Fuller & Unwin, 2011). This may not be unconnected with the fact that it provides a path through which young people acquire everyday work experiences, up to date knowledge, and facilitates their entry into the job market (Billet, 2014). According to Ryan (2000), apprenticeship generally refers to a formal, structured vocational preparation programme usually supported by an employer that juxtaposes part-time off-the-job instruction with on-the-job training and work experiences of at least two years leading to a recognized vocational qualification at craft or higher levels. It is therefore a model which favours a combination of work and training.

The apprenticeship training programme is deeply rooted in many countries of the world (Fuller & Unwin, 2011); in Denmark for instance, an Apprentice usually alternate between workplace and school (independent vocational college) for a minimum of three years with terminal vocational examinations validated by the craft and trade branches. In Sweden, the programme lasts for three years integrated into upper secondary school with certification based on the outcomes of the coursework done in the school (Andersson & Wärvik, 2015). The Norwegian system is a bit different; while the certification process is similar to that of Denmark, the programme lasts for four years broken into two years of school-based preparation and additional two years of on-the-job training integrated into upper secondary school. This diversity is found in almost all countries of the world.

In Nigeria, unlike what is obtainable in other parts of the world, reports show that there is a decline in the adoption and implementation of this model for the training of the

21st-century workforce needed to transform the country (Fajobi, Olatujoye, & Adedoyin, 2017). The authors reported that the sharp decline and its pattern has evolved and can be mirrored through the socio-cultural process in the society which inhibits the master craftsman and the apprentice to relate and practice freely devoid of hiccups. Adekola (2013) noted that the major problem of apprenticeship system in Nigeria is the long-held notion that the programme is meant for either those who are less intelligent and cannot cope in the regular formal education or those who cannot afford the cost of formal education system.

The consequence is that, in the construction industry where the tile fitting craftsmen are expected to operate, for instance, many of the industry players relied on the limited number of skilled expatriates to execute certain tasks which ought to have been handled by the local workforce mostly at exorbitant cost (Ugochukwu & Onyekwena, 2014). This arrangement is not only uneconomical on the side of the industry practitioners, but facilitates the increase in the number of unemployed and unskilled labour force in the country. However, this drawback was aptly recognized by the Nigerian government; to arrest the situation, the government in 2016 established the National Social Investment Programme (NSIP) (Federal Government of Nigeria, FGN, 2020) to coordinate and manage the processes of revitalizing the apprenticeship system through the instrument of "N-Power Build".

N-Power Build is an apprenticeship programme designed to provide an enabling environment for accelerated vocational skills training for unemployed Nigerian Youths. This is to ensure that a new crop of highly competent and skilled workforce in the categories of technicians, artisans and other service professionals are injected into the Nigerian Automobile and Construction sectors. The N-Power Build programme was designed to last for 12 months broken into three months in-centre training (off-the-job instruction) and nine months On-the-job in partnership with both the public and private sector employers. (Osinbajo, 2018). On graduation, trainees are mobilized with an exit Toolbox/Starter Kit for commencement of their journey into the field of work (FGN, 2020). The targeted crafts in the first instance include Automobiles, Carpentry and Joinery, Electrical Installation, Masonry and Tiling, Plumbing and Pipe fittings among others (Osinbajo, 2018). Without prejudice to other crafts within the N-Power Build framework, this study was designed to focus on Masonry and Tiling Crafts.

The objectives of Masonry & Tiling crafts component of N-Power Build apprenticeship programme is to enable the trainees acquire the necessary skills needed to "translate what the professionals have designed and drawn into the physical building by laying blocks or bricks to construct brickwork, and also to lay any combination of stones, bricks, cinder blocks, or similar pieces or concrete to make up the walls and structural elements of the building including foundations, floors, columns and beams. They also undertake plastering, tiling and similar finishing work in the building" (Federal Government of Nigeria (FGN), 2020).

Despite this laudable, though, broad objectives of the training programme, Auta, Giwa and Nnajiofor (2020) discovered that the trainees recruited in the first batch of the programme only acquired "moderate skills" in Masonry and Tiling crafts. This appears to be far from what the organizers of the programme anticipated. The implication is that, the performance of the trainees in the field of work may not be as desirable if not offered the opportunity to acquire further training. This is further reinforced by the fact that, Auta et *al*. (2020) study utilized a self-reporting approach where the trainees who are in a better position to evaluate themselves return such a verdict. This unpleasant outcome can be attributed to many factors including: overloaded skill area, limited training period, unclear objectives, inadequate content, lack of defined instructional methods, and use of faulty assessment instruments.

The tiling craft which is the concern of this study was not even dignified in the formulation of the Masonry and Tiling crafts objective of the N-Power build; according to FGN (2020), the objective is to enable the trainees to perform "tiling and similar finishing work in the building". No deliberate attempt was made to highlight what constitute the major skill areas of the craft and the mechanism for harvesting instructional feedbacks. The trainees therefore are left at the mercy of the master craftsman for their apprenticeship training programme. These therefore call for concern on how best to achieve the objectives of this training programme. For instance, the merger of Masonry and Tiling as a crafts can be viewed as one of the major sources of this drawback. This is the premise on the long-held notion that "a generalist cannot be specialist". An Apprentice may be interested in becoming a Tile fitter, addition of masonry work to his area of skill training may be a source of distraction, and this may wane the Apprentice's interest to put in his best. Instructively, with the institutionalization of the N-Power Build programme and its domestication in the Federal Ministry of Humanitarian Affairs and Disaster Management, the recruitment of potential Apprentices has become a yearly event. This therefore, calls for the need to develop and validate a distinct Tiling Craft Training Module (TCTM) for the N-Power Build apprenticeship programme.

The module is regarded as a unit of curriculum that is concerned with the development of competencies at the entry-level of training with an approximate specific period of instruction that an average trainee can cover (Olaitan, 2003). It can also be seen as a "self-contained", independent unit of training activities developed to assist trainees achieves well-defined objectives (Anyawu, Nzewi & Akudolu, 2004). It can therefore be seen as an instructional process designed to enable an individual acquire relevant and adequate specific skills and competencies that can be put into productive use in solving societal challenges. To achieve that, this study, therefore, provided answers to the following questions:

RQ 1: What are objectives of the TCTM for producing skilled craftsmen?

RQ 2: What are the Instructional contents to be included in TCTM?

RQ 3: What are the Instructional methods to be used in teaching the contents of TCTM?

RQ 4: What are the methods of evaluation of skills acquired after the implementation of TCTM?

Study Model

This study was based on Tyler Curriculum model (1949). The choice of this model is based on the fact the model utilizes the Technical-Scientific approach, which is considered to be logical, efficient, and effective in delivering education (Bhuttah, Xiaoduan, Ullah & Javed, 2019). Hence, it is regarded as the most famous modernist model of curriculum development (Lau, 2001). This model provides theoretical support for the development of the TCTM for the N-Power Build apprenticeship training programme. In developing this model, Raph W. Tylor in 1949 raised the following four questions:

1. What are the learning rationales a school should try to find?
2. Which learning principles can be presented that will probably achieve these rationales?
3. In what manner these learning experiences can be organized effectively?
4. How to find out whether the rationales are being accomplished or not?

Answers to the four questions above provided a basis for Raph Tyler to formulate the famous four basic principles of curriculum development. According to Tyler, every curriculum development endeavour must start by defining its purpose usually in the form of objective statements; then related education experience relative to the objectives can now be selected to add "flesh" to the objective. Subsequently, the "raw" related education experience selected must be organized to give it meaning; at the end, the organized related education experience will now be appraised to get feedback as to whether the objectives formulated are being achieved or not; that will serve as a basis for curriculum innovation.

Bhuttah, Xiaoduan, Ullah and Javed (2019) noted that Tylers' model appears to be deductive, linear and starts from general to specific; hence, the curriculum developer is guided on what to do and when to do it. The emergence of Tyler model has changed the narrative on how curriculum should be developed. In fact, most of the subsequent models that emerged were said to be an extension of Tylers' model. Though this model has its inherent weakness such as its inability to explain where the objectives come from (Klieberd, 1995), it makes intention too explicit rather than implicit since curriculum planners only think about their task and the intended outcomes (Cruickshank, 2018) it still fits into the mould of the current study.

To establish the relationship and to show the theoretical support provided by this model to the current study, Table 1 shows the four basic principles as juxtaposed with the four components that made up the TCTM:

Table 1. Relationship between Tylers four basic principles and the components of TCTM

S/N	Tylers' four basic principles		Components of TCTM
1	Defining the purpose of the school	-	Objectives of TCTM for producing skilled craftsmen
2	Selecting related educational experiences	-	Instructional contents to be included in TCTM
3	Organizing related educational experience	-	Instructional methods to be used in teaching the contents of TCTM
4	Evaluating of the objectives	-	Methods of evaluation of skills acquired after the implementation of TCTM

As presented in Table 1, all the basic principles outlined by Tyler largely complied with the conduct of this study.

METHODOLOGY

The procedures adopted in the conduct of this study were discussed under this heading. Specifically, the areas discussed include the design adopted, the participants and the validity and reliability.

Design

The study adopted a mixed-method design. According to Skulmoski, Hartman & Krahn (2007), the application of Delphi technique requires the combination of both qualitative and quantitative research skills; and for that reason, Creswell (2013) and Kos & Aydın (2013) classified this technique to be a mixed-method research design. The Delphi technique is a systematic process designed to obtain the most reliable consensus of a group of experts through the use of series of questionnaires in an in-depth and diverse manner with controlled opinion feedback (Dalkey & Halmer, 1962). It can also be defined as a method for group communication that effectively allows individuals to come to a consensus on a complex problem (Linstone & Turoff, 1975). This design was considered appropriate for this study because it provides a vehicle for bringing together a diverse group of experts to utilize their knowledge and skills in synthesizing a module for training building operatives on tiling craft for the Nigerian construction industry.

Delphi research usually incorporates four main features: anonymity, iteration, controlled feedback, and computed statistical group response (Van Zolingen & Klaassen 2003). Anonymity entails that the group of experts drawn usually from a diverse background for the exercise do not know one another. Therefore, they are free to present their own opinions devoid of pressure from other members of the panel. Iteration, on the other hand, refers to the processes of multiple sending and re-sending

of questionnaires to the experts until they arrived at a consensus. Controlled feedback simply means the processes in which the experts are informed of the opinion of other anonymous experts every time the questionnaire is re-sent usually in the form of a computed statistical summary of the group's response.

The experts have usually availed the opportunity to appraise based on the feedbacks their own initial opinion which may lead to either or combination of both additions, subtraction, or modification of their initial opinion on the matter under consideration to align with the opinion that is common to the group (Mitroff & Turoff, 2002). This design is considered appropriate for this study since its anonymous feature gives room for free sharing of opinion and reduces the inconveniences associated with bringing together experts from diverse backgrounds under a roof for the development and validation of the training module under consideration.

Participants

Choosing the right participants to serve as experts is critical in Delphi research (Nworie, 2011). This is because the quality of the experts involved in the conduct of the study play significant roles in improving the overall quality of the outcomes, reducing all perceived prejudice, and enhancing the overall reliability of the results (Powell, 2003; Okoli & Pawlowski, 2004; Nworie, 2011). Hence, purposive sampling is often used as a sampling technique in selecting participants for Delphi study since it allows the researcher(s) the liberty to spell out the criteria considered to be the most suitable based on informed angle in selecting experts for the study (Fraenkel, Wallen & Hyun, 2015).

In this study, a highly competitive selection process was utilized to identify, appraised and select the participants. The group of experts eventually selected to participate in this study were a diverse mix of technical teachers and industry practitioners. The following criteria were used in the selection of the participants: Technical Teachers with at least a masters' degree in technical education (building technology) with a minimum of 5 years experience in the field as teachers; and industry practitioners with a bachelor degree in building with a minimum of 5 years industrial experience registered with both the Nigerian Institute of Building (NIOB) and Council for Registered Builders of Nigeria (CORBON).

To identify potential participants based on the laid down criteria for selection, the researchers collaborate with the Association of Vocational and Technical Educators of Nigeria (AVTEN) for the selection of Teachers and the Nigeria Institute of Building (NIOB) for the selection of the industry practitioners. To achieve that, the academic curriculum vitae of the two groups of participants who are members of the two respective professional associations were accessed and reviewed through the leadership of the two professional bodies. Table2 shows the profile of the participants and their level of participation in the three Delphi rounds.

Table 2. *Delphi Participants Profile and their level of participation*

S/N	Categories	Ass.	N_1	N_2	P_1	P_2	P_3	P_4
1	Technical Teachers	AVTEN	16	12	11	11	10	3
2	Industry practitioners	NIOB	41	26	21	20	19	4
		Total	57	38	32	31	29	7

Note: Ass= Professional Association of the respective participants; N_1= Number of identified potential participants; N_1= Number of potential participants that agreed to take part in the study; P_1= Number of participants that took part in Round 1; P_2= Number of participants that took part in Round 2; P_3= Number of participants that took part in Round 3; P_4= Number of participants that took part in Round 3

At the end of the review, 16 and 41 potential participants drawn from AVTEN and NIOB respectively were identified. The potential participants were invited through emails and phone calls, however, only 12 and 26 members of AVTEN and NIOB respectively agreed to voluntarily participate in the study. During the first round of Delphi study, all 38 panellists from the two associations participated. In the first round, 32 out of the 38 participants responded to the open-ended questionnaire. While in the second and third rounds, only 31 and 29 participants respectively participated. In the follow-up interview, only seven participants agreed to take part in the interview session.

Garrett and Sharma (2010) and Ager, Stark, Akesson, and Boothby (2010) noted that there is no specific number of participants required for Delphi studies, however, they suggested that there should be between 5-100 participants. Therefore, the number of participants who took part voluntarily in the study up to the final round can be regarded as adequate.

Validity and reliability

Determining the validity and reliability of a Delphi study may be a bit complicated; however, available literature on Delphi studies (Hasson, Keeney & McKenna, 2000; Keeney, Hasson & Mc Kenna, 2001; Okoli & Pawlowski, 2004; Seuring & Müller, 2008) accentuates that certain measures should be observed to ensure the validity and reliability of the results that may emerged from Delphi study. The researchers, therefore, ensure that:

1. The Participants selection processes complied with the established criteria-knowledgeable on the subject with relevant industrial experience. This will ensure and enhance the content validity of the study.
2. The questionnaires sent to the participants are clearly expressed, adequately explained, and fluently presented. This will positively enhance the validity and reliability of the results.
3. The same participants were used in all three rounds of the Delphi study. That would increase the validity of the study.
4. The content analysis on the data obtained in the first round was done independently by two researchers and the reliability coefficient of the coding established quantitatively. This will enhance the reliability of the results.

5. The questionnaire prepared at the end of each round was sent back to the experts for their feedback and reevaluation. Thus, construct validity is inherently ensured.
6. All the details associated with the Delphi process were adequately explained to the participants before each round.

RESULTS

Delphi study by its nature is iterative (Van Zolingen & Klaassen 2003); therefore, the data for this study was collected through the distribution and re-distribution of questionnaires to the selected participants in three Delphi rounds and a follow-up interview (El-Gazzar, Hustad, Olsen, 2016). All the questionnaires were e-mailed to each of the Delphi participants in the three-round- 1, 2 and 3; and five weeks was used to conclude each Delphi round- 2 weeks for the experts to complete the questionnaire, 2 weeks for the researchers to conduct the data analysis, and 1 week for the researchers to summarize controlled feedback before redistributing the results to the experts for another round of the Delphi exercise. The results are presented in detailed descriptions of the three rounds to address the research questions.

Round 1: The Brainstorming Phase

This is the first round of the Delphi exercise. As the name implies, the brainstorming phase is a stage where the expert generates ideas spontaneously for the consideration of the larger group of experts to arrive at a consensus. To achieve this, open-ended questions in line with the research questions were sent to each of the 38 experts by email. However, only 32 responded within the given time frame. The experts were instructed to provide an answer to the open-ended questions raised on Module for the Training of Building Operatives in Tiling Crafts relative to the following categories:

1. Objectives of the Training module
2. Contents of the Training module
3. Instructional methods
4. Methods of evaluation

The experts were also asked to elaborate on each line of opinion where necessary to justify the importance and consequences of the individual entry. They were also given the right to add new categories, subcategories as they deem fit for further consideration. The data obtained from the experts' statements and explanations were collated and analyzed through the instrument of content analysis.

Content analysis is the process of reading and organizing data to draw a general meaning from it. It also involves taking notes; descriptions, classifications, and interpretation of data and presenting the findings with or without predetermined categories (Fraenkel, Wallen & Hyun, 2015). At the end of the exercise, items found to be similar were combined while those with duplicate meanings were expunged. Consequently, 106 items were identified and grouped under the four main components

(Categories) of a typical training module as presented in Table 3. To ensure the reliability of the content analysis, the data obtained in the first round was analyzed and coded independently by two of the researcher(s). The reliability of the coding was established and a coefficient of 0.81 was obtained which according to Uzoagulu (2011) can be regarded as adequate.

Table 3. Delphi "Brainstorming" Phase Result

S/N	Categories	R_1
1	Objectives of the training module	13
2	Contents of the training module	77
3	Instructional method	6
4	Method of evaluation	10
	Total	106

R_1= Number of Items Identified after the brainstorming session- Round 1

All the 106 items that emerged from round one were presented to the panel in round two- The narrowing down phase of the study.

Round 2: The Narrowing-Down Phase

The 32 experts who participated in Round 1 of the study were invited through emails to complete the second round. Based on the feedback received and the content analysis conducted, a questionnaire with a dichotomous scale of "appropriate" and "inappropriate" was developed and sent to them. They were requested to rate the appropriateness or otherwise of each of the revised items. In Delphi study, there are no fixed rules regarding the measure of consensus and when it should be achieved (Keeney, Hasson & McKenna, 2011; Powell, 2013). Thus researchers utilize different sets of statistical tools such as median, mean, percentage among others (Korkmaz & Erden, 2013; Powell, 2003; Putman, Spiegel & Bruininks; 2013).

In this study, the data obtained from round 2 was analyzed using a percentage of total votes obtained for every item under each category. The aim was to narrow down the list of items into a manageable size relative to their importance. Only items chosen by 35% or above of the participants in each category was selected. This produced a shortlist of 95 items out of the 106 that emerged from the first round as presented in Table 4. The use of 35% as a possible threshold to consider an item as being appropriate is borne out of the fact that the researchers need to be careful not to sacrifices other important items that had votes slightly below 40% in each of the categories.

Table 4. Delphi "Narrowing-Down" Phase Result

S/N	Categories	R_1	R_2
1	Objectives of the training module	13	12
2	Contents of the training module	77	70
3	Instructional method	6	5
4	Method of evaluation	10	8
	Total	106	95

R_1= Number of Items Identified after the brainstorming session- Round 1; R_2= Number of Items selected after the narrowing-down session- Round 2

Comparatively, the results of the Round 1 (brainstorming stage) and those of Round 2 (narrowing-down phase) obtained through the reduction analysis present: (1) objectives of the training module (identified = 13 items, selected = 12 items), (2) contents of the training module (identified = 77 items, selected = 70 items), (3) instructional method (identified = 6 items, selected = 5 items), (4) method of evaluation (identified = 10 items, selected = 8 items). Total number of items (identified = 106, selected = 95).

Round 3: The Ranking Phase

In this phase, the 95 items identified as appropriate by the experts in the round 2 exercise were randomly arranged and sent to each of the experts for ranking. This is to enable them determine the relative importance of the items. Kendall's coefficient of concordance (*W*) was used to measure the degree of consensus among the experts on each category of the component of the training module. Kendall's *W* is a non-parametric statistical tool that provides a measure of the consensus among panel participants (Kendall & Gibbons 1990). A coefficient of $W \geq 0.7$ is said to be considered as an indication of a high level of agreement for Delphi studies (Schmidt 1997). The result is presented in Table 5.

The results obtained from the third Delphi round indicated that the Kendall *W* values showed a high level of agreement among the two groups of experts: Technical Teachers (N = 10, $W = 0.81$); Industry Practitioners (N = 19, $W = 0.79$). It can therefore be concluded that there is a high degree of consensus among the experts that participated in the results that emerged from the study.

Table 5. Delphi "Ranking" Phase Result

Category	Sub-Category	Items	T	I
Objectives	-	Understand the concept of tiling and a Tile Fitter	45	38
	-	Understand safety issues associated with tiling	4	3
	-	Identify different types of tiles	94	95
	-	Identify the different design patterns	59	53
	-	Identify the different tiling tools and pieces of equipment and their uses	46	52
	-	Read and Interpret drawing/sketches	95	93
	-	Carry out simple measurement and estimation of tiles for a particular area	16	54
	-	Prepare Mortar for tiling operations	47	34
	-	Prepare background suitable for tiling operations	10	7
	-	Cut tiles to the required size	33	59
	-	Lay tiles based on a predetermined pattern	32	26
	-	Understand problems associated with tiling operations	72	73
Contents	Concept of tiling	Define the term tiling	1	4
		Importance of tiles to building	84	75
		Roles of a Tile fitter in a Construction site	60	60
		Qualities of a good Tiler		
	Safety in tiling	Importance of Safety on site	17	15
		Safety clothing	76	78
		Safety habits	9	8
	Types of tiles	Ceramic Tile	63	74
		Mosaic Tiles	93	92
		Terrazo Tiles	34	27
		Glazed/Unglazed Tiles	2	5
	Design patterns	Tiling with shades	65	62
		Colourful pattern design	78	77
		Straight joint	49	55
		Herring pattern	79	76
		Staggered joints	64	61
	Tiling tools, pieces of equipment and their uses	Measuring Tape	58	51
		Pencil	67	72
		Ruler	75	71
		Wooden Float	29	25
		Tile Cutters	42	50
		Pinchers	52	49
		Line and Pins	3	1
		Try square	74	70
		Calculator	43	58

Table 5. Delphi "Ranking" Phase Result (continuation)

Category	Sub-Category	Items	T	I
		Note pad	18	16
		Spirit level	66	82
		Builder square	31	28
		Mallet	5	9
		Hammer	62	63
		Scribers	49	40
		Brush	83	81
		Watering Can	8	2
	Read and Interpret drawing/sketches	Floor plan	61	57
		Elevations	35	39
		Sections	80	83
	Measurement estimation	Measure a given area using appropriate tools	6	10
		Measure the area of the selected tiles to be used	48	56
		Divide the measured area with the area of the tiles	82	80
		Multiply the quantity obtained by the unit price of each tile	7	6
		Add 2% for contingency	81	79
		Keep a record of the tiles supplied and used	26	22
	Mortar preparations	Selection of materials	88	35
		Batching of materials	81	69
		Determination of the quality of water	89	86
		Correct application of water quantity in the mix	12	14
		Mixing of materials	92	84
		Transportation of mixed materials	25	31
	Background Preparations	Provision of "key" on the wall surface	86	94
		Cleaning of the floor area	20	20
		Levelling the floor area	68	66
		"Screeding" the floor area	91	87
		Wetting the surface area to be tiled	58	30
	Tiles Cutting	Correct use of measurement	82	88
		Correct use of tile cutter	52	46
	Tiles Laying	Soaking the tiles by immersion in water	39	35
		Levelling of background surface	13	11
		Determining "reference point"	53	45
		Embedding the tiles	21	19
		Alignment of tiles unit	71	67
		Making provision of equal or less than 2mm joints	14	18

Table 5. Delphi "Ranking" Phase Result (continuation)

Category	Sub-Category	Items	T	I
		Filling of joint with grout	90	89
		Skirting	40	47
	Problems associated with tiling	Misalignment of tiles unit72	72	68
		Using wrong grouts	27	23
		Provision of inadequate joint	15	13
		Wrong estimate	85	91
		Incorrect measurement	56	41
		Efflorescence	37	34
		Peeling	70	68
Instructional method	-	Demonstration	19	21
	-	Discussion	69	64
	-	Field Trip	23	42
	-	Work-based learning	11	12
	-	Documentary video	73	90
Method of evaluation	-	Ability to identify appropriate tools for the task accomplishment	36	29
	-	Ability to use working tools appropriately	24	17
	-	Ability to read and interpret drawings/sketches	55	43
	-	Ability to measure and estimate the number of tiles needed to cover a particular area	50	44
	-	Ability to conserve materials and supplies	30	24
	-	Ability to comply with all safety measures on-site	54	48
	-	Ability to execute tasks independently	22	32
	-	Ability to complete tasks aesthetically	25	33
		W	0.81	0.79

T= Technical Teachers; I= Industry Practitioners

Follow-up Interview Phase

The purpose of interviews in a Delphi study is to deepen the argument and interrogate the results obtained from the initial three Delphi rounds (El-Gazzar, Hustad, Olsen, 2016). It is a vital tool that will enable the researcher to triangulate the outcomes of the Delphi study thereby increasing the validity of the findings (Day & Bobeva 2005). In this study, all participants who took part in the third Delphi round-ranking phase were invited through emails and phone calls to participate in a follow-up interview. As presented in Table 2, only seven participants agreed to take part in the follow-up interview.

The interviews which were conducted through phone calls and WhatsApp messages dwelled on the four key areas of concern in the study. Each participant was engaged on the issues highlighted during the brainstorming phase, narrowing down phase and the ranking phase. This afforded each of the seven experts the chance to elaborate on the opinions advanced during the three Delphi rounds on the four key areas of concern. The interviews buttress the outcomes of the "ranking phase" and brought to the fore some valuable insights which led to further examination and understanding of the issues of concern. The most significant "take-away" is presented below:

Objectives of the Training module

This is one of the most crucial aspects of the process of the development of the TCTM. As some of the participants put it:

> *Participant 1:* Determining the appropriate objectives is a key to the success or otherwise of this training module, one needs to be very careful so that the objectives that may likely emerge will accommodate what a typical tile fitting job should be. Therefore, understanding certain concepts and related technical information should be the starting point.
>
> *Participant 3:* A training module developer should be meticulous in stating the objectives of such a module. A simple oversight may deprive the trainee a key skill that will incapacitate him/her for life except if extra effort is put in place to acquire it while on the job. For instance, in this study, I forgot to add a very key objective for the module in round 1, but when the questionnaire was resent to me with an option of "appropriate" and "inappropriate" I discovered that it was added as one of the objectives probably by one of the panellist. I was happy.

Contents of the Training module

Contents are usually derived from the objectives of the training module. Therefore, the validity of the contents depends solely on the validity of the objectives. Where the objectives do not align with the requirements for best practices in the vocational skills under consideration, the contents will be inadequate. Some of the participants put it thus:

> *Participant 5***:** it is trite that a training module particularly for vocational skill training must have a built-in mechanism for teaching health and safety-related issues to the trainees, it is only a health worker that can work. That's why I gave the theme a prominent place in my submission. Also, the trainees must understand the different types of tiles and where they can be used.
>
> *Participant 2***:** One of the major duties of a tile fitter is to carry out simple measurement and estimation of the number of tiles needed for a particular job. Underestimation or over-estimation beyond 15% should be discouraged. That's

why the content as it relates to estimation and measurement must have in addition to the necessary technical information, several simple arithmetics as well.

*Participant 4***:** Effective use of tools and equipment must be emphasized, and a tile fitter must understand all the problems associated with tiling and how they can be remedied to achieve excellent results. The trainee must also learn the different tiles pattern and where each can be used. He must learn how to prepare the background by providing "keys", cut the tiles to specification and lay it in line with the predetermined pattern.

Methods of instructional

A training module may be well designed and crafted, but it may not yield a positive outcome if the medium of instruction is faulty. Therefore, in developing a training module, the instructional method should be clearly stated to provide a guide to those that may be saddled with the responsibilities of implementing it. In this follow up interview, some of the participants bare their minds on the various instructional methods that emerged from the three Delphi rounds:

*Participant 7***:** I think the issue of instructional medium is very important, that is why I insist that it must vary depending on the situation. For instance, discussion can be used to pass all the relevant technical information while the demonstration method can be used to show how it can be done in practice such as measuring an area, cutting of tiles to size, "keying" the wall surface preparatory to receive the tiles and so on. It is also important that some practical assignments be given to the trainees and that is where the work-based learning will surface.

Participant 6: I always advise that in every training endeavour, a field trip should form part of the process, this will enable the trainees to learn firsthand how the various task that constitutes the major blocks of the occupation under consideration is done in the real world. That will not only motivate them, but it will supplement whatever that they might learn in the shop to optimum performance.

Methods of evaluation

Evaluation generally is a feedback mechanism to determine how far or how effective the instructional programme is. For this activity to be valid, the instrument to be used must ensure that all the constructs that depict best practices are adequately captured as some of the participants advised in the interview:

Participant 3: Let me ask a simple question: How will I know that you have acquired the necessary skills needed to effectively practice as a Tile fitting craftsman? The answer to this question is what constitutes the evaluation method. In this tiling fitting craft, I can assume the position of an "authority" having practised the craft for eleven years. So, one must look at how the trainee selects

his tools, how he uses the tools, his safety consciousness, his independence in handling tasks and the neatness of the job when completed. When the trainee can show significant evidence that he can do those things competently through a neatly developed rating scale, one can agree that he has acquired appropriate Tiling skills.

DISCUSSION AND CONCLUSIONS

This study was set to develop and validate a model for training tiling fitting craftsmen for the N-Power apprenticeship programme. The use of Delphi technique in the study has presented a path through which it can be deployed in development of a training module for all other vocational skill training programmes. It has also brought to a fore several salient issues associated with programme development which should be recognized by programme developers for the development of robust, comprehensive and implementable training modules.

The importance of harmonious integration of theory and practical in vocational skill training programmes emerged from the findings of this study. According to Wrenn and Wreenn (2009), the balance between theory and practice should be maintained to pass all the necessary technical information to the trainee before getting the hands-on experience. In this study, for instance, the need for safety training emerged as one of the key areas that the trainees should be exposed to in the course of their training. The rationale for it cannot be far fetched, since "it is only a healthy worker that can work". Considering the rise in occupational hazards in recent times (Idubor & Osiamoje, 2013) and the unpleasant consequences associated with it, the need for workers to be safety conscious and ensure strict compliance with all the established safety protocols become necessary. The different types of tiles and their design pattern were also identified as one of the key areas that trainee should be conversant with in the course of his training. This is to enable him make an informed decision while guiding his client in the selection process. This can be achieved through knowledge acquisition.

The outcome from this study also revealed the vital roles of basic science and mathematics in tiling craft skill training. The measurement and estimation which is one of the major objectives that emerged in the training module underscore the fact that the construction budgeting process requires sound knowledge of mathematics to be effectively carried out. Where that is not done correctly, other ugly issues of budget overruns (Sweis, 2013) and delay (Jarkas & Younes, 2014) will set in which may alter the cash flow of the potential client thereby questioning the professional wellbeing of the Tile fitter. This may be the reason why Cruickshank (2018) stress the need for an interdisciplinary approach to curriculum development particularly in the selection of related learning experiences to give the trainee/student broad-based knowledge which may be consciously or unconsciously useful in the course of the trainees' professional growth.

Evidence emerging from the outcome of this study also suggests that effective vocational skills can only be acquired where tools and equipment are readily available for the training programme. Tiling craft for instance, requires different kinds of tools and equipment, where these tools are not available, the practical component which is expected to constitute more than 75% of the training programme cannot proceed. Audu, Aede, Yusri and Muhammad (2013) opined that the inability of most trainees to perform excellently in the field of work can be largely attributed to either inadequacy or non-availability of tools and equipment needed for their training. It is therefore imperative that tools and equipment are captured on the concurrent list of every planned skill training programme.

LIMITATIONS AND IMPLICATIONS FOR FUTURE STUDIES

This study makes a significant contribution to the process needed to arrest the visible decline in the apprenticeship system of training in Nigeria. The study utilizes mix design method incorporating both the qualitative and the quantitative approaches as obtain in a typical Delphi study. Also, Technical teachers and industry practitioners were used as participants (experts) thereby enhancing the diversity of the experts' opinions which is projected to have strengthened the outcome of the consensus. However, despite the vigorous approach adopted in this study, there are still some limitations particularly as it relates to the sample size and selection of the participants. In this study, only members of the NIOB and AVTEN participated in the study.

However, this study provides a basis for future research in the development and validation of training modules for other vocational skill areas. The use of a larger sample size and incorporating the "sample of laymen" in the participants' selection process in future research can further strengthen the validity of the training module.

ACKNOWLEDGEMENT

The authors wish to register their sincere gratitude to the panellist who voluntarily took their time despite their tight schedule to participate in this study.

REFERENCES

Adekola, G. (2013). Traditional apprenticeship in the old Africa and its relevance to contemporary work practice in modern Nigerian communities. *British Journal of Education, Society and Behavioural Science,* 3(1), 397-406

Ager, A., Stark, L., Akesson, B. and Boothby, N. (2010). Defining best practices in care and protection of children in crisis-affecting settings: A Delphi study. *Child Development*, *81*(1), 1271-1286

Andersson, I. and Wärvik, G. (2015). Formation of apprenticeships in the Swedish education system: Different stakeholder perspectives. *International Journal for Research in Vocational Education and Training,* 2(1), 1-24. doi: 10.13152/IJRVET.2.1.1

Anyanwu, F. N.; Nzewi, U. M. and Akudolu, L. R. (2004). *Curriculum Theory and planning.* Nsukka: University Trust Publishers.

Audu, R., Aede, H. M., Yusri, B. K. and Muhammad (2013). *Provision of workshop tools and equipment: Necessity for technical vocational education graduates skills acquisition*. A paper presented at the 2nd International Seminar on Quality and Affordable Education.

Auta, M. A., Giwa, M., and Nnajiofor, F. N. (2020). Self-validation of N-Power build trainees' skills acquisition: A mechanism for revitalizing apprenticeship training system in Nigeria. *Puissant*, *1,* 88-97.

Billett, S. (2014). The standing of vocational education: sources of its societal esteem and implications for its enactment. *Journal of Vocational Education &Training*, 66(1), 1-21.

Buhttah, T. M., Xiaoduan, C., Ullah, H. and Jave, S. (2019). Analysis of curriculum development stages from the perspective of Tyler, Taba and Wheeler. *European Journal of Social Sciences,* 58(1), 14-22

Creswell, J. W. (2013). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches.* Thousand Oaks, CA: SAGE.

Cruickshank, V. (2018). Considering Tyler's curriculum model in health and physical education. Journal of *Education and Educational Development*, 5(1), 207-214

Dalkey, N., & Helmer, O. (1962). An experimental application of the Delphi method to the use of experts. *Management Science,* 9(3), 458-467.

El-Gazzar, R., Hustad, E. and Olsen, D. H. (2016). Understanding cloud computing adoption issues: A delphi study approach. *The Journal of Systems & Software, 118(1*), 64-84. doi: 10.1016/j.jss.2016.04.061

Fajobi, T. A., Olatujoye, O. O., & Adedoyin, A. (2017). Challenges of apprenticeship development and youths unemployment in Nigeria. *Sociology and Criminology,* 5(2), 1-8. doi: 10.4172/2375-4435.1000172.

Federal Government of Nigeria (2020). *N-Power informational guide*. Abuja: NERDC Press

Fraenkel, J. R., Wallen, N. E., & H. H. Hyun. (2015). *How to design and evaluate research in education.* New York: McGraw-Hill Education.

Fuller, A., & Unwin, L. (2011). Apprenticeship as an evolving model of learning. *Journal of Vocational Education & Training*, 63(3), 261-266.

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing*, 32(4), 1008-1015.

Idubor, E. E. and Osiamoje, M. D. (2013). An exploration of health and safety management issues in Nigeria's effort to industrialize. *European Scientific Journal,* 9(12), 154-169.

Jarkas, A. M. and Younes, J. H. (2014). Principal factors contributing to construction delays in the state of Qatar. *International Journal of Construction Project Management,* 6(1), 39-62.

Keeney, S., Hasson, F., & Mc Kenna, H. P. (2001). A critical review of the Delphi technique as a research methodology for nursing. *International Journal of Nursing Studies*, 38(2), 195-200.

Keeney, S., Mc Kenna, H., & Hasson, F. (2011). *The Delphi technique in nursing and health research*. Oxford: John Wiley & Sons.

Kendall, M. & Gibbons, J. (1990). *Correlation Methods*, Retrieved: https://scholar.google.no/scholar?q=kendall+and+gibbons&btnG=&hl=en&as_sdt=0%2C5#4

Kliebard, H. M. (1995). The Tyler rationale revisited. Journal of Curriculum Studies, 27(1), 81-88

Lau, D. (2001). Analysing the curriculum development process: three models. *Pedagogy, Culture and Society, 9*(1), 29-44.

Linstone, H. A. and Turoff, M. (2002). Introduction. In Linstone, H. A. and Turoff, M. (Eds). *Delphi method: Techniques and applications.* Retrieved https://web.njit.edu/~turoff/pubs/delphibook/delphibook.pdf

Mitroff, I. and Turoff, M. (2002). Philosophical and methodological foundations of Delphi. In Linstone, H. A. and Turoff, M. (Eds). *Delphi method: Techniques and applications.* Retrieved https://web.njit.edu/~turoff/pubs/delphibook/delphibook.pdf

Nworie, J. (2011). Using the Delphi technique in educational technology research. *Tech Trends, 55*(5), 24–30.

Okoli, C. & Pawlowski, S. D. (2004). The Delphi Method as a Research Tool: An Example, Design Considerations and Applications. *Information & Management*, 42(1), 15–29. doi:10.1016/j.im.2003.11.002

Olaitan, S. O. (2003). *Understanding curriculum.* Nsukka: Ndudim Press and Publishing Company.

Osinbajo, Y. (2018). *N-Power build is this administrations' strategy for creating skilled technical personnel in Nigeria.* Accessed at http://medium.com/@vicePresidentNG/n-power-build-is-this-administration-strategy-for -creating-skilled-technical-personnel-in-Nigeria-3e779d6c685b

Powell, C. (2003). The Delphi technique: Myths and realities. *Journal of Advanced Nursing, 41*(4), 376-382.

Putnam, J. W., Spiegel, A. N., & Bruininks, R. H. (2013). Future directions in education and inclusion of students with disabilities: A Delphi investigation. *Exceptional Children, 61*(6), 553-576.

Ryan, P. (2000). The institutional requirements of apprenticeship: Evidence from smaller EU countries. *International Journal of Training and Development*, 4(1), 42-65. doi: 10.1111/1468-2419.00095.

Seuring and Müller (2008). Core issues in sustainable supply chain management: A Delphi study. *Business Strategy and the Environment, 17*(1), 455-466

Skulmoski, G. J., Hartman, F. T. and Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education, 6*(1), 1-21.

Sweis, G. J. (2013). Factors affecting time overruns in public construction projects: The case of Jordan. *International Journal of Business and Management, 8(23)*, 120-129.

Tyler, R. (1949). *Basic principles of curriculum and instruction.* Chicago: University of Chicago Press.

Ugochukwu, S. C. and Onyekwena, T. (2014). Participation of indigenous contractors in Nigeria public sector construction projects and their challenges in managing working capital. *International Journal of Civil Engineering, Construction and Estate Management,* 1(1), 1-21.

Uzoagulu, A.E.(2011). *Writing research project reports in tertiary institutions*. Enugu: John Jacob's Classic Publishers Ltd

Van Zolingen, S. J., & Klaassen, C. A. (2003). Selection processes in a Delphi study about key qualifications in senior secondary vocational education. *Technological Forecasting and Social Change*, *70*(4), 317–340. doi:10.1016/S0040-1625(02)00202-0

Wrenn, J. and Wrenn, B. (2009). Enhancing learning by integrating theory and practice. *International Journal of Teaching and Learning in Higher Education, 21*(2), 258-265.

Author's Biography

Mohammed A. Auta is a Lecturer in the Department of Technology and Vocational Education, Nnamdi Azikiwe University Awka-Nigeria. He is a specialist in the areas of Building/Woodwork Technology. His Core areas of research interests are Vocational Skills Training Design, Development, Monitoring and Evaluation.

Musibau Giwa is a Lecturer in the Department of Building Technology, Federal College of Education (Technical) Asaba-Nigeria.

Eric K. Gowon is a Lecturer in the Department of Vocational and Technical Education, Benue State University Makurdi-Nigeria.

Aishatu Buba is a Lecturer in the Department of Technology Education, Modibbo Adama University Yola-Nigeria.

Tukur Tafida is a Lecturer in the Department of Technology Education, Modibbo Adama University Yola-Nigeria.

APPENDIX A
TILING CRAFT TRAINING MODULE

Topic/Performance Objectives	Contents	Instructional Materials	Instructional Methods
Topic 1 Understand the concept of tiling and a Tile Fitter	1. Define the term tiling 2. Importance of tiles to building 3. Roles of a Tile fitter in a Construction site 4. Qualities of a good Tiler	Any of the following Instructional material or in concert with other relevant instructional materials can be used: • Pencil • Ruler • Wooden Float • Tile Cutters • Pinchers • Line and Pins • Try square • Calculator • Note pad • Spirit level • Builder square • Mallet • Hammer • Scribers • Brush • Watering Can • Relevant Text Books	Any of the following methods or in concert with other relevant methods can be used: • Demonstration • Discussion • Field Trip • Work-based learning • Documentary video
Topic 2 Understand safety issues associated with tiling	1. Importance of Safety on site 2. Safety clothing 3. Safety habits 4.		
Topic 3 Identify different types of tiles	1. Ceramic Tile 2. Mosaic Tiles 3. Terrazo Tiles 4. Glazed/Unglazed Tiles		
Topic 4 Identify the different design patterns	1. Tiling with shades 2. Colourful pattern design 3. Straight joint 4. Herring pattern 5. Staggered joints		
Topic 5	1. Measuring Tape		**Method of Evaluation** Any of the following methods of evaluation or in concert with other relevant methods can be adopted in the development of the

Identify the different tiling tools and pieces of equipment and their uses	2. Pencil 3. Ruler 4. Wooden Float 5. Tile Cutters 6. Pinchers 7. Line and Pins 8. Try square 9. Calculator 10. Note pad 11. Spirit level 12. Builder square 13. Mallet 14. Hammer 15. Scribers 16. Brush 17. Watering Can	assessment instrument: • Ability to identify appropriate tools for the task accomplishment • Ability to use working tools appropriately • Ability to read and interpret drawings/sketches • Ability to measure and estimate the number of tiles needed to cover a particular area • Ability to conserve materials and supplies • Ability to comply with all safety measures on-site • Ability to execute tasks independently • Ability to complete tasks aesthetically
Topic 6 Read and Interpret drawing/sketches	1. Floor plan 2. Elevations 3. Sections	
Topic 7 Carry out simple measurement and	1. Measure a given area using appropriate tools 2. Measure the area of the selected tiles to	

estimation of tiles for a particular area	be used 3. Divide the measured area with the area of the tiles 4. Multiply the quantity obtained by the unit price of each tile 5. Add 2% for contingency 6. Keep a record of the tiles supplied and used		
Topic 8 Prepare Mortar for tiling operations	1. Selection of materials 2. Batching of materials 3. Determination of the quality of water 4. Correct application of water quantity in the mix 5. Mixing of materials 6. Transportation of mixed materials		
Topic 9 Prepare background suitable for tiling operations	1. Provision of "key" on the wall surface 2. Cleaning of the floor area 3. Levelling the floor area 4. "Screeding" the floor area 5. Wetting the surface area to be tiled		
Topic 10 Cut tiles to the required size	1. Correct use of measurement 2. Correct use of tile cutter		

Topic 11 Lay tiles based on a predetermined pattern	1. Soaking the tiles by immersion in water 2. Levelling of background surface 3. Determining "reference point" 4. Embedding the tiles 5. Alignment of tiles unit 6. Making provision of equal or less than 2mm joints 7. Filling of joint with grout 8. Skirting		
Topic 12 Understand problems associated with tiling operations	1. Misalignment of tiles unit 2. Using wrong grouts 3. Provision of inadequate joint 4. Wrong estimate 5. Incorrect measurement 6. Efflorescence 7. Peeling		