

Developing Skill Assessment Tool in Setting-Out of Building for Effective Evaluation of Psychomotor Skills by Technical Teachers in Akwa Ibom State

Okon Etim Okon & A. D. Usoro (PhD)

Industrial Technology Education

Faculty of Vocational Education, Library and Information Science
(VELIS), University of Uyo

Abstract

The study sought to develop skill assessment tool in setting-out of Building for effective evaluation of psychomotor skills by technical teachers in Akwa Ibom State, three purposes, three research question were poised to guide the study. Research and development (R and D) design was adopted for the study. The study covers all Public Technical Colleges in Akwa Ibom state. Akwa Ibom state. The population for the study was 179 respondents, comprising 138 senior technical II (ST2) students, 25 building and concrete works technical college teachers and 16 tertiary education lecturers with majors in Building Technology. The sample size was 138 respondents. This comprised 108 ST 11 students from two intact classes, 20 building construction works technical college teachers and 10 lecturers with majors in Building Technology. Purposive sampling was used in sampling the respondents used for the sample. The instruments developed by the study were the "Task Instructional Sheet in Setting-out Checklist (TISSC)" and the Setting-out "Psychomotor Assessment Checklist for Technical Colleges" (FSPACTC). The "Task instructional sheet in Setting-out Checklist (TISSC)" instrument was designed with a five-point rating scale with response and weighted options ranging from 1,2,3,4 and 5. The real limits of scale values are presented as follows: 0.5 - 1.49 Not Appropriate (NA), 1.50-2.49 Lowly Appropriate (LA), 2.50-3.49 Moderately Appropriate (MA), 3.50-4.49 Highly Appropriate (HA), 4.50 -5.00 Very Highly Appropriate (VHA). The task instructional sheet in setting-out was face and content validated by experts. The experts from the Department of Industrial Technology Education, University of Uyo, This allowed the researcher to administer the instrument twice on the students with a time lapse of two weeks. Pearson product moment correlation (PPMC) was used to determine the reliability index. This gave a value of 0.87. The Mean ($\bar{x}$) and standard deviation (σ) were used to answer the research question. Pearson Product Moment Correlation Coefficient was used for determining the stability of the FSPACTC. Lawshe content validity ratio was used to determine the quantitative content validity index. The recommended alpha coefficient of 0.70 was used to set the criteria for the reliability coefficient test score acceptability limit. From the findings it was recommended among others that teachers at technical colleges should downplay the use of product assessment only, but rather combine both product assessment method and process assessment as advocated by the Foundation and Setting-out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)". Hence it was concluded that the developed "Setting-out Psychomotor Assessment Checklist for Technical Colleges (SPACTC)" is valid and reliable to be used by technical teachers for assessing practical skills in setting-out of Building.

Keywords: Assessment, Development, Setting-Out, Psychomotor Skills

Introduction

Building construction is an aspect of Technical vocational education. It could be viewed as Technical Vocational Education Training (TVET) type of education whose main purpose is to prepare persons for work. Technical Vocational education and Training leads to practical and applied skills. Skill is the ability to perform a task well. Work skills are designed to enhance learners' employability chances. Building construction students are expected to work with tools, materials equipment and machines to carry out preliminary site operations, block wall construction and finishing. Building construction is designed to produce building technicians for the construction and building industry.

The curriculum for building construction designed by the National Board for Technical Education (NBTE) is made up of (40%) theory and (60%) practical. The aim of this arrangement is to enhance technical skills acquisition by students. It is generally agreed that skills acquisition by students is the result of learning, prompted by the teaching activity by the teacher and produced by the student. A curriculum model suitable for Technical Vocational Education and Training (TVET) is a simplified representing elements in the curriculum as it provides a structure for examining the variables. Curriculum development could be looked at in two ways: as 'process' and 'product'. As the terms imply 'process' is concerned with the methods and means 'how' whereas the 'product' looks at the outcomes, the end product 'what'. The Wheeler model of curriculum development, or cyclic model, asserts that curriculum should be a continuous cycle which is responsive to changes in the education sector and makes appropriate adjustments to account for these changes. It focuses on situational analysis: the context in which the curriculum decisions are taken is considered important, as this is believed to help make the most effective decisions. This model is comprised of five interconnected stages:

- i. Aims, goals and objectives
- ii. Selection of learning experiences
- iii. Selection of content
- iv. Organisation and integration of learning experiences and content
- v. Evaluation

Aims, Goals and Objectives of this model covers all the experiences provided in the curriculum. Goals are tied to specific subjects or group of content within the curriculum; while Objectives describe more specific outcomes as a result of lessons or instructions delivered at a classroom. Learning experiences - Learning experiences is an activity which the learners engages in which the results in his behavior. Content- Content is what we teach. It must be related to validity, significance, utility, interest and learnability. Evaluation- The former has clear objectives and aligned assessment strategies designed to test how well students have achieved the learning outcomes. Wheeler model sets the school objectives as final steps in as well as the first.

Benefits of Wheeler model includes: Continuing activity, Incorporates new information into the curriculum, Views curriculum elements as interrelated and interdependent. Has feedback mechanism, emphasize on the situational analysis, evaluate at a stage where its findings are feedback into the objectives.

Once the cycle has been followed once, it begins again at step one and continues onward to continuously improve the curriculum in the face of any changes that may have been imposed or come about naturally. It is different from other models in that 'selection of learning experiences' comes before 'selection of content': it specifically gears the content in the curriculum to learners. The implication of this theory to this research is that instructional alignment demands a match between what is intended to be taught, what is intended to be evaluated and what is intended to be learnt. Such a process as outlined by wheeler supports instruction in PBL, by beginning with selecting objectives and using the objectives as inputs to the process, while also allowing for review and evaluation at every stage of development. PBL is a constant search for knowledge by students. it supports the idea of reviewing the process and approach if a particular solution does not fit the objective as stated for the learning.

Since vocational training is task oriented and enables trainees to perform expected tasks, training must be systematically identified, organized and managed in order to achieve its expected results. Again, since training is carried out to improve skills performance, the effects of training can actually be seen through performance. Thus, trainees should acquire the expected skills during training. A trainee is expected to change his/her behaviour in an expected direction and at the end of the training should attain the expected level of skills in order to perform the expected job successfully. Therefore, in a training set-up, there should be a systematic procedure to observe whether trainees are changing their behaviours in the expected direction and acquiring the expected skills at the expected standard of performance. This is often known as skills assessment in technical education.

Assessment according to Lamas (2015) is defined as the set of planned procedures which are implemented in the educational process to obtain information necessary to evaluate the achievement of students' educational outcomes/skills training. Through its valuation criteria, skills performance is presented as a level of proficiency or performance seen in certain tasks that the student is able to perform. All assessment efforts are to measure appropriately students' level of proficiency and the extent to which students perform these tasks and meet the criteria. Conceptual pedagogy proposes the following categories to identify proficiency levels: elemental (contextualization), basic (understanding) and advanced.

Tafida and Gwarzo (2021) carried out an analysis of building setting out and foundation skills acquired by national certificate of education students in colleges of education and polytechnics in north west, Nigeria. This study compared Setting out and foundation skills

acquired by the NCE III building students in Colleges of Education and Polytechnics institutions awarding NCE in Northwest, Nigeria.

The study revealed among others that there is no significant difference between the setting out of building skills acquired by Building Technology students of Polytechnics and Colleges of Education in North West, Nigeria.

Okoye and Auta (2020) developed and validated an instrument for assessing students' practical skills in building super-structure operations in Nigerian secondary schools. Five research questions guided the study. The study adopted instrumentation design. The area of the study was Taraba State. The population for the study was 107 comprising 82 final year senior secondary school building

. Based on the findings, it was recommended among others that the major examination bodies should ensure that practical task and skill items of all the major operations found in building construction curriculum are included in their instrument for the conduct of terminal examinations. NERDC should ensure that appropriate and comprehensive guidelines on methods of assessing building construction subject are embedded in the curriculum for proper guidelines.

Nahadi and Erlis (2016) studied performance assessment instrument to assess the senior high students' psychomotor for the salt hydrolysis material. The design used in this study was the Research and Development which consists of three phases: development, testing and application of instruments. The results showed that 16 of 17 tasks of performance assessment instrument developed can be stated to be valid with CVR value of 1,00 and 0,714. While, the rest was not valid with CVR value was 0.429, below the critical value (0.622). In the test phase, reliability value of instrument obtained were 0,951 for the five-student group, 0,806 for the six-student group and 0,743 for the eight-student group. From the interviews, teachers strongly agree with the performance instrument developed. They stated that the instrument was feasible to use for maximum number of students were six in a single observation.

Wening and Siti (2020) investigated project-based psychomotor assessment instruments to increase student competencies in the 21st century. This research and development aim to produce a project-based psychomotor assessment instrument that was valid and appropriate according to the demands of student competence in the 21st century. The project was given in the form of creating social media accounts and online marketing using social media Facebook, Twitter, and Pinterest.

The data generated were analysed using factorial analysis, Cronbach's Alpha Coefficient. A test of three tasks with 24 process skill items was used to determine ability groups of students. While the three hypotheses were tested at .05 level of probability using analysis of variance (ANOVA), the Scheffe multiple comparison tests was utilized to calculate the degree of agreement in the raters rating scores. The results of the data analysis relating to reliability of the instrument. Workshop-based process skill test (WBPST) revealed co-efficient of 71 for grinding operation, 82 for drilling operation and .83 for fitting operation with the overall coefficient of .79.

Psychomotor skills according to Caleb (2019) is often referred to as process or practical work skills in technical education cannot be actually assessed through oral or written examination of the students. The appropriate process of assessment requires a set of tasks to be performed practically. Essential to such an assessment is also the need to detail the degree of accuracy that is necessary in performing the tasks as well as the weighted values for each category of the observable skills. A trainer can assess the effectiveness of training by observing the level of performance demonstrated by a trainee at the end of the training. In order to judge whether or not a trainee has attained the expected level of performance, a trainer has to systematically observe and assess trainee performance and compare the demonstrated performance with the expected standard of performance (Neil, 2020). The effective application of the psych productive model in skills training and assessment would lead to the production of competent manpower for the construction industry.

However, the process of practical skill assessment in technical education may not be easy. As averred by Adekunle (2020), assessment of skills acquisition without valid and reliable criteria could be subjective and bound to bias or deficiency of skills. The Building trade curriculum emphasized tasks and skills that students are expected to acquire in designing of building plans, interpretation of building plans, site preparation leveling, setting out of building, block-laying, plastering and rendering of walls, fitting and finishes among other operations. Each of these operations has tasks that are performed through a sequence of practical activities or skills in relations with the objectives of instruction. Okwori *et al.* (2013) asserted that the knowledge, skills and application of manipulative skills required to perform various building construction tasks must be properly evaluated, hence, the need for building and construction skill assessment instrument.

Reliability of a measuring instrument according to Ofuebe and Izueke (2017) is the ability of the instrument to measure consistently the phenomenon it is designed to measure. The use of valid and reliable practical skill test for assessing technical college students in Blocklaying and concreting will provide an effective means for evaluating both process and product skills acquired by the students in carrying out tasks.

In technical education, assessment has to be comprehensive evaluation, including three aspects, namely the cognitive, affective and psychomotor assessments. Therefore, it is necessary for an assessment instrument development procedure to better assess psychomotor and precisely measure the indicators expected within the learning competence. Evaluation is an aid to training and essential for skills acquisition. This research work intends to scientifically develop a skills assessment tool for building construction for application by technical college teachers.

Statement of the Problem

Building Technology trade teachers in Technical Colleges are expected to evaluate students' psychomotor skills using a combination of process and product assessment methods.

However, observations by the researcher reveals that practical activities are being assessed based on the completed work alone (product) by the teachers. The current practice has made it impossible for the full achievement of the objectives of technical colleges. This is because procedural steps to arrive at the completed project are not properly assessed.

It was also observed that marks are awarded to the students based on what the teacher thinks the students deserve, without recourse to experimental observation and applying proven standards to scoring students using well designed assessment instrument. This method of awarding marks to students as the teacher feels is considered subjective and biased. The implication of this is that current assessment methods practiced in technical colleges in Akwa Ibom State seems ineffective in revealing the actual level of skills possessed by the students. Thus, valuable feedback is lost to the educational process, while affecting the grading of students and their actual employability.

A well-designed assessment instrument is essential for objective and reliable assessment of tasks performance in technical education programmes. The implication is that the scores and grades assigned to students in practical works by the teachers may not be true representative of students' performances. It is against these reasons that this study is designed to develop and validate an instrument for assessing students' skills performance in Building Construction in Technical Colleges Akwa Ibom State.

Purpose of the Study

The purpose of the study was to develop and validate skill assessment tool in setting-out for effective evaluation of psychomotor performance by technical teachers in Akwa Ibom State. In specific terms, the study sought to:

1. Determine the appropriate psychomotor task items in setting-out for inclusion in the assessment instrument for evaluating psychomotor performance in technical colleges.
2. Develop an assessment instrument for evaluating psychomotor performance in setting-out by technical college teachers.
3. What is the skills level of Building Construction students in setting out when assessed using Setting-out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)?

Research Questions

The following research questions were stated for the study

1. what are the appropriate psychomotor task items in setting-out for inclusion in the assessment instrument for evaluating psychomotor performance in technical colleges?
2. what are the developed an assessment instrument for evaluating psychomotor performance in setting-out by technical college teachers.?
3. What is the skills level of Building Construction students in setting out when assessed using Setting-out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)?

Methodology

Research and development (R and D) design was adopted for the study. Developmental study is useful when developing new methods and processes for implementing existing models or using existing tools, (Richey and Klein, 2014) Therefore, R and D is suited for this study as it seeks to analyze, design, develop and validate a new product/service - PBL instructional packages in electrical installation and maintenance for use by technical teachers.

Area of the Study

The study covers all Public Technical Colleges in Akwa Ibom state. Akwa Ibom state is in the South-South Geopolitical zone of Nigeria. Building and construction work is one of the clusters of programmes offered in Technical Colleges in Akwa Ibom State, with the objective of training qualified craftsmen for industries. To take advantages of these opportunities presenting itself as the state opens up to industrialization, the local population needs to be trained and equipped with the necessary skills required to participate in the new economy, otherwise, juicy job opportunities created locally, may have to be filled up with migrant and more occupationally mobile workers from neighbouring states.

Population of the Study

The population for the study was 179 respondents, comprising 138 senior technical II (ST2) students, 25 building and concrete works technical college teachers and 16 tertiary education lecturers with majors in Building Technology. The lecturers were taken as experts who were involved in instrument development. Both the teachers and experts were involved in the validation process for the developed assessment tool.

Sample and Sampling Technique

The sample size was 138 respondents. This comprised 108 ST 11 students from two intact classes, 20 building and concrete works technical college teachers and 10 lecturers with majors in Building Technology. Purposive sampling was used in sampling the respondents used for the sample. Thus, experts, both Technical Teachers and Lectures who actually teaches foundation laying and setting out were used as sample and only schools with provision for practical work assessment were used for the study. The two schools were randomly assigned to control and experimental groups. The control group with 55 students, was treated with the teacher made assessment test, while the experimental group with 53 students was treated with assessment instrument developed by the study.

Instrument for Data Collection

The instruments developed by the study were the “Task Instructional Sheet in Setting-out Checklist (TISSC)” and the Setting-out “ Psychomotor Assessment Checklist for Technical Colleges” (FSPACTC).

The “Task instructional sheet in Setting-out Checklist (TISSC)” is sequenced with task sheet detailing tasks that are required for completion of setting-out. The instrument was designed to help teachers during the process of assessing students’ psychomotor skills in setting-out. The instrument was designed with a five-point rating scale with response and weighted options ranging from 1,2,3,4 and 5. The real limits of scale values are presented as follows:

0.5 -1.49	Not Appropriate (NA)
1.50-2.49	Lowly Appropriate (LA)
2.50-3.49	Moderately Appropriate (MA)
3.50-4.49	Highly Appropriate (HA)
4.50 -5.00	Very Highly Appropriate (VHA)

The questionnaire had four Sections (A, B, C and D) with a total of 51 items covering tasks in setting-out of building skills areas-Profile set-up skills, Batterbaord erection skills, setting out skills.

The instrument was developed from the literature and a review of various texts was used to generate items for the instrument. The assessment instrument was also developed using the NBTE curriculum. The Setting-out Psychomotor Assessment Checklist for Technical College (SPACTC) is a competency-based assessment tool derived from the syllables, ensuring that emphasis is placed on performance and demonstration of learning. This was used to assess the students’ performance during the practical session. The checklist items attempted to measure the rate of skills acquisition with respect to Setting-out

Validation of the Instrument

The task instructional sheet in setting-out was face validated by experts. The questionnaire was given to three experts who reviewed the instrument to ensure that it measures what it was intended to measure. The experts from the Department of Industrial Technology Education, University of Uyo, Specifically, in the building technology unit assessed the instrument in terms of appropriateness of material to the constructs under study.

Content validation was also carried out on the task instructional sheet in setting-out The development of a content valid instrument is typically achieved by a rational analysis of the instrument by raters (experts) familiar with the construct of interest or experts on the research subject. Specifically, experts (Lecturers) in building Technology reviewed all of the contents of the instructional package for readability, clarity and comprehensiveness and came to some level of agreement as to which items should be included in the final instrument.

In determining the quantitative content validity of the process component of the task sheet, Lawshe’s content validity ratio (CVR) method was employed. From the result of analysis, the Scale-Content Validity Index (S-CVI) ranges from 0.71- 1.0. Eighteen items have scale content validity index (S-CVI) of 0.71 while the rest have CVI of 1.0. A CVI of 0.71-

0.79 indicates that the item should be revised, while a CVI of 0.80-1.0, indicates that the task is appropriate and should be included.

3.5.2 Reliability of the Instrument

The task instructional sheet in setting-out was administered through a trial testing on 20 technical college students who were not part of the study but were on the parent population. Test-retest reliability method was employed. This allowed the researcher to administer the instrument twice on the students with a time lapse of two weeks. Pearson product moment correlation (PPMC) was used to determine the reliability index. This gave a value of 0.87.

Method of Data Collection

The process of data collection began with the development of item pool, which began with occupational analysis and studying the syllables to know what areas are covered and what to assess. After the reliability was ascertained, the assessment instrument was then implemented using Senior Technical 11 students in Building Technology works in the two Technical Colleges.

Method of Data Analysis

The data generated were analysed using Mean, standard deviation, Pearson product moment correlation and Lawshe content validity formula. The Mean ($\bar{x}$) and standard deviation (σ) were used to answer the research question. Pearson Product Moment Correlation Coefficient was used for determining the stability of the FSPACTC. Lawshe content validity ratio was used to determine the quantitative content validity index. The recommended alpha coefficient of 0.70 was used to set the criteria for the reliability coefficient test score acceptability limit. Principal component analysis was used to determine the construct validity of the developed FSPACTC.

Results

Research Question 1: What are the appropriate psychomotor task items in setting-out for inclusion in the assessment instrument for evaluating psychomotor performance in technical colleges?

Table 4.1: Summary of Mean Responses of Experts on Appropriate Psychomotor Assessment Tasks Assessment in Setting out of Building

S/N	Sub-items to be Evaluated in Setting out of buildings	Mean	Std Dev	Remarks
1	Correctly interpret building drawing	3.69	0.97	HA
2	locating boundary lines	3.40	1.67	HA
3	accurately marking of the corners of the building	3.11	1.27	HA
4	Replicating the building dimension in the plan on the site using pegs	3.39	1.71	HA
5	Proficiency in driving pegs into the corners of the boundary	3.62	1.50	HA

6	Correct placement of boundary pegs	3.71	1.03	HA
7	Checking the lengths of the sides to conform with dimensions	3.76	0.98	HA
8	Use of stringlines to mark the boundary pegs	3.90	0.74	HA
9	Marking the position of inside walls, doors, and windows on the boards.	3.93	0.76	HA
10	Location of the two boundary pegs that identify the front boundary	3.80	0.77	HA
11	set a taut stringline between two front boundary points	3.70	1.15	HA
12	Location of the two survey pegs that identify the side boundary	3.89	0.76	HA
13	Setting a taut stringline between these two boundary lines.	3.57	1.12	HA
14	Use of temporary timber pegs running over the centre point of the boundary pegs	3.79	0.88	HA
15	Determining the front and side setbacks of the building	4.01	0.64	HA
16	Identify the width of the building from the site plans and place a temporary peg at first corner of the building by measuring the distances from the first corner (width) and the front boundary (setback)	3.94	0.72	HA
17	Placing of a temporary peg at first corner of the building by measuring the distances from the first corner (width) and the front boundary (setback)	3.57	1.12	HA
18	Identifying the depth of the house from the site plans	4.16	0.62	HA
19	Placing a temporary peg at the second corner by measuring the distances from the first corner (depth) and the side boundary (setback).	3.57	1.12	HA
20	Place a temporary peg at third corner of the building by measuring the distances from the 3 rd corner (width) and corner 2 (depth).	4.16	0.62	HA
21	saddle profile Preparing skills	4.09	0.68	HA
22	Preparing hurdle profiles	4.04	0.72	HA
23	Preparing corner profiles	4.02	0.78	HA
24	Preparing Continuous profile	3.96	0.91	HA
25	Setting up profiles 2–3 m from the proposed building outline	4.09	0.68	HA
26	Erect the ledger of a profile so that it is approximately level across its top	1.12	0.61	NA
27	Use a spirit level to check each profile after it has been driven into the ground	1.24	1.50	NA

28	Skills in setting up step profiles along a slope/steep place	1.70	0.18	NA
29	Transferring building measurements from drawing to profile boards	4.09	0.66	HA
30	Placing nails on profile boards using building dimensions	3.51	1.33	HA
31	Install the first profiles A and B approximately 2–3 m from the temporary pegs used to mark the corners of the proposed building.	3.83	0.86	HA
32	Use a spirit level to make sure each ledger is level across the top face and an optical or laser level to check that both profiles are approximately level with each other.	1.02	0.73	NA
33	Measure the front setback from the front boundary to the profiles	3.91	0.86	HA
34	Use a spirit level to transfer the measured position from the ground to the top of each ledger.	3.90	0.87	HA
35	Fix a nail in the top of each ledger at the mark and set the stringline A–B taut between the nails to create the building line for the front of the proposed building.	3.72	1.05	HA
36	Positioning of the second set of profiles between the other ends of the boundaries C and D and checking that they are approximately level with each other and all other profiles in the set-out	3.91	0.86	HA
37	Set the stringline C–D for the side building line of the proposed building	3.14	1.00	HA
38	If the proposed building has right-angled (90°) corners, the stringlines must be checked at this point to make sure that the corner angle is accurate before any other stringlines are installed- use 3:4:5 method	1.71	0.94	NA
39	Determine the building depth from the site plans and specifications to measure the position of the third building line.	1.88	0.79	NA
40	Install the profiles for two adjacent points approximately 2–3 m ensuring the use a spirit level acrosses the top face	1.81	0.89	NA
41	Measure the distance identified as the structure depth from adjacent profiles	1.90	0.82	NA
42	Fix a nail in the top of each new ledger at the mark, and set the stringline on adjacent profiles taut (stretched tight) between the nails to create the third building line	1.81	0.93	NA
43	Determine the specified offset distances from the site plans.	1.68	0.99	NA
44	Set up adjacent profiles for the first offset building line	1.44	1.26	NA

45	Measure the distance identified as the offset width from the first profile to the adjacent profile	1.81	0.89	NA
46	Fix a nail in the top of each new ledger at the mark and set the stringline running from one adjacent profile to the other taut between the nails to create the building line.	1.61	0.96	NA
47	To set out the second offset building line, position profiles from the offset point to the width and measure the distance identified as the offset depth to the first profile	1.01	1.58	NA
48	Fix a nail in the top of each new ledger at the mark, and set the stringline taut between the nails to create the final building line	1.90	0.36	NA
49	The axial lines (center lines) of the trenches are marked with the help of profiles, sighting rails, strings, and pegs.	1.62	0.14	NA
50	Erecting Batterboard	3.66	0.98	HA
51	Installing Pegs every 2 meters	3.76	0.99	HA

Table 4.1 presents the summary of mean and standard deviation responses of experts on the psychomotor tasks in setting out and strip foundation laying to be assessed in technical colleges and for inclusion in the assessment tool. The analysis shows that the Mean ($\bar{x}$) and standard deviation (σ) scores ranges from 1.01 – 4.16 and 0.14 – 1.58 respectively. The result of analysis reveals 16 items with mean responses below 2.0, indicating not applicable. Thus, those items with mean values below 1.90 were excluded and not included in the final assessment tool. The result also found that out of the 51 items, 35 items have mean responses above 3.0, the weighted mean. This shows that the experts agreed that only 35 out of the 51 items were deemed fit to be included in the assessment tool. The 51 items were thus, fit to be included in the assessment tool. The cleaned instrument thus, have 35 items and is represented thus.

Research Question 2:What is the developed assessment instrument for evaluation psychomotor performance in setting out and strip foundation laying by technical college teachers?

Table 4. 2: Selected items included in the assessment instrument

S/N	Sub-items evaluated in Setting out of buildings
1	Correctly interpret building drawing
2	locating boundary lines
3	accurately marking of the corners of the building
4	Replicating the building dimension in the plan on the site using pegs
5	Proficiency in driving pegs into the corners of the boundary
6	Correct placement of boundary pegs

- 7 Checking the lengths of the sides to conform with dimensions
- 8 Use of stringlines to mark the boundary pegs
- 9 Marking the position of inside walls, doors, and windows on the boards.

- 10 Location of the two boundary pegs that identify the front boundary

- 11 set a taut stringline between two front boundary points
- 12 Location of the two survey pegs that identify the side boundary

- 13 Setting a taut stringline between these two boundary lines.

- 14 Use of temporary timber pegs running over the centre point of the boundary pegs
- 15 Determining the front and side setbacks of the building
- 16 Identify the width of the building from the site plans and place a temporary peg at first corner of the building by measuring the distances from the first corner (width) and the front boundary (setback)
- 17 Placing of a temporary peg at first corner of the building by measuring the distances from the first corner (width) and the front boundary (setback)
- 18 Identifying the depth of the house from the site plans
- 19 Placing a temporary peg at the second corner by measuring the distances from the first corner (depth) and the side boundary (setback).
- 20 Place a temporary peg at third corner of the building by measuring the distances from the 3rd corner (width) and corner 2 (depth).
- 21 saddle profile Preparing skills
- 22 Preparing hurdle profiles
- 23 Preparing corner profiles
- 24 Preparing Continuous profile
- 25 Setting up profiles 2–3 m from the proposed building outline

- 26 Transferring building measurements from drawing to profile boards

- 27 Placing nails on profile boards using building dimensions

- 28 Install the first profiles A and B approximately 2–3 m from the temporary pegs used to mark the corners of the proposed building.
- 29 Measure the front setback from the front boundary to the profiles

- 30 Use a spirit level to transfer and mark the measured position from the ground to the top of each ledger.

- 31 Fix a nail in the top of each ledger at the mark and set the stringline A–B taut between the nails to create the building line for the front of the proposed building.
- 32 Positioning of the second set of profiles between the other ends of the boundaries C and D and checking that they are approximately level with each other and all other profiles in the set-out
- 33 Set the stringline C–D for the side building line of the proposed building
- 34 Erecting Batterboard
- 35 Installing Pegs every 2 meters

The study developed an assessment tool titled “Setting-out Psychomotor Assessment Checklist for Technical College (FSPACTC)”. Details of the assessment tool is given in Table 2. The developed instrument was derived from the occupational/task analysis and based on the curriculum and scheme of work. The assessment tool also identifies assessment based on processes and products, with provision for marks. This assessment tool has a sequence of related tasks, that when performed by the student, should help the teacher award marks accordingly. The essence of the assessment tool is to help the technical trainer apply effectively the task instructional sheet during instruction.

Research Question 3: What is the skills level of Building Construction students in setting out when assessed using Setting-out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)?

Table 3: Summary of Mean statistics of Differences in Skills Performance in setting out when Students are assessed using the developed Setting-out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)

Group		Pretest	Posttest	Mean Difference
FSPACTC	Mean	9.79	41.94	32.15
	N	62	62	
	Std. Deviation	4.74	14.69	
Teacher-made Test	Mean	8.067	47.57	39.503
	N	75	75	
	Std. Deviation	3.44	16.39	

Table 3 gives the summary of the mean and standard deviation of students’ scores in setting out when assessed using the developed FSPACTC and teacher-made assessment tool. The result shows that mean difference for students assessed using FSPACTC is 32.15 as against

39.50 for teacher-made instrument. This shows that students assessed using FSPACTC had lower marks than students assessed using teacher-made tests.

Findings of the Study

- i. thirty five out of the 51 items were deemed fit to be included in the assessment tool. The 38 items were thus, fit to be included in the assessment tool and 16 items were rejected.
- ii. The study developed an assessment tool titled “Setting-out Psychomotor Assessment Checklist for Technical College (FSPACTC)” to be used by technical colleges lecturers in practical skills assessment.
- iii. Students assessed using the teacher-made test performed better than students assessed using the developed “Foundation and Setting-out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)”.

Discussion of Findings

Psychomotor Task Items in Setting-Out of Building

The result of analysis reveals 51 assessment tasks in setting-out and strip foundation laying. However, 16 items had mean responses below 2.0, indicating not applicable. Thus, those items with mean values below 2.0 were excluded and not included in the final assessment tool. The result showed that 35 items have mean responses above 3.0, the weighted mean. This shows that the experts agreed that only 35 out of the 51 items were deemed fit to be included in the assessment tool. The 35 items were thus, fit to be included in the setting-out and strip foundation laying assessment tool. The procedure of this study is similar to Hassan, *et al.* (2022) who developed a standardized tool for assessment of students’ practical skills. Task items were identified and formed the core of the assessment instrument. This is further corroborated by Ibrahim (2015) who identified task items to be used for developing an assessment instrument.

Development of an Assessment Instrument for Evaluating Psychomotor Performance in Setting-Out and Strip Foundation Laying for Technical College Teachers

The study developed an assessment tool titled “Foundation and Setting-out Psychomotor Assessment Checklist for Technical College (FSPACTC). The developed instrument was derived from the occupational/task analysis and based on the curriculum and scheme of work. The assessment tool also identifies assessment based on processes and products, with provision for marks. This assessment tool has a sequence of related tasks, that when performed by the students, should help the teacher award marks accordingly. The developmental process followed in the development is the analysis (job/task analysis), design, development and evaluation. The developed assessment instrument had a total of 84 items. However, the process of validation which included content validation and the delphi -technique reduced the items of the instrument to 35 items. The development of the FSPACTC follows scientific process that is corroborated by the findings of Okoye and Auta (2020) Nahadi and

Erlis (2016) who both developed a task item pool at the core of the assessment instrument, then added the scoring on each item as guide to check against wanton award of marks to students.

Skills Level of Building construction Students in Setting-Out when Assessed Using Setting-Out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)

The developed instrument was used to assess students practical work in setting out. The result of analysis shows that students assessed using the teacher-made test had a mean gain of 39.50 as against 32.15. This shows that students assessed using the teacher-made test performed better than students assessed using the developed “Setting-out Psychomotor Assessment Checklist for Technical Colleges (SPACTC)”. This result shows that the teacher-made assessment tool lumped tasks and scores together, they also did not exhaustively identify all the tasks that the student should perform, neither were marks allocated based on complexity of tasks. The developed “and Setting-out Psychomotor Assessment Checklist for Technical Colleges (SPACTC)” on the other hand, had related and sequenced tasks in setting-out, with process and product tasks clearly identified and marks awarded based on complexity. As such, students must needs perform the tasks to be awarded the right marks. This in effect, gives the correct score to students and not awarded wantonly by teachers, which might increase student scores. This finding is supported by Okoye and Auta (2020) who assessed students’ skills using a developed instrument and found that students scored higher with teacher-made assessment tools than standardized assessment instruments.

Conclusion

Based on the findings of the study, it is concluded that the developed “Setting-out Psychomotor Assessment Checklist for Technical Colleges (SPACTC)” is valid and reliable to be used by technical teachers for assessing practical skills in setting-out of Building The assessment instrument if followed by the technical teachers, would help in developing key competencies in Building drawing interpretation skills, Skills in determining the orientation of the building on the site, Profile set-up skills, Batterbaord erection skills.

Recommendations

Based on the findings of the study, the following recommendations are made

- i. The National Board for Technical Education (NBTE) as well related agencies should adopt the developed “Setting-out Psychomotor Assessment Checklist for Technical Colleges (SPACTC)” for technical education programmes across Nigeria.
- ii. Teachers at technical colleges should downplay the use of product assessment only, but rather combine both product assessment method and process assessment as advocated by the Foundation and Setting-out Psychomotor Assessment Checklist for Technical Colleges (FSPACTC)”.
- iii. Seminars and workshops should be organized to get technical teachers in Technical Colleges acquainted with development of standardized assessment instruments to

- enhance uniformity in the standard of rating students' practical work using the assessment guide.
- iv. Learning demonstrated by physical skills in manipulation, dexterity and coordination should be emphasized during training by teachers

References

- Adekunle, A. (2020). *Development and validation of instrument for assessing students' practical performance in electronic work in technical colleges. Unpublished PhD thesis, Department of vocational education, Nnamdi Azikiwe University, Awka.*
- Caleb, E. E. (2019). *Development and Validation of Training Modules for Effective Implementation of Problem-based Learning in Electrical/Electronic Technology Programme in South-South Nigeria. Unpublished PhD Thesis, Nnamdi Azikiwe University, Awka, Anambra State.*
- Hassan, S., Deba, A. & Saulawa, D. (2022). Development and Standardization of an Instrument for Assessing Carpentry and Joinery Students' Practical Skills in Nigerian Senior Secondary Schools. *Canadian Journal of Educational and Social Studies*, 2(1):73-85
- Ibrahim, D. (2015). Development and validation of an instrument for assessing students' manipulative skills in bricklaying and blocklaying practice at technical colleges in Niger State, Nigeria. *Journal of Science, Technology & Education*, 1(1), 34-43.
- Lamas, H. (2015). School Performance. *Propósitos y Representaciones*, 3(1), 313-386. doi: <http://dx.doi.org/10.20511/pyr2015.v3n1.74>.
- Nahadi, H. & Erlis, Y. (2016). Performance assessment instrument to assess the senior high students' psychomotor for the salt hydrolysis material. *Proceedings of International Seminar on Mathematics, Science, and Computer Science Education (MSCEIS 2015)*. <https://doi.org/10.1063/1.4941155>.
- Neil. K. (2020). Introduction to the Performance Evaluation. https://web.worldbank.org/archive/website00822/WEB/PDF/PEG_CH1.PDF
- Ofuebe, C. & Izueke, E. (2017). *Data demands for development research*. Enugu: Prince Digital Press.
- Okoye, K. R. E. & Auta, M.A. (2020). Development and validation of instrument for assessing students' practical skills in building super-structure operations in Nigerian secondary schools. *International Journal of Social Sciences and Educational Studies*, 7(2):1-12.

- Okoye, K. R. E. & Auta, M.A. (2021). Development and validation of building services practical skills assessment instrument for Nigerian secondary schools. *Unizik Journal of Educational Research and Policy Studies*, 3(1):237-254.
- Okwori, R. O., Adamu, M. M. & Odo, I. M. (2013). Evaluation of practical skills possessed by woodwork graduates of technical colleges in Niger State, Nigeria. *Multilingual Academic Journal of Education and Social Sciences*, 1(2), 73-82.
- Tafida, T. & Gwarzo, A. (2021). Comparative analysis of building setting out and foundation skills acquired by national certificate of education students in colleges of education and polytechnics in north west, Nigeria. *International Journal of Education and Social Science Research*, 4(3): 557-574.
- Wening, P. & Siti, M. (2020). Project-Based Psychomotor Assessment Instruments to Increase Student Competencies in the 21st Century. *Advances in Economics, Business and Management Research*, 152, 342-355.