DEVELOPMENT AND VALIDATION OF AN INSTRUMENT FOR ASSESSING STUDENTS' MANIPULATIVE SKILLS IN BRICKLAYING AND BLOCKLAYING PRACTICE AT TECHNICAL COLLEGES IN NIGER STATE, NIGERIA

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Abstract

This study is designed to develop and validate an instrument for assessing students' manipulative skills in bricklaying and blocklaying practice at Technical Colleges of Niger state, Nigeria. Two research questions and one hypothesis guided the study. A research and development design was employed for the study. The study was carried out in all the State owned and Federal Technical Colleges of the state. A total of 67 respondents comprising 47 teachers and 20 registered builders were used as population of the study. A structured questionnaire was developed by the researcher and used for data collection. 23 observable competencies which teachers often value and assess in their students during practical work were identified with appropriate rating scale for the instrument. Cronbach Alpha, Mean and Standard Deviation were used as the statistical tools to analyze the data, while t- test statistic was employed to test the null hypothesis of the study at 0.05 level of significance. The findings of the study revealed among others that all the manipulative skills were considered appropriate for inclusion in the final Instrument for Assessing Students' Manipulative Skills in Bricklaying and Blocklaying Practice (IASMSBBP). It was recommended that bricklaying and blocklaying practice teacher should employ the use of developed instrument in assessing students manipulative skills at technical college level and de- emphasize the use of only product assessment.

Introduction

Technical and vocational education has been described as a vital form of education that provides the trained manpower needed for industrial and technological development of any nation. Technical and Vocational Education as defined in the National Policy on Education (FRN, (2004) is that aspect of educational process involving in addition to general education, the study of technologies and related science and the acquisition of practical skills, knowledge and attitudes necessary for entry into occupation in various sectors of the economic and social life. The goals of technical education as outlined in the National Policy on Education is the production of skilled, self-reliant and enterprising craftsmen and technicians who can apply their technical knowledge and vocational skills necessary for solving industrial, agricultural and economic problems of the nation (FRN, 2004). Part of the effort for achieving this objective is the implementation of National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) programmes in Technical Colleges. The importance of technical and vocational education cannot be over emphasized. This is why practical work has traditionally played a very important part in all technology education programmes right from technical colleges to tertiary institutions. The expectation is that during the practical activities, students are provided with experiences predisposing towards acquisition of manipulative skills. Manipulative skills are those aspects of technical and vocational education which involves hands-on-the-job experience by the student (Bartel 2006). On the other hand, Umo–Otong (2000) defines competencies as those skills needed by the students in carrying out a particular job or for a particular task. These competencies are assessed from students' abilities to execute a practical work.

The clusters involved in bricklaying and blocklaying practice according to National Board for Technical Education (NBTE 2003) curricular for building and wood trades consists of three basic components aimed at achieving the goal and objectives of technical education as specified in the National Policy on Education. These include the general education, the trade courses and the Students Industrial Work Experience Scheme (SIWES) or production work. In every topic or module in a trade curriculum, there are two components; the theory component; and the practical component. The practical components in bricklaying and blocklaying practice trades according to NBTE curricula (2003) include the following; mixing with hand or machine mortar suitable for moulding of bricks, compressive strength of brick, aggregates tests, bonding mortar to specification for specified jobs, test to determine porosity of a given brick, mould clay/sandcrete brick to specification, setting out, ground floor construction, solid walls constructions of thickness of ½ B – 1 ½ B involving ends, junction and quoins in English and Flemish bond, cavity walls involving stopping ends, brick wall features (detached pier, attached pier, buttress capping, square jambs) in 1B – 1 ½ B solid wall, square and rebated jambs in cavity

walls applying appropriate damp exclusion and weathering methods at the opening, decorative brick – work such as block work bonded quoins, diaper bond, basket weave and herring bone bond, erect for use and dismantle timber and tubular scaffolds in accordance with construction regulation, construction of fire place and chimney stack for any class of fuel, set – out and construction to specification septic tank, soak away and inspection chamber, construct to specification roadside channels/gutters in given situation, perform operation with finishing tools, floor screeding operation, test to determine the bearing capacity of soil, leveling , construct brick wall up to 2B thick and above the following bonds (garden and wall bond, English bond, fletching bond), construct corbels and plinth in wall up to 2.2mm thick, decorative panel, arches construction, rendering, concrete mix, slump test, cube test among others. These components need to be assessed to ascertain the achievement of the learners.

Assessment in any educational programme ascertains the outcome of the learners' achievement in terms of the knowledge, skills, attitudes, ability and intelligence acquired in the course of study (Bukar 2006). This is why different organizations for different reasons carry out assessment in different forms. A very important criteria for objective and reliable assessment of tasks performance as suggested by Yalams (2000) is to construct and use a well designed assessment instrument. According to him, without valid assessment instruments, teachers will be generating and working with unreliable data which will mislead both the students and their parents. Musa (2009) recommended that assessment of manipulative skills should proceed logically from action and their sequences to the outcomes and the quality and quantity of the outcomes if students are going to graduate with quality practical skills.

The goal of developing assessment instrument is to improve students' performance as it's revealed the areas of assessment to the students. Such improvement reduces wastage of resources such as time, effort and money by producing students with the right skills and knowledge that delight the employers. Ogbozor (2006) sees development of assessment instrument as the process of producing or creating evaluation tools that can be used for assessing students' performance of the practical task operations. For a valid and effective assessment instrument, Ogbozor suggested that the following criteria should be considered when developing assessment instrument.

- Clearly defining the aim of the study in the instrument;
- List out all the attributes or characteristics that need to be observed in the study;
- Decide on the recording system to be used in the assessment instrument;
- Construct the required model for recording observations;

To achieve the goal of developing an assessment instrument, White and Ahmadi (2003) suggested that the researcher should: Review existing instruments; determine the domains to be included and the items; define the response categories to be included in each domain; establish the reliability and validity of the instrument and develop training materials to accompany the assessment instrument.

UNESCO (2000) suggested the following step in designing or developing a test instrument for assessing performance. These include: specifying the purpose of the test; developing table of specification; selecting test items and; designing and developing relevant test items. The instrument that we develop measures both the perceived importance of stated course objectives and how well those objectives are being met based on students' perceptions of performance (Clayson and Halcy 2000). According to them, instrument developer should determine the content and format of the assessment instrument, list out the learning objectives specify to the course he/she is teaching, select or devise a type of instrument suitable for assessing particular situation and adopt the use of short phrases than the use of long descriptive sentences in developing assessment instruments.

Statement of the problem

Bricklaying and blocklaying practice teachers at technical colleges in Niger state are supposed to be assessing students' manipulative skills on the processes involves and the completed work (product). But evidence from these technical colleges, showed that practical activities are being assessed base on the completed work only (i: e product assessment) rather than process assessment. Experiences also shows that Bricklaying and blocklaying practice teachers at technical colleges in Niger state employ the use of product assessment technique only. Interaction with some of the bricklaying and blocklaying practice teachers during the accreditation visitation exercise 2010/2011 session also indicated that there was no assessment instrument and if there was any, then it was not put use for assessing students' manipulative skill. This has adversely affected the system. For effective assessment of manipulative skills at technical college level, teachers of building technology should be provided with a more viable assessment instrument to enhance effective teaching and learning. From the foregoing, therefore, assessment and testing have become factors of critical concern among the activities of teachers, especially those psychomotive skills. With seemingly no record or appropriate assessment instrument for assessing students' manipulative skills in bricklaying and blocklaying

practice at technical colleges in Niger state, the need to find a more viable assessment instrument becomes paramount. Thus the need for the study.

Purpose of the Study

The main purpose of this study was to develop an instrument for assessment of student manipulative skills in bricklaying and blocklaying practice at Technical Colleges in Niger State, Nigeria. Specifically the study was to determine;

1. The competencies appropriate for inclusion in the instrument for assessing students' manipulative skills in bricklaying and blocklaying practice.
2. The manipulative task in bricklaying and blocklaying practice.
3. The development of assessment instrument.

Research Questions

The following research questions guided the study.

1. What are the competencies appropriate for inclusion in the instrument for assessing students' practical skills in bricklaying and blocklaying practice?
2. What are the major manipulative tasks in bricklaying and blocklaying practice?
3. What are the processes of developing an assessment instrument in bricklaying and blocklaying practice?

Hypothesis

The following hypothesis was formulated and tested at 0.05 level of significance

Ho_1: There is no significant difference between the mean responses of teachers and registered builders with respect to the competencies appropriate for inclusion in the instrument for assessing students' manipulative skills.

Methodology

The study adopted a research and development approach (R & D) because this work involved the development of an instrument for assessing students' manipulative skills performance. The study covered all the technical colleges in Niger State and Federal Science and Technical College Kuta that run bricklaying and blocklaying practice at National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) levels accredited by National Board for Technical Education (NBTE). The target population for the study consisted of all the 47 bricklaying and block laying practice teachers and 20 registered builders while 70 NTC II students of bricklaying and blocklaying 2011/2012 academic session in all the state and federal technical colleges of Niger state, Nigeria were randomly selected and used for try-out. A structured questionnaire consisting of fifty seven (57) items was developed and validated for data collection. The researcher identified the manipulative skills and the competencies that are most often valued and assessed in students during practical project using data obtained from the review of literatures. The rating scale used was a four point descriptive rating scale (4, 3, 2, 1) with each of the categories of the rating scale indicating a criterion or performance level for each score. The preliminary instrument was validated by three experts drawn from the Department of Industrial and Technology Education and was administered to the respondents after which the instrument for assessing students' manipulative skills was developed. The developed instrument was further submitted to the learned and experienced personnel in the Department of Industrial and Technology Education as well as educational measurement and evaluation personnel to comment on the relevance and the appropriateness. After this, the draft copy of the instrument was further validated by the bricklaying and blocklaying practice teachers. The final copy of the developed instrument was then administered to all the technical colleges by the researcher for the bricklaying and blocklaying practice teacher to try its applicability on all the NTC II students' of bricklaying and blocklaying practice. After the rater's comment, the researcher re-considered some of the test items carried out by the rater's upon which the final copy of the developed instrument was drafted. The validated draft copy eventually formed the final copy of the instrument for assessing students' manipulative skills in bricklaying and blocklaying practice (IASMSBBP). See appendix A.

The reliability of the developed instrument was established after a try-out using the item by item technique fashioned along Gay's (1981), inter-rater reliability concept. The result of the trial test was used to compute the reliability of the instrument using Cronbach's Alpha method to ascertain the extent of homogeneity of the items. The result obtained revealed that the reliability coefficient was 0.88. This mean that items in the instruments were internally consistent in measuring what was intended to measure for the study. Data collected was analyzed using mean and standard deviation to answer research questionnaire while, t-test statistic was used to test the hypothesis at 0.05 level of significance.

Research Question I

What are the competencies appropriate for inclusion in the instrument for assessing students' manipulative skills in bricklaying and blocklaying practice?

Table 1: Mean Responses of the Teachers and the Registered Builders on the Competencies/ Skills Appropriate for Inclusion in the Instrument for Assessing Students' Manipulative Skills in Bricklaying and Blocklaying Practice.

S/NO	ITEM	N1 = 47 $\overline{X1}$	N2 = 20 $\overline{X2}$	$\overline{Xt}$	Remarks
1	Ability to read and interpret drawings	3.42	3.20	3.31	Agreed
2	Ability to analyze the plan work	2.56	2.71	2.64	Agreed
3	Ability to identify & select tools for the given task	3.02	2.50	2.76	Agreed
4	Ability to identify & select equipments for the given task	2.62	2.56	2.59	Agreed
5	Ability to use appropriately the identified tools and equipments	3.41	3.32	3.37	Agreed
6	Ability to prepare ground for the given task	2.69	2.51	2.60	Agreed
7	Ability to design the given task	3.24	3.62	3.43	Agreed
8	Ability to select suitable materials for the given task	3.07	2.62	2.85	Agreed
9	Ability to use suitable materials of given task to specification	2.52	2.50	2.51	Agreed
10	Ability to measure accurately on the given task	2.54	2.51	2.53	Agreed
11	Ability to read and apply easily technical information	2.63	2.41	2.52	Agreed
12	Ability to record properly all dimensional specification of a given task	2.64	2.74	2.69	Agreed
13	Ability to construct the given task properly without visible errors	3.63	3.41	3.52	Agreed
14	Care of tools during and after work	2.56	2.61	2.59	Agreed
15	Care of equipment during and after work	2.76	2.62	2.69	Agreed
16	Ability to follow correctly the various work stages	2.60	2.86	2.73	Agreed
17	Ability to proceed logically from action and their sequences to the outcome of a given task	2.79	3.02	2.91	Agreed
18	Observation of safety to prevent accident to self or damage to the work piece	3.00	2.86	2.93	Agreed
19	Ability to complete all the work stage on a given task	3.08	3.76	3.42	Agreed
20	Ability to answer oral question	2.51	2.60	2.56	Agreed
21	Ability to provide level surface of given task	3.45	3.67	3.56	Agreed
22	Comportment during and after work	3.09	2.63	2.86	Agreed
23	Ability to assess the beauty of a finished product	2.50	2.73	2.62	Agreed

Key:

$\overline{X_1}$ = Mean Responses of Teachers; N_1 = Numbers of Teachers

$\overline{X_2}$ = Mean Responses of Registered Builders; N2 = Numbers of Registered Builders

$\overline{X_t}$ = Grand Mean of all Responses

The data in Table 1 reveals that all the items under this sub-heading are rated agreed by the respondents with mean scores ranging from 2.51 – 3.56. This signifies that the competencies are appropriate for inclusion in the instrument for assessing students' manipulative skills in Bricklaying and Blocklaying practice in all technical colleges.

Research Question II

What are the manipulative tasks in bricklaying and blocklaying practice at technical college level in Niger state?

Table 2: Mean Responses of the Teachers and Registered Builders on the Manipulative Tasks in Bricklaying and BlockLaying Practice.

N1 = 47 N2 = 20

S/NO	ITEM	$\overline{X}_1$	$\overline{X}_2$	$\overline{X}_t$	Remarks
1	Setting out building to specification	2.61	2.50	2.56	Agreed
2	Ground floor constructions	2.46	2.64	2.55	Agreed
3	Solid walls construction involving end junctions and quoin in English and Flemish bond	3.08	3.34	3.21	Agreed
4	Cavity walls construction involving stopping ends	2.86	2.74	2.80	Agreed
5	Brick wall features (detached pier, attached piers, buttress capping and square jambs)	3.46	3.82	3.64	Agreed
6	Square and rebated jambs in cavity walls	3.76	2.64	3.20	Agreed
7	Decorative brick work	3.24	3.64	3.44	Agreed
8	Diaper bond, basket weave and herring bone bond	3.42	2.98	3.20	Agreed
9	Timber and tubular scaffolds	2.66	2.61	2.64	Agreed
10	Arches construction	3.46	3.64	3.55	Agreed
11	Fire place and chimney stacks	2.86	2.74	2.80	Agreed
12	Construction of septic tanks	2.50	2.89	2.70	Agreed
13	Constructions of soak away and inspection chamber	2.68	2.50	2.59	Agreed
14	Brick walls construction in English, Stretcher, Header and Flemish bond	3.42	3.88	3.65	Agreed
15	Perform operation with finishing tools	2.64	2.52	2.58	Agreed
16	Floor screeding operations	2.76	2.64	2.70	Agreed
17	Leveling operations	3.06	2.46	2.76	Agreed
18	Rendering and plastering operations	2.41	2.12	2.27	Agreed
19	Slump test	3.03	2.84	2.94	Agreed
20	Compacting factor test	2.24	2.61	2.43	Disagreed
21	Cube test	2.36	2.42	2.39	Disagreed
22	Decorative panel	2.86	2.54	2.70	Agreed
23	Concrete mix	2.04	2.64	2.34	Disagreed
24	Flooring	2.34	2.45	2.40	Disagreed
25	Terrazzo finish	3.00	2.68	2.84	Agreed

Key:
$\overline{X}_1$ - Mean Reponses of Teachers, N_1 = Number of Teachers
$\overline{X}_2$ - Mean Responses of Registered Builders N_2 = Number of Registered Builders
$\overline{X}_t$ - Grand Mean of all Responses.

The data presented in Table 2 revealed that the respondents rated 21 out of 25 items presented as the manipulative task in Bricklaying and Blocklaying practice agreed with mean ranging from 2.55 – 3.65. Six manipulative tasks were rated disagreed. This signifies that bricklaying and block laying practice possess all the 21 manipulative tasks outlined in the table but, manipulative tasks relating to compacting factor test, cube test, flooring and concreting mix was disagreed thus not available in bricklaying and blocklaying practice in all the technical colleges.

Research Question III

What are the processes of developing an assessment instrument?

Table 3: Mean Responses of Teachers and the Registered Builders on the Processes for the Development of Assessment Instrument

N1 = 47 N2 = 20

S/NO	ITEM	$\overline{X}_1$	$\overline{X}_2$	$\overline{X}_t$	Remarks
1.	By reviewing the existing instruments	3.64	3.56	3.60	Agreed
2.	By determining the domains to be included and the items in the instrument	2.84	2.72	2.78	Agreed
3.	By determining the response categories to included in each domain	2.71	2.89	2.80	Agreed
4.	By establishing the reliability and validity of the instrument	2.67	3.14	2.91	Agreed
5.	By developing training materials to accompany the assessment instrument	2.50	2.42	2.46	Disagreed
6.	By clearly defining the aim of the study in the assessment instrument	2.52	2.67	2.60	Agreed
7.	By listing out all the attributes or characteristics that need to be observed in the instrument	3.24	3.07	3.16	Agreed
8.	By deciding on the recording system to be used in the assessment instrument	2.70	2.65	2.68	Agreed
9.	By constructing the required model for recording observations	2.86	3.52	3.19	Agreed

Key

$\overline{X}$ = Mean Responses of Teachers X_2 = Mean Responses of Registered Builders

N1 = Number of Teachers N_2 = Number of Registered Builders

$\overline{X}_t$ = Grand Mean of all Responses

$$\overline{X}_t = \frac{\overline{X}_1 + \overline{X}_2}{2}$$

The analysis of the data presented in Table 3 revealed that the respondents jointly agreed to 8 out of 9 processes of developing assessment instrument with mean ranging from 2.60 – 3.60. One item was rated disagreed. This signifies that processes of developing assessment instrument possess all the 9 items outlined in the table but, the item relating to the development of training materials to accompany the assessment instrument was disagreed thus not available in instrument.

Hypothesis Testing

Hypothesis 1

HO_1: There is no significant difference between the mean responses of teachers and registered builder with respect to the competencies/skills appropriate for inclusion in the instrument for assessing students' manipulative skills.

Table 3: t-test of mean Responses of Teachers and Registered Builders on the Manipulative Sk Appropriate for Inclusion in the Instrument for Assessing Students' Manipulative Skills in Bricklaying a Blocklaying Practice

S/NO	ITEM	$\overline{X_1}$	SD_1	$\overline{X_2}$	SD_2	t- cal	Decision
1	Ability to read and interpret drawings	3.42	0.79	3.20	0.72	1.89	Not Significant
2	Ability to analyze the plan work	2.56	0.59	2.71	0.35	0.48	Not Significant
3	Ability to identify and select tools for the given task	3.02	0.70	2.50	0.44	1.06	Not Significant
4	Ability to identify and select equipments for the given task	2.62	0.61	2.56	0.07	-1.24	Not Significant
5	Ability to use appropriately the identified tools and equipments	3.41	0.78	3.32	0.52	0.84	Not Significant
6	Ability to prepare ground for the given task	2.69	0.62	2.51	0.58	-3.46	Not Significant
7	Ability to design the given task	3.24	0.48	3.62	0.95	1.13	Not Significant
8	Ability to select suitable materials for the given task	3.07	0.44	2.62	0.50	0.88	Not Significant
9	Ability to use suitable materials of given task to specification	2.52	0.37	2.50	0.33	1.14	Not significant
10	Ability to measure accurately on the given task	2.54	0.46	2.51	0.30	-1.10	Not significant
11	Ability to read and apply easily technical information	2.63	0.23	2.41	0.60	0.25	Not Significant
12	Ability to record properly all dimensional specification of a given task	2.64	0.16	2.74	0.18	0.78	Not Significant
13	Ability to construct the given task properly without visible errors	3.63	0.08	3.41	0.77	0.38	Not Significant
14	Care of tools during and after work	2.56	0.38	2.61	0.27	1.07	Not Significant
15	Care of equipment during and after work	2.76	0.45	2.69	0.12	0.95	Not Significant
16	Ability to follow correctly the various work stages	2.60	0.10	2.86	0.47	-0.08	Not Significant
17	Ability to proceed logically from action and their sequences to the outcome of a given task	2.79	0.49	3.02	0.44	1.02	Not Significant
18	Observation of safety to prevent accident to self/damage work piece	3.00	0.50	2.86	0.09	0.61	Not Significant
19	Ability to complete all the work stage on a given task	3.08	0.68	3.76	0.24	0.12	Not Significant
20	Ability to answer oral question	2.51	0.29	2.60	0.16	-1.50	Not Significant
21	Ability to provide level surface of given task	3.45	0.96	3.67	0.53	-0.64	Not Significant
22	Comportment during and after work	3.09	0.33	2.67	0.42	0.45	Not Significant
23	Ability to assess the beauty of a finished product	2.50	0.80	2.73	0.16	-1.30	Not Significant

Note $N_1 = 47$; $N_2 = 20$; $df = N_1 + N_2 - 2 = 65$; $t_{65}(0.05) = 2.000$

The result in Table 3 revealed that the t-calculated for each value of the twenty three items were less than the t-table values and that none of the items are above. Therefore, the null hypothesis was accepted for each of the twenty three items. Accordingly, the opinion of the respondents did not differ significantly on the twenty three items as regards to the competencies appropriate for inclusion in the instrument for assessing students' manipulative skills in Bricklaying and Blocklaying practice. Thus null hypothesis was not rejected.

Discussion of Result

Table 1 shows the competencies appropri for inclusion in the instrument for assessing stude manipulative skills in Bricklaying and Blockla practice. The findings as indicated in Table revealed that all the competencies skills identi were appropriate for inclusion in the instrument.

finding conform with the views of Yalams (2000) who observed that in combining process and product evaluations, certain attributes of the learners, such as the students' abilities and procedures in the use and care of tools and equipment to construct the given task . properly and sequentially should be systematically observed, objectively and comprehensively assessed. Uzoagulu (1996) opined that practical task/projects must be evaluated properly so as to induce high standard students' who are expected to think (cognitive), execute, design and construct (psychomotor) and exhibit good cooperative attitude towards others and the use of tools and equipment (affective). Therefore, to observe and assess these competencies in a students during bricklaying and blocklaying practice is not out of place, thus including them in the final copy of the process assessment instrument becomes necessary.

Table 2 shows the major manipulative task in bricklaying and blocklaying practice. The findings in table 2 revealed that, brick wall features, brick wall construction in English, stretcher, header and Flemish bond, arches constructions, decorative brick work, solid wall construction involving end junction and quoin in English and Flemish bond, diaper bond, basket weave and herring bone bond, flooring, terrazzo square and rebated jambs in cavity walls among others were the major manipulative tasks. This finding was in line with the views of NBTE curricula (2003) who pointed out that setting out building to specification, solid wall constructions of thickness of ½ B – 1 ½ B involving ends junction and quoins in English and Flemish bond, cavity wall involving stopping ends, brick wall features, diaper bond, basket weave and herring bone bond, fire place and chimney stack for any class of fuel, arches constructions, decorative panel, square and rebated jambs in cavity wall among others are the major manipulative areas students' engaged upon.

Table 3 shows the process of developing assessment instrument. The findings of the study on the processes of developing assessment instrument in bricklaying and blocklaying practice revealed that the following processes was found to be relevant in developing assessment instrument in bricklaying and blocklaying practice. The required model for recording observation is constructed, all the attribute or characteristic that need to be observed in the instrument is listed out, the existing instrument is review, the reliability and validity of the instrument is established and the response categories to be included in each domain is determine.

Conclusion

The task and observable skills to be used for NTC/ANTC levels were appropriate for the entire instrument. However, one of the factors responsible for the decline of practical skills acquisition in technical colleges may be attributed to lack or inappropriate instrument for teaching and assessing students' practical work. Furthermore students' gets encourage and learn more in a situation where assessment areas are being revealed to them. It is concluded that when the findings of this study are effectively implemented, a batch of skilled, trained and well equipped graduates will be produced. This will in turn improves the assessment of students' manipulative skills in bricklaying and blocklaying practice in Technical colleges in Niger State.

Recommendations

Based on the findings of this study, the following recommendations were drawn:

1 Bricklaying and Blocklaying teacher at technical colleges should assess students based on the identified manipulative task and competencies and de-emphasize the use of product assessment only.

2 Examination bodies such as National Business and Technical Board (NABTEB), National Examination Council (NECO), West Africa Examination Council (WAEC) Niger State Science and Technical School's Board should considered and adopt the developed instrument for assessing students' practical performances of bricklaying and blocklaying practice at NTC and ANTC levels.

3 Students' should be exposed to all the manipulative task area in Bricklaying and Blocklaying practice.

4 All the characteristic or attribute that need to be observed in students', should be listed out with the required mode of grading and recording observations before assessing students' manipulative skills.

5 Bricklaying and Blocklaying practice teachers' should be acquainted with the developed instrument to enhance uniform standard in assessing students' manipulative skills.

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APPENDIX A. SAMPLED OF THE DEVELOPED INSTRUMENTS

Skills to be observed

Task operations No 0001

	Ability to read and interpret drawings	Ability to analyze plan work	Ability to identify and select tools	Ability to identify and select equipment for given task.	Ability to use appropriately the identified tools & equips	Ability to prepare ground for the given task	Ability to design the given task	Ability to select suitable material for a given task	Ability to use suitable material to specification	Ability to measure accurately on a given task	Ability to read & apply easily technical information	Ability to record all dimension to specification	Ability to construct the task without visible errors	Care of tools during and after work	Care of equipment during and after work	Ability to follow correctly the various work stage	Ability to proceed logically from action and their sequences to the outcome of a given task	Observation of safety to prevent accident to self or damage to work piece	Ability to complete all the work stage of given task	Ability to answer oral question	Ability to provide level surface of given task	Compartment during and after work	Ability to assess the beauty of a finished product
FIRE PLACE AND CHIMNEY STACK RATING SCALE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1 Build the jambs.																							
2 Fix lintel across the opening to carry the brick work.																							
3 Form the throat behind the lintel.																							
4 Build the brick work so that it gradually narrows to the size of the flue.																							
5 Build up the chimney breast with the flue opening in it.																							
6 Render the flue with cement and sand.																							
7 Render external surface of the chimney in the roof space.																							
8 Make junction of the chimney and the roof water tight.																							
9 Clean work area.																							