Application of Rasch to Verify Different Building Competency Sub-Constructs for Competency Evaluation of Graduates in Nigeria

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Abstract

Incessant concerns from employers and private sectors about the incompetence of graduates in Nigeria call for the creation of an assessment tool that could verify their skills. But there is no clear generally accepted and validated assessment instrument available for evaluating graduate performance. The aim of this study was to develop a valid instrument for assessing competency rates of building graduates. Survey design was adopted to obtain expert opinions on the validity of the sub-constructs and the related items about the employers 'needs. Three experts from the academic, public, and private sectors subjected the survey instrument to face, content, and construct validity and reliability. The survey instrument, which was analysed using IBM SPSS and WINSTEP version 3.73.3 was answered by a total of 200 building experts. The consistency of the instrument was determined by fit statistics and point measure correlation (PTMea Corr), for construct validity. The results revealed a very good items and person reliability of 0.97 and 0.94 respectively. Likewise, appropriate PTMea Corr range from 0.36 to 0.68. Infit and outfit means square range obtained between 0.58 to 1.39. The results give students, employers and academic institution a realistic and theoretical interpretation of the reality of labour market needs.

Keywords: **Validation, Assessment, Instrument, Competency**

Background of the Study

Scholars has defined the concept competency in diverse ways. In the context of this study competency refers to ability to display proficiency in specific sub-constructs. **Assessment** means the process of planning, Designing and developing, quality check, and collecting evidences to make judgements on whether competency has been achieved, to confirm that an individual can perform to the standard required in the workplace, as specified

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in a training package [Hodge et al., 2015]. Notably, missing link in most training programme in Nigeria is the absence of a valid assessment instrument that will test the efficiency of individual in these competencies specially to ascertain competency of individuals in specific occupation.

Competency framework for specific job measures individuals who will be effective and competent to perform tasks in that occupation [Suhairom, Musta'amal, Amin, & Johari, 2014]. There is a global campaign on the essential of preparing graduates who are competent, productive, and proactive to carry out tasks in specific skills in the 21st century. According to Ramadani, Supahar, & Rosana, [2017] graduates need to be equipped with competency that they can apply in their daily life. In view of the advancement in technology which is gradually changing the trends in the labour market, it is imperative to raise generation of individuals who are competent, think creatively, make critical decision and work independently, and relate positively with individuals. Achieving this depends largely on the quality of assessment instrument to determine the desired competency acquired. Valid assessment instrument stimulates real-life working situation, competencies and knowledge.

Assessment tools are used to examine students achievements in one or more domains such as affective, psychomotor, and cognitive, creativity and applications [Ramadani et al., 2017]. Psychomotor domain is one of the domain that is still rare to assess. Often regarded as a practice or performance skills which one of them is display of specific skills in building construction could be achieved by demonstration through hands-on exercise in the workshop. The current competency assessment tools used by the concerned stakeholders has proven inefficient owing to inability of building construction graduates to secure a decent job at graduation as a result of lack of specific skills. Consultation with experts in field is critical in ensuring because it will assist in aligning the assessment instrument to current industry methods, technologies, performance and employers expectations [Hodge et al., 2015]. Therefore, easiest way to obtained a widely accepted assessment tool is researcher's consultations with variety of industry stakeholders.

Most of the assessment tools for competency are not validated by experts according to the needs of employers and above all dominated by general knowledge theoretical contents and little emphasis on specific hands-on assessment. Blades, Fauth, & Gibb, [2012] revealed that there has been inconsistency in measurement of graduates competency for employment because of the failure of most existing evaluation instrument to include

assessment of employability competency. Additionally, failure to identify dynamism in the labour market related to their particular occupation.

Development of an assessment tool with specific constructs and Validated by experts would change the narrative among the stakeholders on how competency assessment of graduates is of paramount importance. Sick, [2011] observed that Rasch measurement model is significantly the process of sub construct validation, where questionnaire items constitute the instrument designer's empirical definition of the sub construct.

Development of a valid and reliable assessment instrument for determining competency levels of graduates is sacrosanct as labour market becomes dynamic [Ryan, Spencer, & Bernhard, 2012]. The standards for educational and psychological testing, which were prepared by the American Educational Research Association, American Psychological Association, and the National Council on Measurement in Education [1999], require that measures be reliable and valid predictors of outcomes. In the light of this proposition, competency of graduates in specific building construction skills could be determined using valid assessment tool for selection or promotion, performance appraisal or any developmental opportunity that may affect pay or career opportunities. Instrument is said to be valid when it is consistent in measuring what is meant to be measured. In other words, it is valid for a particular variable when it accurately measures a prescribed variable.

There are four types of validity, face validity, criterion validity, content validity, or construct validity. Face validity is subset of content validity where experts are asked their opinion about whether an instrument measures the intended competencies [Heale & Twycross, 2015]. Criterion validity demonstrates the relationship between one measure and other factors, whereas content validity looks at the content of items. Construct validity, measures the extent to which an instrument accurately measures a theoretical construct that was designed to measure. The focus of this study was to ensure face, contents and constructs validity and reliability of instrument for assessing specific competency of graduates of building construction. In assessing validity of research instrument, three main criteria often considered are face validity, content validity, and construct validity [Heale & Twycross, 2015].

Validity and reliability are closely related, instrument can be reliable but not valid, however, it is valid because is reliable. Therefore, a valid instrument must be reliable. According to [Ghazali, 2016] is difficult checking for instrument validity than reliability

because validity concerns measurement of constructs related to knowledge whereas reliability concerns determination of consistency of scores.

Rasch measurement model is a psychometric technique capable of improving the precision of research constructs and sub-constructs, instruments, monitor instrument quality, and compute respondents' performances. It provides a technique for obtaining insight into how the data cooperate with constructs measures [Linacre, 2012] and for converting raw observational data into item difficulty and person ability estimated on an approximately linear scale. Fisher [2018] developed a rating scale instrument quality criteria to serve as a rule of thumb for decision making based on his many years of experience and available literature in conducting Rasch analysis in diverse ways. Table 1 show a rating scale instrument rule of thumb for making decision.

Table 1 Rating Scale Instrument Rule of Thumb

Criterion	Poor	Fair	Good	Very Good	Excellent
Targeting	>2 error	1-2 errors	<1 error	< .5 error	<.25 error
Item model fit Mean Square Range	<.3- >3.0	0.34-2.9	0.5-2.0	0.71-1.4	0.77-1.3
Person and Item Measurement Reliability	< 0.67	0.67-.80	0.8-0.90	0.91-0.94	>0.94
Person and Item Separation	2 or less	2-3	3-4	4-5	>5
Ceiling Effect: % Maximum extreme Scores	>5%	2-5%	1-2%	0.5-1%	<0.5%
Floor effect: %Minimum extreme	>5%	2-5%	1-2%	0.5-1%	<0.5%
Variance in data explained by measure	<50%	50-60%	60-70%	70-80%	>80%
Unexplained variance in contrasts 1-5 of PCA of residuals	>15%	10-15%	5-10%	3-5%	<3%

Source; Fisher (2018)

Review of Related Literatures

Husain, Affandi, Che-ani, & Nasri, [2018] carried a study to examine the validity and reliability of competency assessment instrument among building Surveyor graduates using Rasch measurement model and the result of their findings showed a very good items and person reliability index. With high level of consistency in measuring the graduates' competency domains it was concluded that the instrument was reliable and acceptable. In a study to determine the implementation of performance assessment for measuring junior high school students' science process skills in excretion system, the results revealed that the assessment instrument was valid in substance, construction, language aspect [Ramadani et al., 2017]. Waltner, Rieß, & Mischo, [2019] conducted a study aimed at developing a reliable and valid approach to assessing sustainable competencies among secondary school students.

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The findings of their study indicated that the assessment tool was suitable to measure competency sustainability.

Rahayah Ariffin, Omar, Isa, and Sharif, [2010] observed in their study to outline a systematic procedure to develop a valid competency model and instrument to measure competency of Chefs who works in the hotel industries in Malaysia that to maintain accuracy of questionnaire from defect, validity and reliability of the instrument is very essential. the skills challenges facing graduates of building construction in Nigeria today calls for improvement validation of training programmes.

Nigeria construction industry need graduates who can work intelligently, and flexibly, and who can meet the demand of the labour market to contribute to economic, social, cultural, technical, and labour force environmental changes. The Nigerian construction industry requires graduates who have the hands-on skills and knowledge to function effectively in their designated roles [Aigbavboa & Aliu, 2017a]. Wang, Liu, & Pang, [2019] in their study to develop performance indicators and their related priority weightings for evaluating staff or competency in Waste Management Company, the results of their study revealed that evaluation of staff competencies consist of 3 dimensions and 11 criteria, competencies in order of importance were Attitude, Knowledge, and Skills.

METHOD

The study employed quantitative research approach using survey design with 16 specific building construction constructs and sub-constructs were identified from literatures such Aigbavboa & Aliu, [2017b]; Abubakar, Kazaure, Yusuf, Kaduna, [2003]; Wiseman, Roe, & Parry, [2014] and *Residential Construction Industry Competency Model*,[n.d.]. to ensure the validity and reliability and wider acceptance of the instrument, the constructs and the items were validated by experienced experts for face and content validity. The input of the validators was used to revise and refine the items.

Fit statistics of the instrument was analysed to ensure the Infit and outfit, and Point Measure Correlation (PTmea Corr) is within the threshold by [Fisher, Elbaum, & Coulter, 2010]. During this process, Infit and out range from 0.4 to 1.5 logit were considered acceptable according to rating scale threshold for Rasch measurement model [Wright, 1994];[Mutalib, Baharom, & Hamzah, 2015], and Fisher [2018]. Only positive values PTmea Corr. Range between 0.4 to 0.8 were accepted, but negative point measure value with standard deviation from 1.40 to – 0.87 can be considered [Mutalib et al., 2015].

The constructs and items retained and used for validation of this competency assessment instrument after experts' verification is as shown in Table 2. Closed-ended 5-point Likert scales format was used for the survey instrument where respondents were allowing to choose from the items on the bases of importance ranging from 1 (not important), 2 (Less Important) 3 (somewhat Important), 4 (Important), and 5 (Most Important). Furthermore, a total of 200 experienced building construction experts selected through stratified random sampling techniques participated in the study. Again, in processing the information data for this research, the statistical analysis procedure was applied with the assistance of the Rasch measurement model using a Winstep software version 3.73.3.

Reliability and separation

The reliability and the separation index of this instrument was according to rating scale criteria by Fisher table of rule of thumb for rating scale in table 1 above. Similarly, [Mutalib et al., 2015] mentioned that for the Cronbach's Alpha reliability coefficient, the value range from 0.0 to 1.0 which denotes that the closer the value to 1, the more reliable the instrument. In addition, the person separation value range from 3 to > 5 indicates how well the test is successful in identifying differences in each person's competency, while items separation indicates how well and reproduce able the items are to produce a consistent result when administered on subject with same characteristics [Rashidi, Begum, Mokhtar, & Pereira, 2014): [Mutalib et al., 2015].

Results/Discussion

The results for the study is presented into three major phases, in first phase, to ensure face validity and reliability of the specific competency constructs and sub-constructs, three experienced experts were engaged to refine the instrument based on the need of the employers. There after the refined instrument was administered on a larger sampled population of experts in the field to ensure wider acceptability. After rigorous scrutiny by experts, total of 16 specific building construction sub-constructs with 82 items were okayed, see details in Table 6. The sub-constructs are shown in Table 2.

Table 2 Sub constructs and elements of specific building construction competency

Competency sub constructs	Items	Code
Plumbing	5	TP
Tiling	5	TT
Carpentry and Joinery	6	TCJ
Block/brick laying	5	TBB
Concreting	4	TCC
Blueprint/Design interpretation	5	TD
Roofing	7	TRF
Scaffolding	5	TSC
Site Preparation	6	TSP
Setting out	7	TSO
Estimation and Scheduling	7	TES
Maintenance and repairs	6	TM
Painting and decoration	5	TPD
Plastering	5	TPL
Iron Bending	4	TIB
General Technical Knowledge	6	TGK
Total	**82**	

For content validity and reliability, the entire survey instrument was analysed using Rasch measurement model. The output from summary of statistics was interpreted following the instrument quality criteria set for rating scale by Fisher [2018] as presented in table 1 above.

Item separation and reliability show a very good and excellent values of 4.05 and 0.94 respectively, which is an indication that the items were consistent and reproducible when administered to same sample with same characteristics. The high item reliability indicates that the is reproducible to measure what is supposed to measure. Similarly, person separation and reliability show how well the test identifies differences in person's abilities with person's separation of 5.48 and reliability of 0.97.

The entire instrument revealed a consistent and reliable results to measure competency effectively considering the high Cronbach Alpha of 0.98. Mutalib et al., [2015] mentioned that for the Cronbach's Alpha reliability coefficient, the value range from 0.0 to 1.0 which denotes that the closer the value to 1, the more reliable the instrument. In addition, the person separation value range from 3 to > 5 indicates how well the test is successful in identifying differences in each person's competency, while items separation indicates how well and reproduce able the items are to produce a consistent result when administered on

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subject with same characteristics. The inference drawn from the result is that the competency assessment instrument is appropriate and effective to measure competency of graduates in specific building construction skills. See Table 3 below.

Table 3. Reliability and separation

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CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .98

    SUMMARY OF 85 MEASURED (NON-EXTREME) ITEM
-------------------------------------------------------------------------------
|           TOTAL                      MODEL      INFIT        OUTFIT       |
|           SCORE    COUNT    MEASURE   ERROR    MNSQ   ZSTD   MNSQ   ZSTD  |
|-----------------------------------------------------------------------------|
| MEAN     529.8    125.0       .00      .14    1.00    .0     .97   -.2  |
| S.D.      31.1      .1        .61      .02     .17   1.3     .17   1.1  |
| MAX.     600.0    125.0      1.19      .22    1.36   2.7    1.39   2.1  |
| MIN.     462.0    124.0     -1.80      .13     .58  -3.9     .59  -3.0  |
|-----------------------------------------------------------------------------|
| REAL RMSE    .15 TRUE SD     .60 SEPARATION 4.05 ITEM   RELIABILITY .94   |
|MODEL RMSE    .14 TRUE SD     .60 SEPARATION 4.21 ITEM   RELIABILITY .95   |
| S.E. OF ITEM MEAN = .07                                                   |
-------------------------------------------------------------------------------
              DELETED:     2 ITEM


INPUT: 200 PERSON  87 ITEM REPORTED: 125 PERSON  85 ITEM  5 CATS WINSTEPS 3.72.3
-------------------------------------------------------------------------------

    SUMMARY OF 111 MEASURED (NON-EXTREME) PERSON
-------------------------------------------------------------------------------
|           TOTAL                      MODEL      INFIT        OUTFIT       |
|           SCORE    COUNT    MEASURE   ERROR    MNSQ   ZSTD   MNSQ   ZSTD  |
|-----------------------------------------------------------------------------|
| MEAN     352.1     85.0      2.42      .17     .98   -.2     .97   -.1  |
| S.D.      40.3      .1       1.06      .07     .24   1.7     .25   1.6  |
| MAX.     423.0     85.0      6.29      .71    1.48   3.1    1.49   2.9  |
| MIN.     227.0     84.0      -.40      .14     .53  -4.2     .51  -4.0  |
|-----------------------------------------------------------------------------|
| REAL RMSE    .19 TRUE SD    1.04 SEPARATION 5.48 PERSON RELIABILITY .97   |
|MODEL RMSE    .18 TRUE SD    1.05 SEPARATION 5.66 PERSON RELIABILITY .97   |
| S.E. OF PERSON MEAN = .10                                                 |
-------------------------------------------------------------------------------
  MAXIMUM EXTREME SCORE:    14 PERSON
             DELETED:       75 PERSON
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The third phase of the study focused on determining construct validity of the instrument. To achieve this Point Measure Correlation (PTMea Corr), fit statistics where Infit and Outfit mean square (MNSQ) and Z-standard (ZSTD) was considered. In a similar manner rating scale table of criteria in table 1 above was referred to. The entire items were screened to ensure that only items with positive values of Point measure correlation were considered valid. According to (M. Linacre, 2012) in determining PTMea Corr. all items need to align in the same direction with positive correlation. The author added that negative PTMea indicate a contradictory response between items and person response as it relates to the sub constructs developed. According to (J. M. Linacre, n.d.) PTMea Corr. Values between 0.20 and 0.79 is accepted and any item with a negative (-) value and below 0.20

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must be rejected because the item indicates not to measure any construct.

Table 4. Rule of Thumb for Fit statistics

Criterion	Acceptable Rating Scale	Sources
PTMea Corr	0.2< PTMear Corr.<0.79	; (John M Linacre, n.d.)
	0.4<PTMea Corr. Value < 0.80	(Mutalib et al., 2015);
Outfit MNSQ	0.5<MNSQ value <1.5	(Wright, 1994)
	0.6<MNSQ value <1.4	(Azrilah Abdul Aziz, Jusoh, Omar, Mohd Haris Amlus, & Tuan Salwani Awang, 2014)
Outfit ZSTD	-2.0 < ZSTD value <+2.0	(J. M. Linacre, 2019)

The survey instrument was treated for fit statistics until there was no any item with negative (-ve) PTMea Corr. The results of the fit statistics in table 5 below show that the items retained met the index of PTMea Corr. By John Linacre in the table 4 above with PTMea index range between 0.36 to 0.68. additionally, the items for treated for Infit and Outfit MNSQ to detect and remove any misfit item. Any item with Infit value outside the range of 0.5 to 1.5 were removed because they fall short of meeting the specified index by Wright, [1994] and Azrilah Abdul Aziz, Jusoh, Omar, Mohd Haris Amlus, & Tuan Salwani Awang, [2014]. When the Infit and Oufit MNSQ are accepted then the ZSTD value can be overlooked Linacre, [2019] and Rashidi et al., [2014]. Consequently, the result show that the items possess good construct validity with Infit and Oufit index between 0.58 to 1.39, therefore the extreme ZSTD were ignored. Table 5 show the details statistics of fit statistics for the specific items that made up the assessment instrument.

Table 5 Items statistics

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INPUT: 200 PERSON  87 ITEM REPORTED: 125 PERSON  85 ITEM  5 CATS WINSTEPS 3.72.3
--------------------------------------------------------------------------------
PERSON: REAL SEP.: 3.11 REL.: .91 ... ITEM: REAL SEP.: 4.05 REL.: .94
          ITEM STATISTICS:  MISFIT ORDER
 -------------------------------------------------------------------------------------
|ENTRY   TOTAL TOTAL          MODEL|  INFIT | OUTFIT |PT-MEASURE |EXACT MATCH|
|NUMBER SCORE COUNT MEASURE S.E. |MNSQ ZSTD|MNSQ ZSTD|CORR.  EXP.| OBS% EXP%| ITEM
|------------------------------------+---------+---------+----------+----------+-----
|   17   549   125   -.32    .14|1.23  1.6|1.39  2.0|A .44   .49| 45.0 54.4| TBB1
|   56   549   125   -.32    .14|1.29  2.1|1.37  1.9|B .43   .49| 45.9 54.4| TSO4
|   11   511   125    .38    .13|1.36  2.7|1.33  2.1|C .53   .57| 39.6 48.5| TCJ1
|   52   565   125   -.67    .15|1.35  2.2|1.23  1.1|D .39   .45| 54.1 60.7| TSP5
|   54   544   125   -.22    .14|1.15  1.2|1.31  1.7|E .43   .50| 48.6 52.9| TSO2
|    7   501   125    .55    .13|1.12  1.0|1.30  2.1|F .57   .59| 40.5 47.6| TT2
|   18   551   125   -.36    .14|1.30  2.1|1.20  1.1|G .44   .48| 50.5 54.5| TBB2
|    3   490   125    .74    .13|1.28  2.2|1.23  1.6|H .57   .61| 41.4 47.5| TP3
|    4   562   125   -.60    .15|1.24  1.7|1.28  1.3|I .41   .45| 49.5 58.6| TP4
|   78   474   125   1.00    .13|1.27  2.1|1.24  1.7|J .60   .64| 42.3 48.1| TIB1
|   64   559   125   -.53    .15|1.27  1.8|1.08   .5|K .43   .46| 51.4 56.7| TES5
|    1   500   125    .57    .13|1.27  2.1|1.19  1.4|L .55   .59| 41.4 47.6| TP1
|   10   495   125    .65    .13|1.26  2.0|1.19  1.3|M .57   .60| 48.6 47.5| TT5
|   65   535   125   -.04    .14|1.22  1.7|1.18  1.1|N .48   .52| 50.5 51.6| TES6
|    6   521   125    .21    .13|1.18  1.4|1.20  1.3|O .52   .55| 44.1 50.5| TT1
|   32   529   125    .07    .14|1.16  1.3|1.19  1.2|P .48   .53| 45.9 51.1| TD2
|   55   575   125   -.93    .16|1.18  1.1|1.19   .8|Q .36   .42| 55.0 65.7| TSO3
|   61   582   125  -1.13    .17|1.18  1.1|1.10   .5|R .36   .39| 62.2 69.3| TES2
|   72   566   125   -.70    .16|1.16  1.1| .97  -.1|S .43   .44| 60.4 60.9| TM6
|   34   573   125   -.87    .16|1.16  1.0|1.00   .1|T .40   .42| 58.6 64.5| TD4
|   14   478   125    .93    .13|1.13  1.1|1.12   .9|U .60   .64| 45.9 48.1| TCJ4
|   58   588   124  -1.48    .20|1.13   .7| .87  -.3|V .36   .35| 79.1 75.9| TSO6
|   63   573   125   -.87    .16|1.12   .8| .91  -.3|W .41   .42| 57.7 64.5| TES4
|   35   541   125   -.16    .14|1.07   .6|1.10   .7|X .48   .51| 50.5 52.6| TD5
|   66   569   125   -.77    .16|1.10   .7| .91  -.4|Y .43   .43| 56.8 62.2| TES7
|   38   541   125   -.16    .14|1.10   .8|1.08   .5|Z .50   .51| 54.1 52.6| TRF3
|       BETTER FITTING OMITTED       +---------+---------+          |          |
|   23   550   125   -.34    .14| .91  -.6| .82  -1.0|z .51   .48| 55.9 54.6| TCC2
|   46   513   125    .35    .13| .89  -.9| .87   -.9|y .59   .57| 49.5 48.8| TSC4
|   53   565   125   -.67    .15| .89  -.8| .77  -1.1|x .47   .45| 60.4  60.7|TSO1|
|   71   543   125   -.20    .14| .88  -.9| .83  -1.0|w .52   .50| 55.0 52.8| TM5
|   85   520   125    .23    .13| .88  -1.0| .82  -1.3|v .58   .55| 50.5  49.8|TGK4|
|   86   505   125    .49    .13| .87  -1.1| .81  -1.4|u .61   .58| 52.3 48.4| TGK5|
|   74   562   125   -.60    .15| .85  -1.0| .87   -.6|t .47   .45| 62.2 58.6| TPD2|
|   50   490   125    .74    .13| .87  -1.1| .85  -1.1|s .63   .61| 52.3 47.5| TSP3|
|   29   532   125    .01    .14| .86  -1.1| .81  -1.3|r .55   .53| 52.3 51.4| TPL4|
|   81   486   125    .80    .13| .82  -1.5| .86  -1.1|q .65   .62| 54.1 47.4| TIB4|
|   24   530   125    .05    .14| .85  -1.2| .83  -1.1|p .56   .53| 55.0 51.2| TCC3|
|   30   529   125    .07    .14| .83  -1.4| .81  -1.3|o .57   .53| 55.9 51.1| TPL5|
|   37   556   125   -.47    .15| .81  -1.4| .82   -.9|n .50   .47| 55.9 55.8| TRF2|
|   87   536   125   -.06    .14| .79  -1.7| .82  -1.1|m .55   .52| 53.2 51.7| TGK6|
|   48   496   125    .64    .13| .82  -1.5| .78  -1.7|l .64   .60| 55.0 47.7| TSP1|
|   27   511   125    .38    .13| .78  -1.9| .81  -1.4|k .61   .57| 55.0  48.5|TPL2|
|   44   511   125    .38    .13| .81  -1.6| .81  -1.4|j .60   .57| 49.5 48.5| TSC2|
|   77   523   125    .18    .13| .81  -1.6| .80  -1.4|i .58   .55| 58.6 51.1| TPD5|
|   45   511   125    .38    .13| .78  -1.9| .77  -1.7|h .61   .57| 52.3 48.5| TSC3|
|   36   570   125   -.80    .16| .77  -1.7| .75  -1.1|g .47   .43| 63.1 62.6| TRF1|
|   28   534   125   -.03    .14| .76  -2.0| .72  -1.9|f .57   .52| 57.7 51.6| TPL3|
|   75   538   125   -.10    .14| .73  -2.3| .76  -1.6|e .56   .51| 57.7 52.0|TPD3|
|   68   520   125    .23    .13| .75  -2.2| .75  -1.8|d .60   .55| 57.7 49.8|TM2 |
|   79   486   125    .80    .13| .70  -2.7| .74  -2.1|c .68   .62| 51.4 47.4|TIB2|
|   43   528   125    .09    .13| .69  -2.7| .73  -1.9|b .59   .54| 56.8 51.1|TSC1|
|   76   533   125   -.01    .14| .58  -3.9| .59  -3.0|a .61   .52| 70.3 51.3|TPD4|
|------------------------------------+---------+---------+----------+----------+-----
| MEAN   529.8 125.0   .00    .14|1.00   .0| .97  -.2|          | 53.1 53.4 |
| S.D.    31.1   .1    .61    .02| .17  1.3| .17  1.1|          |  7.1  6.7 |
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Therefore, it could be inferred that the entire items entered and analysed using Rasch analysis met the specified criteria for rating scale. Thus, is capable of assessing specific building construction competency of graduates to produce valid result.

From the rigorous process of screening, refining, and subjecting the instrument to experts' validation and reliability to obtain on the spot information concerning specific competency relating to building construction, the researchers develop the instrument for assessing graduate's competency as shown in Table 6. To ensure that graduates possesses competency in specific áreas, the assessors are required to rate the graduates under each competency sub construct and check whether is competent or not competent.

Table 6 Competency Assessment Instrument

TP1 Plumbing	Checklist Scores	
Expected competencies	Competent 1	Not Competent 0
1. Ability to assemble repair toilet appliances		
2. Ability to fit pipes in plumbing work		
3. Ability to use various Plumbing tools and equipment correctly		
4. Ability to interpret working drawings		
5. Ability to identify various plumbing pipes		
TT 2. Tiling Skills		
1 Ability to identify tile types and sizes		
2 Skills in application of floor tiles		
3 Skills in application of wall tiles/skirting		
4. Skills in cutting tiles for specific purposes		
5. skills in laying tiles with minimal wastage/breakage		
TCJ3. Carpentry/Joinery Skills		
1. Skills in basic Carpentry and Joinery		
2. Ability to Identify wood (texture, figure of wood)		
3. Ability to use simple joinery tools and equipment		
4. Ability to Fix iron mongery in doors and windows		
5. Skills in construction and dismantling of formwork		
6. Ability to fix wooden doors and windows/frame		
TBB4. Bricklaying and Block laying Skills		
1 Skills in forming first course of block work		
2 Skills in aligning blocks in straight-line		
3 Skills in the use of simple building tools and equipment		
4 Skills in applying mortar bed for block work		
5 Skills in maintaining alternate mortar joint in block work		

TCC5. Concreting Skills

1   Ability to identify appropriate mix ratio for specific jobs

2   Ability to identify quality of concreting materials

3   Skills in placing concrete in a formwork

4   Skills in curing concrete components

TPL6. Plastering Skills

1   Skills in application of mortar to wall

2   Skills in displaying dexterity in dressing walls and windows

3   Ability to select good plastering sand

4   Skills in maintaining mixed ratios in plastering operation

5   Skills in maintaining uniform thickness during plastering

TD7.   Blueprint/Drawing/Specifications

1   Skills to draw rough /detailed scale plans for building structure

2   Skills in production of prototype of a building structure

3   Ability to recognize elements and symbols of blueprints

4   Ability to Interpret dimensions, types of lines, and scales

5   Ability to locate worksite features on a construction plan

TRF8. Roofing Skills

1   Skills in forming roof trusses on wall

2   Ability to interpret roof design details

3   Skills in identifying various roofing members

4   Ability to Identify various roof covering sheets

5   Skills in laying modern roofing sheets

6   Skills in proper spacing of roof members

7   Ability to Identify roofing sheets connectors

TSC9. Scaffolding Skills

1   Ability to identify parts of scaffold

2   Skills in Assembling tubular scaffold

3   Skills in Assembling bamboo scaffold

4   Skills in Construction of wooden scaffold

5   Skills in dismantling of tubular scaffold

TSP10. Site Preparation Skills

1   Skills in providing free access to new site

2   Ability to identify nature of construction site soil

3   Skills in using site preparation tools and equipment

4   to identify building line, setback, corners, and elevation

5   Ability to Prepare site for excavation

6   Ability to Lay foundations

TSO11. Setting out Skills

1   Skills interpret building design details

2   Skills in transmitting correct building dimensions to the ground

3   to identify foundation trench /wall thickness on profile boards

4   Skills in setting out using 3:4:5 method

5   Skills in Setting out using simple levelling instrument

6   Ability to use simple setting out tools and equipment

7   Skills in positioning profile boards/pegs

TES12. Estimating and Scheduling Skills

1   Skills in marketing during purchase of building materials

2   Ability to Identify quality materials for specific jobs

3   Skills in proper estimation of construction materials

4   Skills in smooth delegating of tasks on site

5   Skills in scheduling of site daily job

6   Skills in time management for productivity

7   Skills in critical analysis of costs of construction materials

TM13.   Building Maintenance/Repairs

1   Ability to identify fault in construction

2   Skills in proffering solution to construction defects

3   Ability to use appropriate materials to address faults

4   Skills in preventative maintenance to service structures

5   Skills to repair and restore existing structures

6   Dexterity in maintenance of building tools and equipment

TPD14. Painting and decoration Skills

1   Skills in mixing paint

2   Skills in preparing wall surface for painting

3   Skills to apply paints to wall surface to admiration of clients

4   Skills in the use of painting and decoration tools

5   Ability to Identify primary and secondary colours in paints

TIB15. Iron Bending Skills

1   Ability to Identify Iron rod sizes for specific purpose

2   Skills in bending iron bars of different sizes

3   Skills in bending rods according to measurements

4   Skills in bending irons bars for different concrete components

TGK16. General Technical Knowledge

1   Knowledge of contemporary technological issues

2   Knowledge of professional ethics

3   Knowledge of Building codes

4   Knowledge of appropriate roof and drainage gradient

5   Knowledge of parts of scaffolds

6   Knowledge of properties of building materials

Total Score

Implications

Convincing theoretical and practical implications emerged from the findings of this study because relevant major stakeholders in building construction industry were carefully selected. The experts gave first-hand information about the current practices and their experiences with fresh graduates in the field and during employment interview. The findings have enormous theoretical and practical implications for graduates, Educational Institutions, Government, Private and Public employers of labour, Professional bodies, and Researchers.

Theoretical implications to the Institutions is that they will strive to disseminate more specific knowledge rather than the general knowledge hitherto provided to graduates. The findings will make instructors to create workplace environments in the classroom; hence, bringing hands-on training to the academic setting. The findings will serve as document for introducing internship programme for other graduates who desire to update their competency. Policy makers could use the framework to improve the existing Nigeria Skill Qualification Framework (NSQF) to meet the current realities. The findings will add value to the body of knowledge by contributing to the empirical literature concerning competencies in the workplace.

Practical implication to private and public sector employers is that they can use the instrument as a template for training and re-training of staff in competency for career advancement. Professional bodies can also use the framework as a reference document for professional selection of fresh graduates into the profession. Organisations can use the instrument as documented evidence for interview selection of fresh graduates for employment. Finally, it contributes to the body of knowledge as it can be used for inculcating specific competencies required by employers in students for effective transition to work environment.

Conclusions

Employers are highly concerned about the quality of graduates provided by educational institutions due to the lack of skills to fulfil their requirements. Higher institutions were unable to fulfil their policy mandate because the curriculum concentrated more on theory than realistic, and did not have adequate coordination for competence training between the institutions and the industries. In the course of this study, contact with experts and labour employers revealed that graduates lack sufficient skills in their various

careers chosen to meet employers 'demands. Different literatures were united in their belief that the job market today needs graduates with both technical and non-technical skills to be employed and effectively employed. A comprehensive and meticulous analysis processes and methods were followed to ensure comprehensibility, dependability, and validity of the instrument to improve the system.

References

Abubakar, M. S., Kazaure, M. A., Yusuf, S. M., & Kaduna, P. M. B. (2003). *Introducing the NVQF for more Open and Flexible Skills Domain in Nigeria National Board for Technical Education (NBTE) Plot B Bida Road*.

Aigbavboa, C., & Aliu, J. (2017a). Requisite Skills for Graduate Success: Perceptions of the Nigerian Construction Industry. *Socioeconomica*, Vol. 6, pp. 21–42. https://doi.org/10.12803/sjseco.61102

Aigbavboa, C., & Aliu, J. (2017b). Requisite Skills for Graduate Success: Perceptions of the Nigerian Construction Industry. *Socioeconomica*, *6*(11), 21–42. https://doi.org/10.12803/sjseco.61102

Azrilah Abdul Aziz, Muhammad Shahar Jusoh, Omar, A. R., Mohd Haris Amlus, & Tuan Salwani Awang. (2014). Construct Validity: A Rasch Measurement Model Approaches. *Journal of Applied Science and Agriculture*, Vol. 9, pp. 7–12.

Blades, R., Fauth, B., & Gibb, J. (2012). Measuring Employability Skills. *A Rapid Review to Inform Development of Tools …*. Retrieved from http://www.ncb.org.uk/media/579980/measuring_employability_skills_final_report_march2012.pdf

Fisher, W., P. (2018). Rasch Measurement Transaction: Rating Scale Instrument Quality Criteria. 21:/p1095.

Fisher, W. P., Elbaum, B., & Coulter, A. (2010). Reliability, precision, and measurement in the context of data from ability tests, surveys, and assessments. *Journal of Physics: Conference Series*, Vol. 238. https://doi.org/10.1088/1742-6596/238/1/012036

Goodwin, S. (2016). A Many-Facet Rasch analysis comparing essay rater behavior on an academic English reading/writing test used for two purposes. *Assessing Writing*, *30*, 21–31. https://doi.org/10.1016/j.asw.2016.07.004

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-Based Nursing*, *18*(3), 66–67. https://doi.org/10.1136/eb-2015-102129

Hodge, R. A., Hardi, P., Bell, D. V. J., Australian Skills Quality Authority, Sebhatu, S. P., Schröter, D., & Factors, E. (2015). Guide to developing assessment tools. *Australian Skills Quality Authority*, (August), 1–11. https://doi.org/10.13140/RG.2.1.1925.9605

Husain, S. H., Affandi, H. M., Che-ani, A. I., & Nasri, N. M. (2018). Analyzing validity and reliability of Malaysian Building Surveyor graduates competency - Model survey instrument using the Rasch Measurement Model. *International Journal of Engineering & Technology*, *7*(21), 15–19. https://doi.org/10.14419/ijet.v7i4.21.21608

Linacre, J. M. (n.d.). *FACET*.

Linacre, J. M. (2019). *Winsteps Help for Rasch Analysis 4.4.7*.

Linacre, M. (2012). Winsteps Tutorial 2. *Winstep Tutorial*, pp. 1–38.

Md Ghazali, N. H. (2016). A Reliability and Validity of an Instrument to Evaluate the School-Based Assessment System: A Pilot Study. *International Journal of Evaluation and Research in Education (IJERE)*, *5*(2), 148. https://doi.org/10.11591/ijere.v5i2.4533

Mutalib, A. A., Baharom, S., & Hamzah, N. (2015). *Rasch Model Analysis Of Implementation Effectiveness For Final Year Research Project Course In Civil & Structural Engineering* (Pp. 11–22). Pp. 11–22.

Rahayah Ariffin, S., Omar, B., Isa, A., & Sharif, S. (2010). Validity and reliability Multiple Intelligent item using Rasch measurement model. *Procedia - Social and Behavioral Sciences*, Vol. 9, pp. 729–733. https://doi.org/10.1016/j.sbspro.2010.12.225

Ramadani, M., Supahar, S., & Rosana, D. (2017). Validity of evaluation instrument on the implementation of performance assessment to measure science process skills. *Jurnal*

Inovasi Pendidikan IPA, *3*(2), 180. https://doi.org/10.21831/jipi.v3i2.15534

Rashidi, M., Begum, R., Mokhtar, M., & Pereira, J. (2014). The Applications of Rasch Measurement Model for Calibrating Survey Instrument for Analysing the Criteria of Sustainable Construction. *Current World Environment*, *9*(3), 653–662. https://doi.org/10.12944/cwe.9.3.14

Residential Construction Industry Competency Model. (n.d.).

Ryan, G., Spencer, L. M., & Bernhard, U. (2012). Development and validation of a customized competency-based questionnaire: Linking social, emotional, and cognitive competencies to business unit profitability. *Cross Cultural Management*, *19*(1), 90–103. https://doi.org/10.1108/13527601211195646

Sick, J. (2011). Rasch Measurement in Language Education Part 6: Rasch Measurement and Factor Analysis. *JALT Testing & Evaluation SIG Newsletter*, Vol. 15, pp. 15–17.

Suhairom, N., Musta'amal, A. H., Amin, N. F. M., & Johari, N. K. A. (2014). The Development of Competency Model and Instrument for Competency Measurement: The Research Methods. *Procedia - Social and Behavioral Sciences*, Vol. 152, pp. 1300–1308. https://doi.org/10.1016/j.sbspro.2014.09.367

Waltner, E. M., Rieß, W., & Mischo, C. (2019). Development and validation of an instrument for measuring student sustainability competencies. *Sustainability (Switzerland)*, *11*(6), 1–20. https://doi.org/10.3390/su11061717

Wang, C. H., Liu, S. H., & Pang, C. T. (2019). A study of the evaluation of the staff competencies in waste management company by Fahp. *Ekoloji*, *28*(107), 1901–1905.

Wright, B. D. (1994). *R_Rasch Factor Analysis vs Traditional FA.pdf*.