DEVELOPMENT OF PROCESS SKILL RATING SCALE FOR STUDENTS' ASSESSMENT IN DATA PROCESSING FOR SCIENCE, TECHNICAL AND VOCATIONAL SCHOOLS IN SOUTH EAST NIGERIA

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ABSTRACT

Purpose: The study developed process skill rating scale for students' assessment in data processing for Science, Technical and Vocational schools (STVs).

Method: Instrumentation research design was utilized for the study and was conducted in Enugu State, South East, and Nigeria. The sample size for the study was 37 students offering data processing which consisted of three ability groups (11 low, 18 average and 8 high abilities). A draft of the rating scale containing 85 data processing skill items was validated and utilized to develop the process skill rating scale in data processing (PSRSDP). The PSRSDP was utilized to evaluate data processing students in STVs. Kaiser-Meyer-Olkin (KMO), Factorial analysis, Cronbach alpha and Scheffe test were utilized in analyzing the data generated. The PSRSDP had overall reliability coefficient of 0.84.

Results: The study revealed significance difference in mean scores of the three ability groups.

Conclusion: The utilization of PSRSDP for assessing skills possessed by the students in trade subjectscan provide teachers and examination bodies a valid judgment on the students' achievement in the trade.Based on the effectiveness of PSRSDP in determining skills possessed by students, teachers and nationalexamination bodies are advised to adopt the instrument for examining the students for appropriatecertification.

Keywords: Development, Assessment, Skill, Science Technical and Vocational, STVs

INTRODUCTION

Barely can any nation survive technologically, industrially and economically without providing education that empowers the youth with skill for entrepreneurial engagement (Illeris, 2009). The Federal Government of Nigeria (FGN) in a bid to provide such education geared towards equipping her citizens with skills, established science, technical and vocational schools (STVs) across the country aimed at inculcating requisite skills and competences to empower the young school leavers, making education functional, and to address the dearth of technical skills in Nigeria (FGN, 2013). The Nigerian Educational Research and Development Council (NERDC) were further directed by FGN to develop a number of curricula in various trade subjects which are currently being implemented in STVs in Nigeria. The first trade subjects' curricula for senior secondary school was published in 2009, (FGN, 2013) and the implementation started from September 2011.The new curriculum incorporated the best aspect of

Syllabus through the adoption of a core and elective subjects. All students must study themandatory core subject as well as one trade subject, which include data processing.

Data processing is one of the trade subjects offered in STVs aimed at empowering the learners with skills and competencies on the applications of computer system for carrying out various operations on data with the use of application software such as word processing, spreadsheet packages, database management system, graphics packages and presentation packages to transform data items into a meaningful form. According to Ndhlovu (2009), data processing helps in generating meaningful information by collecting raw data together and manipulating them to produce the required information available. In corroboration, Onyishi (2019) opines that data processing is any computer process that converts data into meaningful information. Alabi (2014) further asserts that the aim of introducing data processing in schools by the FGN was to; empower the students with competencies in the utilization of Information Communication Technology (ICT) application that will facilitate the acquisition of entrepreneurial skills for everyday living in the global world of work. To ascertain if these objectives are achieved at STVs, it becomes paramount to evaluate the students.

Assessment is an integral part of instructional deliveries which helps to determine whether the goals of education are being met or not (Beumann & Wagner, 2018; Fulmer et al, 2015). Studies have recorded that Assessment of data processing skill acquisition level of school leavers indicated that students are usually assessed in data processing using traditional assessment tools such test (essay and objectives) and the use of traditional method do not provide valid result on the students' achievement in the trade (Jimoh, 2010; Ezugwu, 2018; Authors, 2019). The implication of this to the society is that the products of the trade do not have the skills and competencies required to perform the tasks in the trade. In order to address this situation it becomes imperative to develop effective assessment instruments that can comprehensively assess the mastery of skills by the students in the subject. Ajogbeje et al. (2013) posited that students' achievement in a trade can only be determined with a valid assessment instrument. However, process skill rating scale has been identified as an appropriate device for evaluating students in skill oriented subjects such as data processing (Authors, 2019).

Process skills rating scale assessment is a step wise set of procedures to be performed by students in order to complete a task (Ombugus, 2014). Process skill rating assessment can also be defined as a device for evaluating the level in which a learner can portray the skills learnt and to execute them in condition similar to the working environment of the trade (Okwelle & Okey 2012) The authors further stated that it is step wise practical operations required to determine student's level of academic performance and to ascertain the possible skills gained after teaching and learning process. It is a device that can be applied in evaluating performance of tasks, qualities, quantities, procedures, skill levels, processes, or end products, such as reports, drawings, and computer programs (Enuike & Samuel, 2018). These are judged at a defined level within a stated range. Process skill rating scales are very close to checklists except that they reveal the degree of accomplishment of a task rather than indicating yes or no. Moreso, to generate accurate result, the developed instrument should be valid and reliable in the evaluation processes.

A valid instrument is very useful for assessment purposes. Validity is a concept that guarantees that a device measures the construct it is assumed to measure (Effiong, 2012; Nor, 2016; Muijs, 2011; & Miller, 2012). When an instrument correctly measures any stated variable it is considered a valid instrument for that stated variable. In other words, validity refers to how accurately a process skill rating scale in data processing measures the skill sets it is supposed to

Measure furthermore; reliability of an assessment instrument is the extent in which the results of an instrument can yield the same result under similar condition (Okeme, 2013; Roborta & Alison, 2015; Hamed, 2016; Akib & Ghafar 2015; & Yarnold, 2014). Reliability can be assessed by examining the consistency of findings across time and across different observers (Pallant, 2011). Generally, a valid assessment instrument is reliable if it can generate accurate results that are reproducible (Jackson, 2003). The uses of PSRSDP for assessing students in STVs, will help to generate accurate result for determining the level of student's achievement in the trade. Ogbuanya & Adameji (2015) asserted that the use of appropriate instrument in measurement of psychomotor domain usually categorize students based on the students ability groups. An ability group according to Adeyemo (2010) indicates the intellectual capacities of the students that reveal the levels of skills and competencies that can be performed or demonstrated with ease. Ability group of a student in STVs is the traits which can predict student's academic performance. The author further revealed three ability levels in line with educational settings, these includes High, Average and Low.

Despite the importance of effective assessment, both the school-based assessment and external examination bodies are not assessing students comprehensively in skill oriented subjects with the use of traditional assessment methods. West African Examination Council (WAEC) uses alternative to practical to assess students' skill in data processing while National Examination Council (NECO) and data processing teachers in schools base the practical assessment on mere looking at the printed output with total negligence of various instructions required in completing the task (Authors, 2019). This provides wrong judgment in the students' performance which makes it difficult to achieve the objective of data processing subject STVs.

The use of traditional assessment instruments in assessment of students in data processing has resulted in producing incompetent products from STVs that cannot perform the practical skills in the trade despite the good grades returned by examination bodies. This work therefore, developed a process skill rating scale for students' assessment in data processing which can reveal the true performance of the students in the trade in STVs in Enugu state, South East, Nigeria.

Purpose of the Study

The major purpose of this work is to develop process skill rating scale for students' assessment in data processing. Specifically, the study sought to:

- Identify process skill items in data processing (word processing, spreadsheet, database, graphic package and presentation package) for inclusion in PSRSDP for student's assessment in STVs.
- Develop PSRSDP for assessing students of data processing in STVs.
- determine the validity of the developed PSRSDP
- establish the reliability of the developed PSRSDP
- determine the ability groups of students rated with process skill items in word processing, spreadsheet, database management system graphic packages and presentation packages

Research Hypothesis

One null hypothesis was formulated and tested at 0.05 level of significance.

H_1:   *No significance difference exists in the mean scores of the three ability groups (High, Average and Low) rated with the PSRSDP.*

METHOD

Design of the study

The study adopted Instrumentation design. According to Salkind (2010), instrumentation research design is a plan of study that helps researchers to develop valid instruments required for effective execution of prescribed tasks in education.

Study Area

The study was carried out in Enugu, South East, and Nigeria.

Population for the study

The population of the study was 71 comprising of 34 data processing teachers and 37 year III students of data processing in eight STVs in Enugu, South East Nigeria.

Instrument for data collection

This study utilized two instruments for data collection. Data Processing Practical Skill Questionnaire (DPPSQ) and Process Skill Rating Scale in Data Processing (PSRSDP). DPPSQ was constructed from data processing curriculum and utilized for data collection from teacher in order to identify the items that are appropriate for inclusion in the development of PSRSDP. DPPSQ consisted of 5 practical sections with 101 process skill. Section A consists of 24 skill items on Word Processing, section B contains 19 skill items on Spreadsheet packages, section C with 20 skill items on Database Management System, section D had 19 skill items on Graphics Packages and section E had 19 skill items on Presentation Package, with each having four point response options of Highly Appropriate (HA), Moderately Appropriate (MA), Slightly Appropriate (SA) and Not Appropriate (NP) with values of 4, 3, 2 and 1 respectively.

PSRSDP with 85 process skill was used to rate the students on four points response options of; Excellent- 4 points, Good- 3 points, Fair- 2 points and Poor- 1 point.

Procedure for the Development of PSRSDP

Multi stage approach was adopted for the development as suggested by Benson & Clark(1982) and Cluzeau (2002) in Robert (2018), as follows

- Utilization of NERDC curriculum for selecting specific objective.
- Identification of the task in data processing.
- Identification of process skill items that were used for development of PSRSDP
- Preparation of table of specification.
- Construction of the PSRSDP.
- Face and content validation of the draft instrument form by panel of experts.
- Final assembly of the final instrument.
- Pilot testing.
- Field testing of the final instrument on students.

Validation of the Instrument

To determine the appropriate process skill items to be included in PSRSDP, the following validations were conducted; Kaiser-Meyer-Olkin was used to determine the sampling adequacy, factor analysis at 10% overlapping variance using 0.55 or above as benchmark for selecting appropriate skill item for inclusion. After the analysis 85 items loaded 0.55 or above and were retained for the development of the assessment while 16 items loaded below and were discarded.

Based on Dave's (1975) model of psychomotor domain was used to prepare a table of specification which assisted the researcher in ensuring that the 85 skill items were spread across the levels. A DPPSQ and draft copy of the PSRSDP was validated by five experts.

Reliability of the Instrument

The developed process skill rating scale was pilot tested on 15 final year students offering data processing from University of Nigeria Secondary School, Nsukka who were not among the sample group for the study. The purpose of the pilot test was to determine the internal consistency of the items in the instrument which was estimated by calculating the Cronbach alpha reliability coefficient. Thus, the reliability test yielded a coefficient of 0.84. The choice of Cronbach alpha method in determining the reliability coefficient in this study was in consonance with Trochim (2019) who posited that Cronbach alpha method of testing the reliability of an instrument is suitable for instrument that have large number of items and in clusters. Furthermore, Bukar (2012), suggested that every 5th out of the 15 students were strategically chosen and rated by 3 research assistants to establish the inter rater reliability. Kendal coefficient of concordance (Tau) was used to analysis the rating points. The Kendall correlation coefficient between rater A and B yielded 0.96, rate A and C yielded 0.95 and rate B and C yielded 0.95. Each of the values represents the extent of closeness or relationship among the raters on the level of performance among the 15 students.

Data Collection and Analysis

Data collected from DPPSQ was computed using Kaiser-Meyer-Olkin (KMO) statistics in order to establish the sampling adequacy for the items. KMO values generated have good value of measure of sampling adequacy (MSA) for all items with overall value of MSA=0.894, 0.705, 0.702, 0.853 and 0.723 for Word processing, Spreadsheet, Database management system, Graphic package and presentation package respectively. According to Beaumont (2012), items with a MSA of 0.70 or above should be considered. Similarly, Bartlett'sTest of Sphericity for the clusters showed associated p values < 0.001, hence factor loading of each items of the five construct.

The PSRSDP assessment was trial tested on 37 year III students of Technical College Obinagu Akpugo, Enugu state. Cronbach alpha reliability coefficient was utilized to test the degree of the reliability of each task and the entire rating scale. According to Uzoagulu (2011), any reliability range of 0.5–0.9 is acceptable for an instrument used in educational assessment.

To determine students' ability groups, the scores of the 37 students who were assessed using PSRSDP were computed, ranked from highest to lowest, and grouped into three levels based on Adeyemo (2010) ability classification of 70 marks and above for High ability; 50–69for Average ability and 0–49 for Low ability.

The hypothesis was tested using, Analysis of Covariance. If the F–value reaches a significance value greater than the alpha value of 0.05, then the null hypothesis is upheld otherwise it is rejected. Sheffe's multiple comparison tests were utilized to calculate the degree of agreement in the raters' rating scores.

RESULTS

This section presents the data generated for answering the questions and testing the hypothesis of the study. The presentation is done in tables for each research questions and the hypothesis.

Research question 1: What are the skill items in word processing, spreadsheet, database, graphic package and presentation package that are appropriate for inclusion in the rating scale for assessing students' data processing skills in STVs? For selecting process skill items that are

appropriate to be included in the rating scale assessment, a factor loading of 0.55 or above was used as a benchmark otherwise the item was discarded. Five tasks with 85 process skill items loaded 0.55 or above, hence were included in the development of PSRSDP while 16 process skill items were discarded as shown in Table 1.

Table 1
SUMMARY OF SKILL ITEMS APPROPRIATE FOR INCLUSION IN THE RATING SCALE INSTRUMENT

S/n	Skill Area	Number of items Selected	Number of items Discarded
1	Word processing	20	4
2	Spreadsheet	16	3
3	Database management System	15	5
4	Graphics packages	16	3
5	Presentation packages	18	1
	Total	**85**	**16**

Research Question 2

What is the validity of the developed PSRSDP?

To answer this research question, a Table 2 of specification was prepared based using Dave'smodel as shown in Table 2 below.

Table 2
Dave'smodel

S/N	Dave's Domain	No. of Items	Percentage
1	Imitation	12	14.12%
2	Manipulation	51	61.17%
3	Precision	9	10.59%
4	Articulation	5	5.88%
5	Neutralization	7	8.24%
	Total	**85**	**100.00%**

However, before arriving at the above selection, the draft process skill items were submitted to the experts in Computer and Robotics Education and Science Education who reviewed the appropriateness of the items, during the face and content validation. The experts helped in rewording, restructuring of the items and made useful comments in some area of the instrument. The result of KMO and Factor analyses was also utilized in validating the instrument.

Research Question 3

What is the reliability of the PSRSDP?

Data for answering this research question is presented in Table 3.

Table 3
SUMMARY OF CRONBACH ALPHA RELIABILITY INDICES OF THE PROCESS SKILL RATING SCALE INSTRUMENT

S/N	Task	No. of items	Cronbach Alpha
1	Word processing	20	0.85

2	Spreadsheet	16	0.92
3	Database management system	15	0.83
4	Graphic packages	16	0.83
5	Presentation packages	18	0.79
	Total number of items	**85**	**0.84**

Research Question 4

What are the ability groups of students rated with process skill items in word processing, spreadsheet, database management system, graphic packages and presentation packages?

To provide answer to this research question, PSRSDP was administered to the 37 students in Technical College Obinagu Akpugo, Enugu State, the result is show in Table 4 below.

The task with the corresponding process skill items utilized in determining the ability groups of the students in data processing.

Table 4: **ABILITY GROUPINGS OF STUDENTS RATED WITH PSRSDP**				
S/N	Ability grouping	SD	N	X
1	High	8	77.13	6.13
2	Average	18	68.83	6.71
3	Low	11	40.45	8.66
	Total	37	58.81	21.5

H₂: *There is no significant difference in the mean scores of the students of three ability groups (High, Average and Low) on the developed process skill rating scale items in word processing, spreadsheet, database management system, presentation packages and graphics packages based on their ability grouping.*

Table 5 **SUMMARY OF ANALYSIS OF VARIANCE OF THE MEAN PERFORMANCE OF HIGH, AVERAGE AND LOW ABILITY STUDENTS ON THE PROCESS SKILL RATING SCALE ASSESSMENT OF THE FIVE TASKS IN DATA PROCESSING**					
Sum of Squares	Mean Square	F	Sig	Decision	Df
Between Groups	6308.01	2	3154.00	60.31	0.00
Within groups	1778.10	34	52.30		S
Total	8086.11	36			

Table 5 shows the result of the ANOVA conducted to test for significant difference in the mean performance of the three e and low ability students on the process skill items in the PSRSDP for assessing students' performance in word processing, spreadsheet, database management system, graphics packages and presentation packages.

DISCUSSION

The findings on research question 1 revealed that 85 items out of 101 items had factor

loading 0.55 and above were selected for inclusion in the process skill rating scale instrument developed. This finding corroborate with (Udoudo, 2014; Williams, 2012; Adamu et al., 2015) who asserted that items of assessment with good factors and satisfied all the psychometric properties are appropriate for selection.

The validity of PSRSDP was obtained through analysis of the responses of the five experts who determined the process skill items that were appropriate for assessing student skills on data processing. Hersbatch (2010); Okoro (2012) suggested that content validity of psychomotor domain can be obtained by itemizing the skill items to be reviewed by experts in order to arrive at an agreement on the appropriateness of the items to be utilized in development of the PSRSDP. It was further revealed that factorial analysis of the developed PSRSDP items ranged from 0.558 to 0.950 indicating very high validity which agrees with findings of Garba (2010); Olaitan (2014) in similar assessment instrument developed. The analysis of the responses gave a high level validity, meaning that the instrument was valid and adequately covered the curriculum. This is in line with the approach adopted by Ombugus (2013) who established content validity from detailed with reference to Simpson 1972 model and the comments from experts.

On reliability, 0.84 was estimated as the overall reliability of the PSRSDP. This shows that the process items were very reliable across the 6 levels of Daves taxonomy tested. This assertion agrees with the opinion of Uzoagulu (2011) who stated that for research purposes that the reliability coefficient of 0.70 and above is acceptable. This implies that the instrument was reliable. Also, the finding of this work is similar to Udoudo (2014) and Ugwu (2009) studies whose instruments had reliability coefficient of 0.89 and 0.90 respectively. It was revealed that 8 out of 37 students (representing 21.62%) indicating high ability; 18 students or 48.65% fell under average ability group while 11 students or 29.73% fellow under low ability..

On the ability groups, it was revealed that 8, 11 and 18 students fall into high, average and low ability groups respectively.

On the hypothesis, the null hypothesis was rejected. The expected p-value is less than the alpha value (0.05). This reveals that significance difference exist in the mean scores of the students on the tasks in word processing, spreadsheet, database management system, graphics package and presentation package in data processing based on their ability level. Scheffe's multiple comparison test analysis was utilized to ascertain the direction of the difference. It was revealed that the high ability group performs significantly better than the average and low ability groups.

The findings are in agreement with the view of Adeyomo, (2010) who stated that students are qualitatively different in their ability groups. Other studies have also found that the performance of high ability students have been on increase while the low ability students are low (Ayuba, 2007 & Robert, 2018).

The findings of this study has implications to curriculum planners who are interested in designing a curriculum that will effectively embrace the psychomotor domains of learning through the use of the developed process skill rating scale assessment instrument. This will result in providing the teachers with adequate process skill content for efficient and comprehensive psychomotor evaluation.

The findings of the study could also influence the decision of the examination bodies such as WAEC and teachers in adopting process skill rating scale for students' assessment in data processing in STVs. Similarly, the instrument could help employers of labour in Information and Technology (IT) industries in selecting high performing employees, thereby

having increased productivity and reduction in wastages.

CONCLUSION

The use of traditional assessment methods adopted by teachers and examination bodies in south East, Nigeria for assessing students in trade subjects such as Data processing in STVs do not provide accurate and valid judgment in the student's academic achievement in the subject as the product of the trade do not possess sufficient skills and competencies needed to perform in the trade, even with the good grades returned by the teachers and examination bodies after graduation. To remedy this gap in assessment method in psychomotor domain, a process skill rating scale assessment was developed to help teachers and the examination bodies to assess students effectively and comprehensively in order to generate accurate result in the students' achievement in the trade.

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