HIERARCHY OF ENTREPRENEURSHIP COMPETENCE FOR ELECTRICAL TECHNOLOGY PROGRAMME IN HIGHER INSTITUTIONS

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Abstract

The item hierarchy is essential for the categorization of the items into the level of difficulty. The development of a framework is very important for an educational programme. Many a time, the constructs are very broad and are not classified into their level of difficulties. This makes classification arbitrary and haphazard. Recent studies have indicated that the entrepreneurship skills framework for fostering the employability of Electrical Technology students in Colleges of Education in Nigeria is classified into electrical-specific skills and electrical mindset skills. The purpose of the study is to classify the variables into their levels of difficulty. Consequently, the Rasch Model Measurement was used to generate and classify the constructs from the framework into the four levels of item difficulty. The four-point scale of most important, moderately important, less important, and lowest important. The fit statistics of the eigenvalue and variable map are of great use. The difficult items are located at the upper region of the scale above the mean, while the less difficult or easy items are categorized at the bottom of the scale. The moderate item to endorse is located in the middle around the mean. This is essential for item categorization and ensuring that instruction flows from the less difficult to the most difficult.

Keyword: Hierarchy; Entrepreneurship, Competence; Rasch Model; Electrical Technology

Introduction

Electrical Technology students in Colleges of Education in Nigeria are prepared for teaching, business, and industry and to be self-reliant through their training (NCCE, 2012; NPE, 2013). Despite the growing number of opportunities, the rate of unemployment among graduates had been on the increase yearly (Afolayan et al., 2019; Aminu, 2019; National Bureau of Statistics, 2018; Orunbon and Akinyemi, 2020). The teaching service seems to have had enough Electrical Technology teachers and the opportunity for an alternative source of income is not coming from the Industry. Research clearly shows that higher institutions in Nigeria are talking

about introducing entrepreneurship into the school curriculum, but there seems not to exist a clear, pragmatic and focused framework for its implementation (Orunbon and Akinyemi, 2020). Most institutions are concerned with tailoring works, cosmetics activities and the like. Neglecting the core of entrepreneurial specific and mindset skills that are germane to graduate employability. The programme (Entrepreneurship) is being implemented without recourse to the specificity of disciplines. This might not be unconnected with the recommendation of the researcher who advocated for the further definition of the generic and specific skills needed by employees based on emerging professional demands (Alfalih & Ragmoun, 2020; Guàrdia, Maina, & Mancini, 2021; Yasin, Amin Nur, Ridzwan, Ashikin, & Bekri, 2013). Therefore, this study is aimed at developing an entrepreneurship skills framework that will be capable of inclusion in the curriculum of Electrical Technology in Colleges of Education in Nigeria. This will in a way fulfill the recommendation of Sousa, (2018) for the conduct of parallel research that could create a typology of skills to build a framework of pedagogical content for the development of entrepreneurship skills. Similarly, Orunbon and Akinyemi, (2020) note that the availability of resources and favourable government policies alone cannot guarantee the rapid economic development of a nation, but the entrepreneurial skills of the people. Therefore, the study aims to ensure that the skills gap that is existing between Colleges and Employers is considerably bridged for the benefit of the students, parents, educational institutions, government in particular, and society in general. The study is guided by an objective which is the development of anentrepreneurship competencehierarchy for Electrical Technology students in Colleges of Education in Nigeria. Monitoring the objective is a single research question that seeks to find an answer to the competence categorization using the Rasch Model Measurement.

Rasch Analysis Model

The Rasch analysis is a psychometric technique that was developed to improve the precision with which researchers construct instruments, monitor instrument quality, and compute respondents' performances (Boone, 2016). In particular, Rasch analysis enables researchers to utilize a respondent's raw test or scale scores and express the respondent's performance on a linear scale that shows the unequal difficulties across all test items. Rasch analysis is a fundamental and adequate method for developing direct measures from ordinal data (Mahmud, Ghani, and Rahim, 2013).

Rasch analysis depends on a probabilistic model and the parameters are thought to be interdependent (Mahmud et al., 2013). However, the separation between the two parameters is

equally assumed. The separation is accomplished by using a probabilistic method in which a person's raw score on a test is converted into a success-to-failure ratio, and afterward into the logarithm odds that the individual will accurately answer the items. A person's logit score would then be utilized as a gauge of that person's ability, and the item logit score would then be utilized as an estimate of that item's difficulty (Baron, Gürçay, Moore, and Starcke, 2012; Linacre, 2002; John Linacre, 2006; Said, 2015; Saidfudin et al., 2010). The Rasch model is a member of the family of item-response latent-trait models (bin Abd. Razak, bin Khairani, & Thien, 2012). It uses a set of carefully selected items in an interval scale to determine item difficulties and person measures. The items are arranged on the scale according to how likely they are to be endorsed. The Rasch model is different from the perspective underpinning statistical modeling because, modeling is often used to describe a set of data where parameters are then modified and accepted or rejected based on how well they fit the data (Othman, Asshaari, Bahaludin, Nopiah, and Ismail, 2012). Whereas, the Rasch model is used to obtain data that fit the model (Linacre, 2002). The rationale for this perspective is that the Rasch model embodies requirements that must be met to obtain a measurement. Therefore, Rasch Analysis Model will be used for this study because of its quality to generate a sample-free framework for item analysis unlike the sample-specific offered by the traditional method (Burgess, and Ene, 2018). This is made possible due to its advantage of producing invariant item parameters and using goodness-of-fit to detect problematic items, thereby leading to more accurate item results (Sampson, Bradley, Arrowsmith, and Mensah, 2018).

Methodology

Sample Size for Rasch Measurement Analysis

Since the current study is seeking to establish the validity of the entrepreneurship skills framework for Electrical Technology students in Colleges of Education through the use of the Rasch Analysis Model. Therefore, the sample size prescribed for Rasch Measurement Model was followed. The researcher decided to go for ± ½ logit with a 99% confidence level, and the minimum sample size range is 108 to 243. Rasch analysis sample size of at least 150 respondents and a minimum of 20 items are suggested for attaining stable indices (Green, & Frantom, 2002; Saidfudin et al., 2010). For the pilot study, to obtain ± 1 logit of 95%, a minimum sample size range of 16 to 36 is recommended, while the size for most purposes is 30 (Linacre, 2002). For this study, the sample size for the pilot study was 40. This is done to be able to predict the

difference between the items (separation) because of the implication of using a smaller sample size. Table 1.1 describes the sample size base on the Rasch Measurement Model.

Table 1.1: Rasch Measurement Model Sample Size

Item Calibration stable within	**Confidence**	**Minimum sample size range (best to poor targeting)**	**Size for most purposes**
± 1 logit	95%	16 -36	30
± 1 logit	99%	27 - 61	50
± ½ logit	95%	64 - 144	100
± ½ logit	99%	108 - 243	150

Source: (Aziz, 2011; Linacre, 2002)

Analysis and Findings

What are the items according to the constructs for the entrepreneurship skills framework (QESFW) instrument?

The list of items for each construct in the QESFWwas generated by reviewing the constructs mentioned in the qualitative aspect of this study. This was followed by the development of an item pool for theQESFW instrument.

Inter-rater Agreement

Before the instrument was used for pilot study testing, an inter-rater agreement involving 3 experts in Electrical Technology was carried out. This was aimed at gaining the expert's agreement towards the items contained in the ESFWinstrument. The ratings in the instrument are Not Important =0, Less Important = 1, Important =2. The value of Fleiss Kappa for the items is shown in Table 1.2.

Table 1.2: Fleiss Kappa Agreement Index for Constructs in QESFW

Constructs	**No of items**	**Rater1**	**Rater 2**	**Rater 3**	**Mean of % Average**	**Level of Agreement**
Entrepreneurial Specific and Mind-set Skills	120	69/120 = 57.50	69/120 = 57.50	86/120 = 71.66	62.22%	Substantial Agreement

The table indicates that the level of agreement among the three experts is generally very good for the constructs in the QESFWinstrument. After some modifications had been made, the instrument was given to two experienced lecturers in technical education to ensure its face validity. The data set for Fleiss Kappa is shown in Appendix F.

a) Demographic Profile

A total of 150 electrical students in the College of Education nationwide were involved in the quantitative phase of this study. Based on the data collected using a questionnaire, 75% of the respondents are male while 25% are female. 79% of the data were collected from government-owned Colleges of Education, while 21% were from privately owned Colleges of Education in Nigeria. The analysis further shows that 49% of the respondents are from the Southern part of Nigeria and 51% are from the Northern region.

i) Summary of Person and Item Separation and Reliability. Separation and Reliability of Person and Item

To arrive at an appropriate and valid item hierarchy, preliminary tests and measurements have to be conducted to ensure the validity and reliability of the items. The summary statistics provided the overall statistics of the complete data processed on item and person responses. The value of person separation and reliability for the constructs is 2.01 and 0.80 respectively. The values for item separation and reliability at the same time were 2.73 and .88 respectively. The Cronbach Alpa(KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .86. The separation is used to determine the difficulty level of the item. Raw variance explained by measures = 99.8%. Similarly, the Unexplained variance in 1st contrast = .1% with an Eigenvalue of 3.0. The details are found in Appendix G. With the preliminary standards measures observed and met, the stage is set for the analysis of the major constructs of Entrepreneurship Specific Skills and mindset skills.

However, since the researcher is concerned with the framework and hierarchy, what is needed in this circumstance is the value of the item map. The separation and reliability of person are more important when conducting a profiling of the person's responses (Linacre, 2002; Azrilah, 2010). Consequently, the result of the separation and reliability for both the Entrepreneurship Specific item and the mindset item is fit for Rasch Analysis Model.

ii) Entrepreneurship Specific Data

Table 1.3: SUMMARY OF 7 MEASURED ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	19.0	9.0	.00	2.18	.32	-.6	.14	-.8
S.D.	6.9	.0	16.14	.77	.42	.5	.19	.5
MAX.	29.0	9.0	17.93	3.26	.99	.2	.45	.0
MIN.	11.0	9.0	-25.84	1.14	.02	-1.0	.01	-1.2

REAL RMSE	2.32	TRUE SD	15.98	SEPARATION	6.90	ITEM	RELIABILITY	.98
MODEL RMSE	2.32	TRUE SD	15.98	SEPARATION	6.90	ITEM	RELIABILITY	.98
S.E. OF ITEM MEAN = 6.59								

DELETED: 41 ITEM
UMEAN=.0000 USCALE=1.0000
ITEM RAW SCORE-TO-MEASURE CORRELATION = -.99
63 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 10.83 with 46 d.f. p=1.0000
Global Root-Mean-Square Residual (excluding extreme scores): .1568

The Item measured for Entrepreneurship Specific skills has a separation of 6.90 and a reliability of .98. This is a very good measure for this study because it shows initial fits for Rasch measurement. Thus, the person sample is large enough to confirm the item difficulty hierarchy of the instrument and that the instrument is able to distinguish among the strata of item difficulty. That is, among the most important items and the lowest important item as it is concerned with this study.(Linacre, 2002; John Linacre, 2011; Saidfudin et al., 2010).

iii) Mind-Set Data

Table 1.4: SUMMARY OF 17 MEASURED ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	25.6	11.0	.00	.97	.91	-.2	.96	.1
S.D.	11.7	.0	10.92	.24	.61	1.2	1.01	.8
MAX.	42.0	11.0	12.59	1.82	2.09	2.0	4.01	1.8
MIN.	12.0	11.0	-14.46	.80	.06	-1.8	.03	-1.0

REAL RMSE	1.11	TRUE SD	10.86	SEPARATION	9.82	ITEM	RELIABILITY	.99
MODEL RMSE	1.00	TRUE SD	10.87	SEPARATION	10.88	ITEM	RELIABILITY	.99
S.E. OF ITEM MEAN = 2.73								

MAXIMUM EXTREME SCORE: 4 ITEM
MINIMUM EXTREME SCORE: 1 ITEM
DELETED: 50 ITEM
UMEAN=.0000 USCALE=1.0000

The Item separation for the mindset skills is 9.82 with an Item reliability of .99. This shows that the sample is large enough and that the instrument is able to distinguish among the strata of item difficulty. That is, among the most important items and the lowest important item as it is concerned with this study.

iv) Findings Hierarchy for Entrepreneurship-Specific Skills

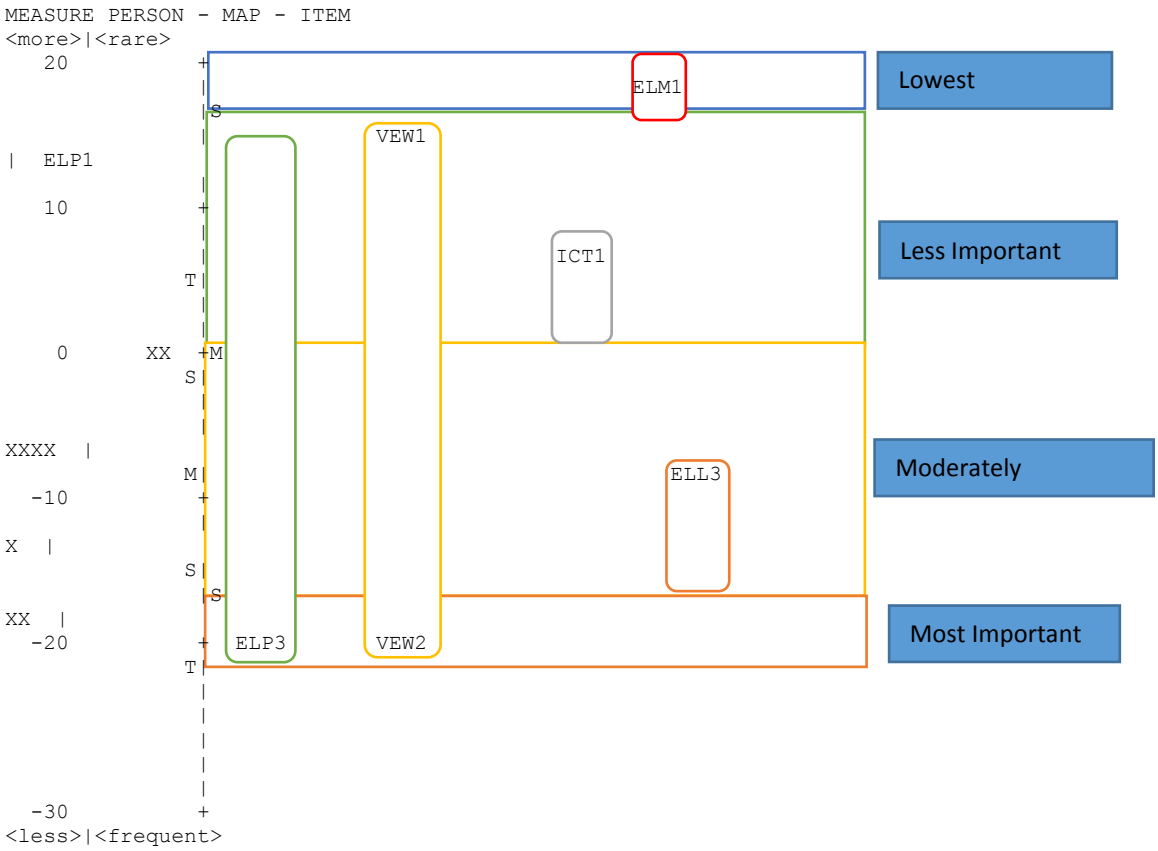

Figure 1.1: Item Map for Electrical-Specific Skills

Figure 1.1 shows the hierarchy of skills to be mastered by the students from the basic one which is from the 'most important' (ELP3, VEW2) through to the 'lowest important' (ELM1). These are the Electrical-Specific skills that come from the most important to the lowest important. However, to be able to achieve the lowest important skills, the students should possess the ability for troubleshooting electrical generation equipment and circuit optimization. They form the basic skills to be mastered by the students of Electrical Technology in Colleges of Education to guarantee their employability.

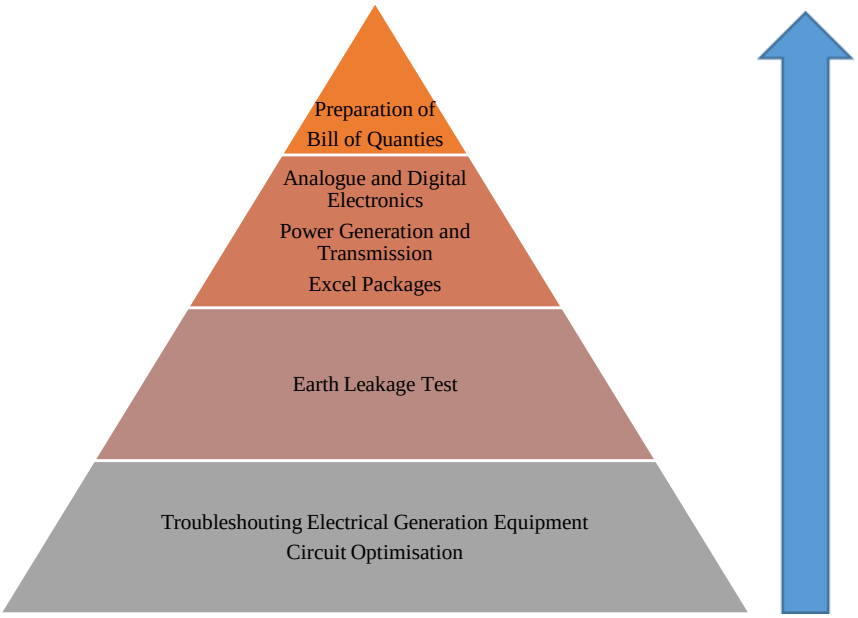

Figure 1.2: Hierarchy for Entrepreneurship-Specific Skills

v) Findings Hierarchy for Entrepreneurship Mind-Set Skills

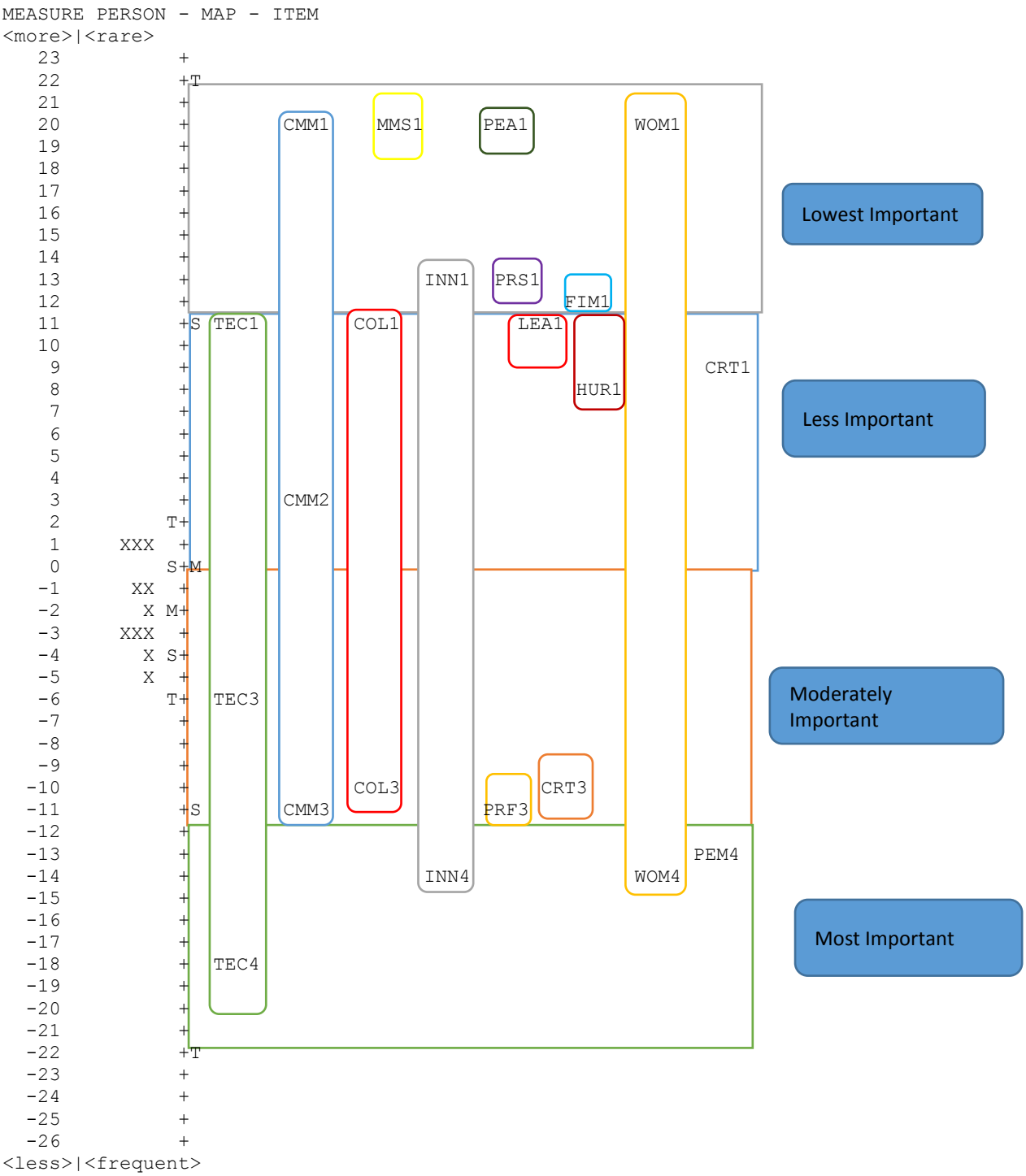

Figure 1.3: Item Map for Entrepreneurship Mind-Set Skills

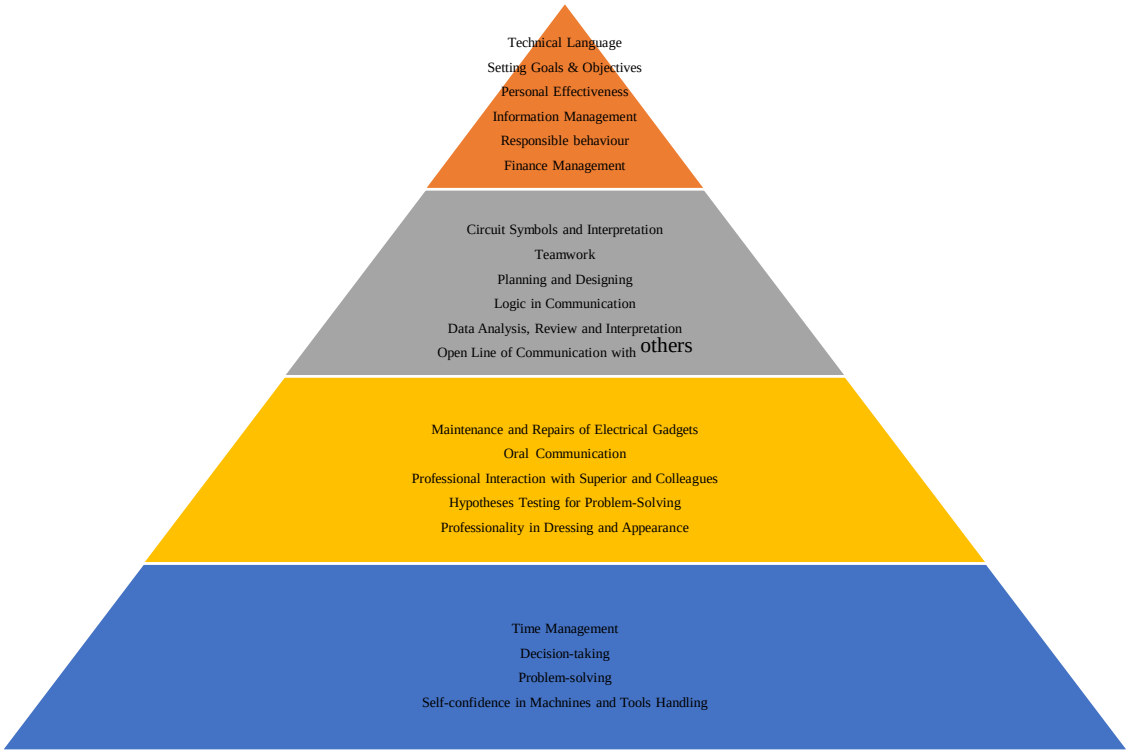

Figure 1.4: Hierarchy for Entrepreneurship Mind-Set Skills

As shown in Figure 1.3, the 'Most important' skills for the Mind-Set skills (TEC4, INN4, WOM4, and PEM4) are meant to be mastered before the 'Lowest important skills'. The implication is that these items are less difficult to learn.

Discussion of Demographic Profile

The quantitative data collected shows that 75% of the respondents are male students of Technical Education with a bias in the Electrical/Electronic Technology option. 25% are female students. This shows that we have more male enrolment in Technical Education than female enrolment. The data also shows that 27% of the respondents are within the age bracket of 15-20 years; 40% of them fall between 21 and 25 years. Similarly, 15% of the respondents are between the ages of 26 and 30 years. Also, 18% of the respondents are in the age bracket of 31 and 35 years. This show that the larger number of the respondent is a youth group who are not above 25 years of age. This seems to be very good for the study because of the revolutionary age where the students are expected not only to be ICT compliant but to fit into the global work best practices.

Further analysis shows that 79% of the respondents have a preference for Electrical Technology while the remaining 21% show interest in Electronic Technology. Electrical and Electronic Technology are taught together in the Colleges of Education in Nigeria. The students might have chosen their respective Colleges due to weak guidance. The parent and the councilors show to play a prominent role during the admission process for their children and wards. Furthermore, analysis indicates that 79% of the respondents attended Public Colleges of Education while only 21% are in Private Colleges. This also affirmed the findings by researchers that technical education is capital-intensive. (Tsai 2013; Maigida, Saba, and Namkere 2013; Raj Kumar Mittal, Namita Garg and Horizon 2018; Rufus et al. 2020; Toby 1997; Banke and Ph 2016). This might have accounted for the fewer Colleges with Technical Education and the attendant low enrolment related to high tuition. Last but not the least, the classification by region shows that 51% of the respondents are from Northern Nigeria while the remaining 49% are from the South.

vi) Reliability and Separation Index

This test was performed to determine the validity and reliability of the ESFW scale. This step involves a series of instrument testing to ensure that the scale is improved. The value of Item separation for Electrical specific is 2.73 with a reliability of .88. Raw variance explained by measures 99.8%. Equally, the value of the Item separation for mindset skills is 6.90 with a reliability of .98. The Item Raw Score –To-Measure Correlation for Mind-Set skills is -.99. The results showed that the current study has a relevant person sample size, and the ESFW instrument is sensitive enough to distinguish between low and high performers. Similarly, the reliability of (.91) and (.97) indicates that the instrument is capable of measuring the same items when reapplied to another sample of the group with a similar ability. According to Linacre (2002), a high item separation index is an evidence that the person sample size is large enough.

The value of the item separation refers to the number of strata of item difficulties obtained in the instrument. With the recommendation of Linacre (2002), a separation value that is >2 is good to proceed with further analysis.

Bond & Fox (2001) suggested that when the value of reliability is >0.8, it is acceptable. When it is < 0.8, it is less acceptable. From every indication, based on the reliability of the data analysis for this study, both the Technical and Non-Technical constructs met the requirement of the Rasch Analysis Model. Consequently, the instrument is good for further analysis.

vii) Item Hierarchy

The item hierarchy is essential for the categorization of the items into the level of difficulty. The difficult items are located at the upper region of the scale above the mean, while the less difficult or easy items are categorized at the bottom of the scale. The moderate item to endorse is located in the middle around the mean. In Figure 4.2, the item hierarchy for Electrical specific skills is categorized into the level of importance starting from "Most Important" to "Lowest Important Item". The hierarchy shows the skills to be mastered by the students from the basic one which is from the most important (Circuit optimisation) through to the lowest important ones (preparation of Bill of quantities). These are the Electrical-specific skills that come from the most important to the lowest important. However, to be able to achieve the lowest important skills, the students must have acquired sufficient skills in circuit optimisation, troubleshooting of electrical appliances, measuring instruments, and so on. The emergence of the 'Bill of Quantity' is a new dimension in the teaching of electrical/electronic technology. It will be specifically helpful to those who wanted to go into merchandise, construction, or serve as electricians.

Based on Rasch's Analysis, employing the partial credit model indicates that each item has its rating scale (Adams & August 2010; Wetzel & Carstensen, 2014). Thus, the higher order item of the Bill of Quantity cannot be attained without first achieving the basic and the Most Important, Moderately Important, Less Important, and Lowest Important Items.

Similarly, time management, decision-making, problem-solving, and self-confidence in machine and tool handling are located below the hierarchy as the basic and most important items to be mastered before the next level of 'Moderately Important skills' can be attained by Electrical Technology students in Colleges of Education in Nigeria. The 'Ability to use and interpret technical language' forms the lowest important item to be mastered by Electrical Technology students within the array of Mind-Set skills. This is located at the topmost part of the hierarchy and it is a sub-construct of Technology.

Although a few of the constructs fitted the hierarchy for the Specific skills and Mind-Set skills, it is important to note that those constructs having a mean above zero are not suitable for inclusion in the final proposed framework. The fit items corroborate Spencer and Spencer (1992); Pritchard (2013) that hard skills and soft skills are better predictors of success. The combination of the two constructs will substantially reduce the rate of unemployment among Electrical Technology graduates (Abolo, 2016).

It has to be emphasised that excluding these items does not rule out their importance. The implication is that the most basic items must be learned before the higher order skills which are the lowest important item as displayed in the hierarchy. For example, Brain, Crooks, and Combs (2018) assert that integrity increases organizational efficiency. They noted that integrity is important in reducing production costs more than competence-based trust. Similarly, Al-Far, Qusef, and Almajali, (2019) affirmed the importance of confidentiality and integrity in building any secured software during developmental phases. Therefore, the importance of integrity in the life of a student and more importantly, as regards employability cannot be underestimated. That integrity constituted a misfit item does not underestimate its importance.

Conclusion and Recommendation

The study has been able to process all the primary data collected and propose a concise entrepreneurship skills framework for inclusion into the curriculum of Electrical Technology in Colleges of Education in Nigeria. The findings show that the aggregation of electrical specific and mindset skills will help to solve the problem of unemployment among Electrical Technology graduates. Consequently, the Federal government of Nigeria should put in place an accreditation body for the employability of technical graduates. The student needs a new mental orientation of being creative and innovative in contrast to over-reliance on the academic qualification that is rooted only in theories without genuine practical impetus and the skills for accessing the available jobs.Entrepreneurship skills in each programme or discipline should be encouraged and adequately funded rather than creating a new department of entrepreneurship. The conscious efforts by Higher Institutions to camouflage theories as competence should be jettisoned for where the personnel for the programme/job resides. The issue of entrepreneurship and employability is a construct with broad concepts. Therefore, future studies should be based on discipline-difference to a mark of departure from the broad framework. This is in a bid to familiarize the students in a particular discipline with what is special about their disciplines, and what special requirements the employers are looking for. There should be a conscious effort to enhance collaboration between the Colleges of Education Institutions and Employer of Labour. This will help to bridge the skill gap between the Colleges and Employers.

Conflict of Interest

There is no conflict of interest regarding this study.

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