

Structural Classification of Employability Skills Hierarchy using Rasch Analysis Model



Sunday Rufus Olojuolawe, Nor Bt Mohd Amin Fadila, Adibah Abdul Latif, Habibu Aminu Sani, Haruna Garba Wase

Abstract: *This study considers the procedures for conducting item classification employing Rasch Analysis Model. The knowledge of the hierarchy enables lecturers to organize their learning objective and also permits the students to measure their employability. The survey study employs exploratory sequential mixed methods. It was conducted to identify and give the hierarchy of the skills required by Electrical Technology students in Colleges of Education in Nigeria to be employable. The first phase involved 10 electrical experts from Industry and Colleges of Education who were purposely selected. The analysis of the findings obtained using Nvivo 12 led to the second phase which comprised of 104 respondents. The sample also consists of Electrical Technology expert in both Industry and Academics. In order to ensure that all items fit the Rasch Analysis Model, the fit statistics were performed to refine and remove all misfits item. Because, the item was ordinal and ranked, Partial Credit (Rasch) Model was involved in the treatment. A separation index of 3.28 and 5.28 was obtained for the technical and non-technical skills with a reliability of .91 and .97 respectively. The implication is that each group is unique and therefore, the most basic item at the bottom of the hierarchy must be learned before the next higher-order item.*

Keywords: *Employability skills, Hierarchy, Rasch analysis, Structural.*

I. INTRODUCTION

Researchers and the expert world over, are advocating for the study and introduction of employability skills into the course contents of schools curriculum. The course covered by employability has no limit and therefore, Electrical Technology is not an exception. [1]. Notes that the development of the world economy brought about human and capital development. These developments are supported

through the provision of skilled human resource impetus that enhances the social-economic status of a country. Therefore, Nigeria as a country, cannot afford to continue to sit back in the global race for technology break-through, and innovations in her quest to solve the problems of hunger and poverty. The problem arose as a result of the lack of relevant skills (employability) needed for the world of work by graduates of Higher Institutions. This is more realizable with Electrical Technology students who are a better position to be the engine room of the nation's growth and development.

[2]. Opines that TVET programmes as it is currently implemented in many developing countries are based on the premise that the development of such country's economic production capacity and employment opportunities can benefit significantly from the levels of knowledge and skills in the nation's workforce that is being raised. This assumption stresses the proposition that investment in the training programme and Education should raise the productive level of workers. Understanding this, the government of Nigeria described her specialized and professional Instruction program as Vocational and Technical Education (NPE, 2004 revised). VTE, as contained in the Policy document [3], is utilized as a complete term alluding to those parts of the instructive procedure including, broad training, the investigation of advances and related sciences and the attainment of practical skills, knowledge, comprehension, and learning identifying occupational areas of economic and social values. The skills are learned in the Junior and Senior Secondary schools. Technical Colleges are designed to prepare individuals as craftsmen as well as specialists at sub-proficient levels. While graduates of Electrical Technology from Colleges of Education forms the crops of Technical Officers Cadre between the Craftsmen and the Engineers. The absence of non-qualification of these officers necessitated the worries of the employers and the need to bring in foreigners who can fit into the jobs from outside the Country. It has been established that the jobs are there, the human resources sector of the economy lacks the competently trained personnel to fill the vacancies [4]. There is, therefore, the need to develop an employability skills framework the will match Electrical Technology students from Colleges of Education with the competencies required for jobs in this dynamic 21st-Century.

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II. ACADEMICS AND EMPLOYERS AS CRITICAL STAKEHOLDERS IN EMPLOYABILITY

The reason for the inclusion of Employers, and Academics and in the study was based on the assertions of scholars about the need to have a strong collaboration between the school and the employer [5]–[10].

Equally, the gradual emergence of Technological Unemployment; The 4th Industrial Revolution which is associated with advanced digital automation is noted to be capable of making skilled workers jobless [11]. Thus, [12], [13] recommends inclusive growth that involves all stakeholders to avoid job stagnation that would emerge from IR4.0. Furthermore, [10][14] asserts that the lack of uniformity in the definition of employability was because of the different views held by the Industry, Institutions and the Students.

The employers are expected to have inputs and contributions to the curriculum designs of Higher Education at every stage of preparation because they are the end-users of the school products. They will not be willing to buy a bad product. This comes in the form of students work experience scheme, placement, and internship [14]. There should be a valued innovation through effective collaboration between the two critical stakeholders in graduate employability. [15]. While stressing the importance of employability skills note that effective work performance of the employee enables the organization to attain its set goal with ease.

Equally, [16] came up with four stakeholder groups in their study on drawing a comparison between Human Capital theory and Signal theory that are relevant to Higher Education, these are; employer, government, existing students and potential students, and the University (HE).

The enhancement of employability is the most crucial factor within the Educational Institution [17]. However several factors come into force while considering students employability. The age of the graduate students, gender, work experience, academic achievement and the socio-economic background of the students are factors to reckon with especially, in a society that is generally believed to be corrupt [18][14]. It is on record that the employers expect the graduates to exhibit broad skills beyond their academic qualifications. The absence of these factors has an overbearing influence on the employers in deciding which candidate to be selected for a particular job.

Similarly, the academics are expected to teach the students about how to be employable. The lecturers must display adequate mastery of their disciplines, and know the career options and outcomes that are inherent therein. They are required to be explicit about the career pathways and not just exhibition of academic competence which is becoming obsolete to the employers. There should be an authentic assessment activity that aligned with the employers' required practices, standards, and approaches to doing things. The student work experience scheme and internships should enjoy full support from the academics. In addition, the relevant graduate employability skills in the learning outcomes for every course of study should be clearly articulated. The engagement between the school and the employer should be cordial, stronger and firm. The employers should be actively

involved and engaged in school activities. The employers can be engaged in school activities as a panelist to form a yardstick for assessing the school curriculum, and for the immediate feedback process. The employers are the end-users of the school products. They are crying aloud that the current graduates fall short of the requirements needed for the workplace. Thus, they are finding it difficult to fill the existing job vacancies [19]. Consequent upon the above, the development of a 21st-Century employability skills framework involving item classification is needed by the employers and help in shaping the students with the current market realities.

III. RELATED AND EMPIRICAL STUDIES

[20]. Conducted a study on the employability of Hospitality graduates to determine the perception of Student and Industry in Taiwan. The focus was on the perception of Senior Hospitality Students and Industry Managers of employability in the industry. The result shows that both senior students and graduates lack confidence in their employability especially, in the areas of professional management skills. He made a recommendation for the replication of the study in other countries of the world.

Equally, [21]. studied the development and application of the competency model in manufacturing operations in Malaysia. Their review highlights the relevance of the competencies model to individual workers development in an Organization. They aver that the competency model helps in scaling up workforce productivity for the achievement of the overall economic competitiveness of a country economy.

[22] Study identifies the competencies required for effective job performance at the General Administrative Sub-Division level in the Thai Department of Agriculture. The method used is the Behavioural Event Interview (BEI) technique [23]. Out of the 23 competencies identified by the study, only 9 competencies made the model for the Department of Agriculture in Thailand. This corroborates [24] that the enormous broad number of employability skills framework available does not solve and meet the requirement of graduate unemployment.

The human capital theory has been used by so many employability skills researchers. Some applied the theory of human capital by Shultz (1961) to either create a framework for employability of graduates or use it to give a comparative analysis of theories in the context of graduate employability and its desirability in the school curriculum. [26]. In his study of a framework for understanding employers' perceptions of graduate employability, gave an insight into the requirements of the employers. The study gives an understanding of what the employers think about the estimation of graduates with comparable educational qualifications in the working environment, utilizing understanding from new institutionalism. [26]. Divided his framework into exogenous factors, initial signaling effects and the process of both public and private learning. He used the concept to evaluate the effect of graduate employability by foreign educational providers on how to influence employers' beliefs.

However, [26] observed that the positive foresight relationship between educational attainment and the labour market outcomes of human capital theory did not give consideration to such factors like uncertainty in labour market, imperfect knowledge of individuals' qualities, the type of school attended including inadequate knowledge of demand and supply. These are seen as a weakness for human capital theory.

In a related study, [26] equally studied the relationship between human capital theory by [27] and signaling theory by [28] for educational attainment and labour market outcomes. He posited that most studies rely on either human capital theory or signaling theory when it comes to the relationship between educational attainment and labour market outcomes. Even though, the two theories imply that a positive investment in education yields a good labour market returns, he observed a difference in their line of arguments concerning how the mechanism concerning education affects employment. For example, unlike the human capital theory, Job market signal theory [29][28][30] focused on the principal-agent relationship. It is based on the assumption that hiring is an investment decision for employers. For instance, when making decisions, employers take into consideration the level of educational attainment of the employee. The job seekers send signals to the employer about their ability level by acquiring certain educational qualifications while the employer screens the job applicant based on the signals transmitted by the educational credentials. Therefore, an educational qualification only serves as a substitute measure of ability or quality [26]. To this end, he noted that education only serves as a tool for Job-seekers to signal their ability to employers. Thus, it is the innate ability and not education itself that increases productivity. This is unlike human capital theory which argues that education increases individuals' productivity and consequently increases the company's overall productivity.

[31]. Investigated the antecedents of employee's perceived employability based on self-concept and human capital theory. The study also examined the interactive relationships between self-concepts and voluntary learning behaviour as a means of enhancing human capital. The study which was conducted in Korea consisted of 301 employees of an organization. The findings of the study show that Organizational –Based Self –Esteem (OBESE) and its interaction with voluntary learning behaviour were positively correlated. It further shows that individuals' self-evaluation is determined not only by their abilities and positions but also by their relationships with specific individuals or groups with whom they compared themselves with. [31]. Argues further that students who believe they are among the most valuable and competent are likely to evaluate themselves as an individual who is capable of attaining high-prestigious occupation. This means that the employee's objective levels of skills, knowledge, and experience for enhancing human capital are substantially related to perceived employability. Strong self-concept in a specific framework may be a strong requirement for perceived employability among other employed individuals [31].

Similarly, [32] carried out a study on the increased interest by Australian business faculties in the development of

students' employability skills. They submitted that many Universities had demonstrated their commitment to translating such interest into practice by elaborating on the lists of graduate qualities suitable for the development of generic skills and encourage their staff to adopt specific pedagogy towards such ends. This approach was based on the assumption that such an approach would enhance the acquisition and transfer of skills that enhance students' human capital and their subsequent employability. The study presented a conceptual framework for the problem of the study. Attention was shifted from social exclusion to social inclusion in the workplace as a function of cultural capital.

[33]. In their study, 'Rusty, Invisible and threatening': Ageing, Capital, and Employability discuss the difficulties faced by older jobseekers; human capital which focuses on older workers' job skills, and ageism in employment. [34]. Conducted his interview among 80 matured older Australians. The age brackets of those interviewed were between 45 to 73 years old with their occupation ranging from managers, technicians, trade workers, professionals, community and personal service workers, clerical and administrative workers. Nvivo software, version10 was used to manage the coding of the data and transcription of coded data until saturation was reached. The results indicated that a few of the interviewee's associated ageism with the notion that older workers were slower, less fit and more prone to injury. This could be associated with the reasons for high unemployment among the older population in Africa [35][36]. [34]. Consequently recommended re-skilling for older workers in order to re-establishing the value of older workers' human capital.

[37]. In their own study conducted on 189 students from Ukrainian Universities, on the provision of Entrepreneurship Specific Education (ESE) to equip students with the entrepreneurial alertness and risk-taking assets required to pursue entrepreneurship. He builds upon the insights from a dynamic view of the human capital. The paper explores the linkage among Entrepreneurship Specific Education investment, alertness and risk-taking accumulation, and the outcome relating to the intention to become an entrepreneur. The findings of the study show that entrepreneurship specific education student indicates higher entrepreneurial mindset. And students showed more entrepreneurial mindset when they perceived less risk. Building upon the insight of human capital theory, and the linkage between ESE dynamics of human capital investment, [37] recommends the introduction of entrepreneurship specific education in the Universities curriculum to increase the number of students showing interest in entrepreneurial education. They were, however, courteous about generalizing the result of their findings until its validity and reliability are tested on a wider scope.

Equally, [38] conducted a study that drew a comparison between human capital and signaling theories. The purpose of the study was to revisit the debate on the relevance of Higher Education (HE) to the economy which has been dominated by human capital theory and signaling theory. [38].

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Contents that investment in higher education (HE) contributes to employability by adding to the potential productivity of graduate employees. While signaling theory asserts that Higher Education (HE) contributes by enabling employers to differentiate potentially productive employees. Relying on the advances from the literature on employability to re-assess the two theories, their findings reveal that Higher Education (HE) increases student's tendency to learn in employment, and signal to employers that graduates are people who have the capacity to learn on the job. Four stakeholder groups were identified in the study. The four stakeholders are the employer, government, existing students and potential students, and the University (HE). They came up with a new concept of vocational which they termed, "graduate propensity to learn"; Graduate propensity to learn is the most important economic outcome of a University education [38]. This conclusion was drawn based on the integration of human capital theory and signaling theory with a graduate propensity to learn. The propensity to learn on the job is a clear assertion that the students lack the relevant skills for the job.

[39]. Conducted an exploratory study of factors affecting undergraduate employability using qualitative and quantitative approach. The paper explores the importance of 17 factors influencing graduate employability through an extensive review of the literature to identify new graduate employability. Their study placed high importance on soft-skills than academic qualification. The finding implies that the University programme and courses should focus on learning outcomes that are linked to the learning and development of soft skills in order to improve graduates' employability.

In a similar vein, [26] conducted a study that studies the framework for gaining insight into employers perception of the relevance of graduates who has similar certificates in the place of work using the experience gained from institutionalism. He classifies the framework about employers' beliefs into exogenous, initial signal effects and the process of both private and public learning. The framework was used to justify how a proactive interaction between the Universities and employers can increase graduates employability. [26] maintained that achievement is influenced by the way policymakers and the university administrator understands the mechanism of relating to the formation of an employer's beliefs.

Furthermore, as a result of the increasing rate of enrolment into Higher Institutions and the lack of a job after graduation, [39] conducted a study geared towards understanding employability resources by university graduates. The aim of the study was to help university graduates on how to enhance their competitive advantages when entering the employment market. The introduction of Dynamic Capabilities (DCs) into the framework of the four major resources that university graduates should possess (intellectual, personality, metal-skill, and job-specific) enhances the integration of these other resources. Dynamic Capabilities (DCs) are found to be crucial for enhancing the value of these individual resources. The reference made to pre-graduate application and construction of personal narrative as essential signals that university graduates can use to enhance their value in the

world of work by [39] affirmed the assertion of [26] that initial signal exists before private and the public learning process begins. Consequently, in order to increase employability, university students need to embrace a flexible view of competitive advantage [39].

[40]. Carried out a study to test a model of undergraduate competence in employability skills and its implications for stakeholders. The study revealed that despite the integration of employability skills into the higher education curriculum worldwide, certain skills possessed by recent graduates have not met the industry expectation. The study was carried out in Australia. It was conducted on 1008 Australian business students who self-rated their competence against a framework of employability skills considered to be essential for graduates. Multiple regression techniques were used for analyzing the collected data. [40] Study provides a number of industry-relevant skills that make graduates work-ready. The framework consists of 10 skills and 40 constituent behaviours with descriptors that are aimed at overcoming the ambiguity in the precise meaning of certain skills. Table 1 describes the framework and its behaviours.

Table- I: Employability Skills Framework

Skills	Behaviour
Working effectively with others	Task collaboration Team working Social intelligence Cultural and diversity awareness. Influencing others
Communicating effectively	Conflict resolution Verbal communication Giving and receiving feedback Public speaking Meeting participation- written and communication
Self-awareness	Metal-cognition Lifelong learning Career management
Thinking critically	Conceptualization Evaluation
Analyzing data and using technology	Numeracy Technology Information management
Problem-solving	Reasoning Analyzing and diagnosing Decision-making
Developing initiative and enterprise	Entrepreneurship/ intrapreneurship Lateral thinking/ creativity initiative Change management
Self-management	Self-efficacy Stress tolerance Work/life balance Self- regulation
Social responsibility and accountability	Social responsibility Accountability Personal ethics Organizational awareness
Developing professionalism	Efficiency Multi-tasking Autonomy, time management, drive Goal and task management

In his study of student perspectives on employability studies in Higher Institutions, [10] noted that the constant complaints by employers that graduates lack the employability skills needed by the industry necessitated the research work. The study seeks to determine the perception of the students themselves on employability. The study was based on the learning theory that motivation and commitment of learners is an essential prerequisite for effective outcomes. The sample for the study consisted of 400 undergraduate students from business studies, marketing, and human resource management. The findings of the study show that

there exists a little relationship between the views of students and other stakeholders. Students' views were narrow-minded while other stakeholders' views were broad-minded. Consequently, [10] made a recommendation for detailed studies on the analysis of skills and attributes framework to explore the meaning of employability and the discrepancies between students view that placements were more important than employability skills. **Error! Reference source not found.** describes the comparison of employability skill frameworks in different countries.

Table- II: Name of the Table that justifies the values

Kreber, (2006). Competencies higher education institutions should provide.	Andrews and Higson (2008). Employer and graduate perspective	Top 10 competencies identified by businesses in the USA	Top 10 competencies emphasized in the business curriculum in the USA	Archer and Davison, (2008). Employers in the UK.	Cumming, (2010). Government in Australia
Able and willing to contribute to innovation and be creative.	Professionalism	Communication skills	Communication skills	Communication skills	Communication
Be able to cope with uncertainties	Reliability	Problem-solving	Problem-solving	Team working skills	Team working
Prepare for lifelong learning	Ability to cope with uncertainty	Result oriented	Team working	Integrity	Problem-solving
Social sensitivity and communicative skills	Ability to work under pressure	Interpersonal skills	Leadership skills	Intellectual ability	Initiative and enterprise
Team working	Ability to think and plan strategically	Leadership skills	Technical expertise	Confidence	Planning and organizing
Willing to take responsibility	Communicate and interact with others, either in team or networking	Customer focus	Interpersonal skills	Character / personality	Self- management
Become entrepreneurial	Good writing and communication skills	Flexible and adaptable	Businesses expertise	Planning and organizational skills	Ready for learning
Versatile in different cultures	Information and communication technology skills Creativity and self-confidence	Team working	Hard-working	Good writing skills (Literacy)	Technology
Versatile in generic skills across disciplines	Self-management and time management	Dependable	Results-oriented	Numeracy	
Literate in areas knowledge forming the basis for various professional skills especially, technologies.	Willingness to learn and accept responsibility	Quality focused	Dependable	Analysis and decision-making skills	

Equally, [41] conducted a study that developed an integrative methodological framework for studying entrepreneurship education. 88 journal articles reporting empirical studies between 2002 and 2012 were used in the meta-analysis. The literature was coded based on the method used, type of study, data collection and analysis techniques. The findings of the study suggest that both qualitative and quantitative research can be used in entrepreneurship studies viz-a-viz employability. Each of the approaches has its own merits and demerits. Therefore, the combination of the two would give room for a more objective study. Consequently, [41] recommended the integration of both approaches in research design for case studies in entrepreneurship education. Therefore, the used of exploratory sequential

mixes method for this current study is justified [42][43].

[44]. In their study tagged 'from the firm to the network: global value chains and employment-related theory', canvasses the need to introduce a new globalized employment relation as against the traditional employment relations that are strictly based on individual nations' institution framework. They designed a new framework that is based on global chain theory; a configurational framework that addresses the employment relations, implications of the interconnections within and between firms in the global economy.

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Thus, their study provided a theoretical framework for the analysis of employment relations in a global context. The courses offered by Electrical Technology students from 100

Level to 300 Level is shown in Table 3.

Table 3: Course structure for Electrical Technology

Course Code	Course Title	Credits	Course Mode
VTE110	Introduction to Vocational & Technical Education	1C	Theory
TED113	Introduction to Electricity/Electronics	2C	Theory
TED116	Fundamental of Technical Drawing	1C	Theory
TED117	Applied Mechanics	2C	Theory
MATH118	Algebra	1C	Theory
TED123	Magnetism and Electromagnetism	2C	Theory
TED126	Descriptive Geometry/Pictorial Drawing	1C	Theory
MATH128	Calculus	1C	Theory
PHY123	Mechanics and Property of Matter	2C	Theory
TED211	Foundry and Forging	2C	Theory
TED212	Machine Woodworking 1	2C	Theory
TED213	Construction Method 1	1C	Theory
TED214	Auto Braking, Suspension and Steering Systems	2C	Theory
TED215	Graphics	2C	Theory
TED216	Heat Engines	1C	Theory
TED217	Auto Electrical System Repairs and Computer	2C	Practice
TEM111	Introduction to Physical Chemistry	2C	Theory
VTE220	Entrepreneurship 1	1C	Theory
TED221	Machine Shop Practice	2C	Theory
TED222	Woodwork Design, Construction, and Finishing	2C	Theory/Practice
TED223	Electrical and Electronic Devices	2C	Theory/Practice
TED224	Elementary Structural Design	2C	Theory
TED225	Automobile Engine	1C	Theory
TED226	Electrical/Electronic Drawing	1C	Theory
TED227	Special Methodology	1C	Theory
TED228	SIWES	2C	Practice
TED320	Entrepreneurship II	1C	Theory
EE321	Electrical Machines and Power	1C	Theory
EE322	Telecommunications	1C	Theory
EE323	Electrical Circuits and Electrical Measuring Instruments	1C	Theory/Practice
EE324	Practical project	2C	Practice
EE325	Mechanical Engineering Drawing		Theory
EE326	Maintenance and Repairs of Electrical Equipment	1C	Theory/Practice
EE327	School Workshop Management	1C	Theory
EE328	Digital Electronics	2C	Theory
EB324	Building Drawing	2C	Theory/Practice
GSE	All General Studies	6C	Theory
EDU	All Education courses	-	Theory

IV. SIGNIFICANCE OF HIERARCHY

The framework consists of a construct that underlies continuum, and it comes in two ways [45]. The continuum can be an ordering of the respondents, and or ordering of the item responses. While it is the respondents ordering that it is important in classical test theorists, both are important in Rasch [45][46]. For the item construct map, the items are ordered from highest to lowest.

Competency hierarchy is crucial for job search for the employee. It helps to classify the items into strata of difficulty. It enables educational institutions to plan and manage their instructional modules. This translate to matching an employee's education and training with the knowledge and skills required for the job. Competency hierarchy summarizes the knowledge, skills, and abilities required for an open position. Detailing these factors in a hierarchy allows human resources staff to identify candidates that would perform well. The advantage over traditional methods of recruiting lies in the structured approach. Competency hierarchy provides an objective framework for eliminating unsuitable items and narrowing the field. The choice of the best item is made easier by detailed matching of educational background, experience,

and training to the requirements of the position [47][48]. Competency hierarchy is typically a method for identifying specified skills in order of difficulty levels [46]. In most commercial organizations, the purpose is to provide value to the external customer [49]. Therefore, competency hierarchy for Electrical Technology students will help in organizing the skills into strata of difficulty levels for the purpose of instruction and learning.

V. OBJECTIVE

The main objective is to develop employability skills hierarchy for Electrical Technology students in Colleges of Education in Nigeria. To drive the study, the following research questions were raised:

1. What is the construct and sub-construct of employability skills required by Electrical Technology students in Colleges of Education in Nigeria for 21-Century jobs?
2. What is the hierarchy of employability skills for Electrical Technology students in Colleges of Education in Nigeria?

VI. METHODOLOGY

Research design describes the general procedure used for carrying out scientific research. The purpose is to serve as a guide in the research process to gather, analyze, and interpret the data. Choosing an appropriate research design is crucial for any researcher who intends to conduct any type of research [43]. The current study is survey research that employs the use of Exploratory Sequential Mixed Method. [50]. Described survey research as the type of research that studies large populations where samples are related, in order to discover relative incidence, conveyance, and interrelations of sociological and psychological variables. Survey research is commonly used in the field of education to find out about the perception, beliefs, values, behaviours, demography of people [43]. Survey research sometimes uses a personal interview, questionnaire checklist, a rating scale to elicit information from respondents.

The mixed-method involves the combination of qualitative and quantitative methods of research in a single study [41]. The complementary strength of qualitative and quantitative method provides a superior research result in terms of validity and depth than when a single method is used [41], [51].

The exploratory sequential design is mixed-method research that takes two-phases [52]. The results of the first method (qualitative) inform the second method (quantitative). This design is used for one of several reasons. It is utilized where instruments are not accessible, the factors are not known, or there is no directing structure or theory [43], [53]. The design is especially helpful where the researcher needs to create and test an instrument since one is not accessible, or when a researcher needs to distinguish an important variable to study quantitatively when the variables are unknown. Similarly, it is employed when a researcher wants to generalize results to different groups. The mixed-method is equally used when carrying out a detailed study of an event and its rate of prevalence [50].

In this study, the researcher first conducted a qualitative study by developing the instrument for the interview session using information collected from documents and then analyze the result. The result of the qualitative data was used to develop the instrument for quantitative data.

A. The sample size for Rasch Analysis Model

Since the current study is seeking to establish the hierarchy of the employability skills framework for Electrical Technology students in Colleges of Education through the use of Rasch Analysis Model, it is therefore important to follow the sample size prescribed for Rasch Measurement Model based on the newly-developed instrument. The researcher decided to go for $\pm 1/2$ logit with a 95% confidence level, and the sample size for most purposes is 100. Rasch analysis sample size of at least 100 respondents and a minimum of 20 items are suggested for attaining stable indices [54][46]. 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 [55]. 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 4 describes the sample size base on the Rasch Measurement Model.

Table 4: 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
$\pm 1/2$ logit	95%	64 - 144	100
$\pm 1/2$ logit	99 $1/2$ %	108 - 243	150

B. Instrument Validity

In order to determine the reliability and construct validity of the items in the instrument, the Fleiss Kappa Inter-rater reliability was conducted using three experts in Technical Education to assess their agreement with the items contained in the instrument. The evaluation process involved certain procedures as follows:

- i. Based on the extensive review of the literature and the interview findings, an item pool was developed to ensure that all items are covered.
- ii. Items were mapped out based on constructs and sub-constructs. There were five constructs and 193 sub-constructs.
- iii. Three experts in the related field were identified and selected.
- iv. Each panel member was provided with the questionnaire for their independent judgment.
- v. The responses of the three experts were then analyzed using an Excel calculator to get the percent agreement. The mean percent agreement by experts is 85.83%.

Thus, for the content validity, a very good agreement of 85.83% was obtained using the Fleiss Kappa Manual Excel Calculator. 193 items were contained in the instrument for the 3 Raters who are Experts in Electrical Technology. After analysis, 152 of the items were in agreement with the Experts judgment and retained. Observations and corrections of expert’s views were reflected in the instrument for Pilot study. Also, some items from the interview were considered to be important and sensitive to be discarded and therefore, retained for the pilot test. Table 5 and Table 6 shows Fleiss Kappa result and the interpretation respectively. The formula for calculating Kaapa is given as follows:

$$K = \frac{Po - Pe}{1 - Pe}$$

Where:

K = Calculated Kappa

Po = Observed Agreement

Pe = Expected Agreement

Table 5: Kappa Interpretation

Kappa Value		
< 0.00	poor	Less than chance agreement
0.01 to 0.20	Slight	Slight agreement
0.21 to 0.40	Fair	Fair agreement
0.41 to 0.60	Moderate	Moderate agreement
0.61 to 0.80	Substantial	Substantial agreement

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0.81 to 0.99	Almost perfect	Almost perfect agreement
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Source: (Viera, & Garrett, 2005; Fleiss Kappa, 1971)

Table 6: Fleiss Kappa Agreement Index for Instrument

constructs	No of items	Rater 1	Rater 2	Rater 3	Mean of % Average	Level of Agreement
Technical (Electrical specific)	70	50/70 = 71.43	57/70 = 81.43	47/70 = 67.14	70%	Substantial agreement
Non-Technical (Soft skills)	123	105/123 = 85.36	104/123 = 84.55	117/123 = 95.12	88.34 %	Almost perfect agreement

The table indicates that the level of agreement among the three experts is generally very good for the constructs in the QFES instrument. After some modifications had been made, the instrument was given to two experience lecturers in technical education to ensure its face validity

VII. DATA ANALYSIS

The qualitative data was analysed using Nvivo. 12 to generate the theme for the study. The process involved the importation of necessary files and the generation of nodes. The analysis was done using the cluster analysis and the treemap. Similarly, the quantitative data for the research was analyzed using descriptive statistics that employs the Statistical Package for the Social Sciences (SPSS) and Rasch analysis Model. The demographic factors were analyzed using descriptive statistics. The analysis of the data for the constructs was done by using Winsteps software package based on the Rasch Measurement Model. For technical data, separation of 3.28 and reliability of .91 was achieved with 37 measured items. The non-technical skills with a measured item of 113 have a separation of 5.28 and a reliability of .97.

VIII. FINDINGS AND RESULTS

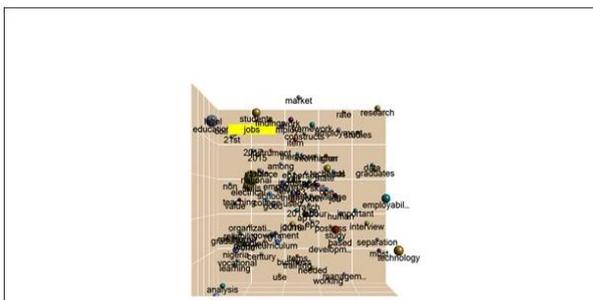


Figure 1: Cluster analysis for the qualitative study

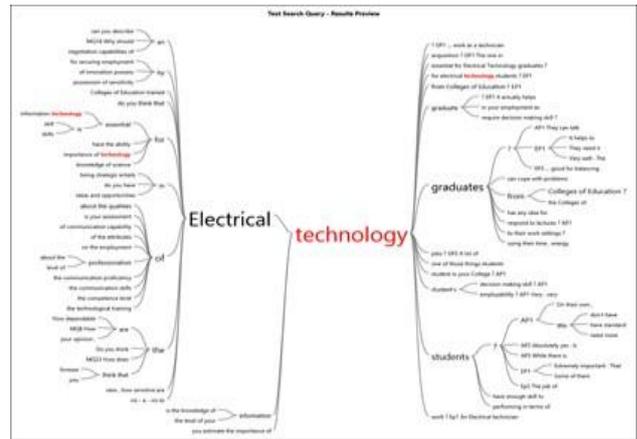


Figure 2: Treemap for the interview protocol

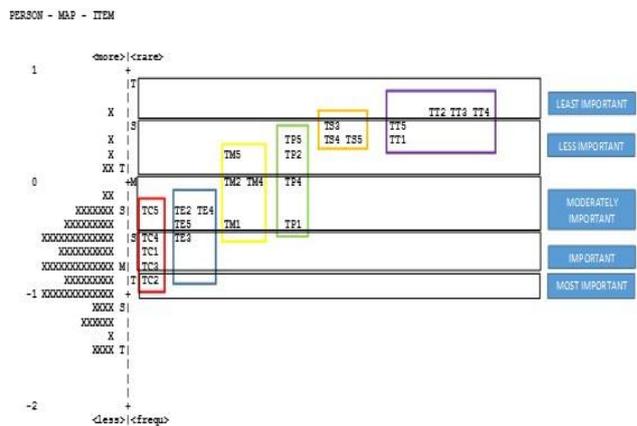


Figure 3: Variable map for Technical Skills

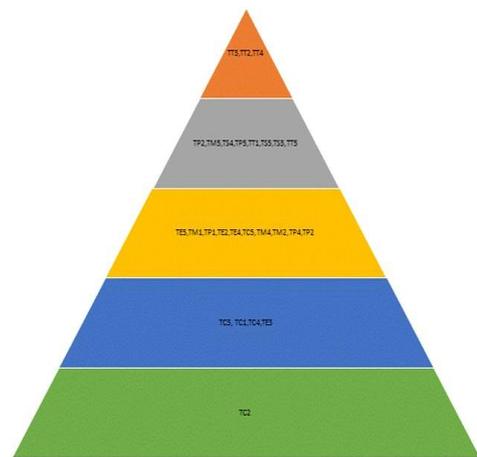


Figure 4: The hierarchy for Technical Skills.

Figure 4 shows the hierarchy of skills to be mastered by the students from the basic one which is from the 'most important' (TC2) through to the 'least important' (TT2 TT3 TT4). These are the Electrical-specific skills that come from the most important to the least important. However, to be able to achieve the least important skills (Knowledge of Electric power transmission), the basic skills (ability to construct simple wiring circuits) must be mastered first by the students.

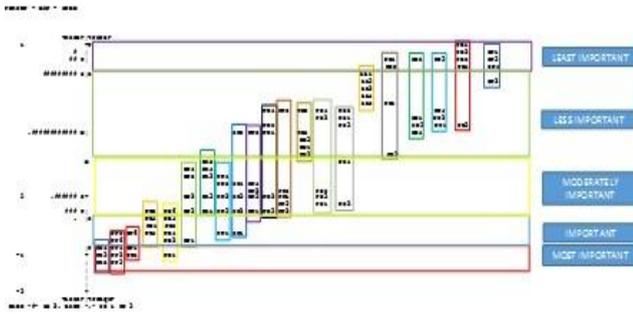


Figure 5: Variable map for Non-Technical Skills

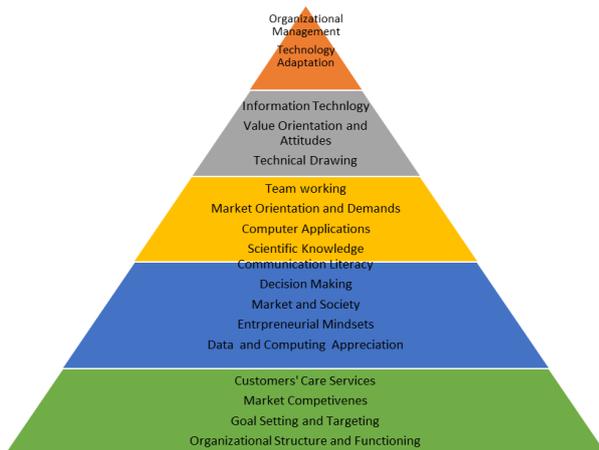


Figure 6: The hierarchy for Non-Technical Skills

IX. DISCUSSION

In order to determine the validity and reliability of the QFES scale, a series of instrument testing was carried out ensure that the scale is improved. The value of Item separation for Technical Skills is 3.28 with a reliability of .91. The analysis proved the Item Raw Score-To-Measure Correlation to be -.99. Equally, the value of the Item separation for Non-Technical skills is 5.28 with a reliability of .97. The Item Raw Score –To-Measure Correlation for Non-Technical was -.99. The results showed that the current study has a relevant person sample size, and the QFES 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 [55], high item separation index is 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 [55], separation value that is >2 is good to proceed with further analysis.

[59]. 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 Rasch Analysis Model. Consequently, the instrument is good for further analysis.

The item hierarchy is essential for the categorization of the items into the strata of difficulty level. 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 3 the item hierarchy for Technical skill is categorized into the level of importance starting from “Most Important” to “Least Important Item”. The hierarchy shows the skills to be mastered by the students from the basic one which is from the most important (TC2) through to the least important ones (TT2 TT3 TT4). These are the Electrical-specific skills that come from the most important to the least important. However, to be able to achieve the least important skills “TT2 TT3 TT4” (Knowledge of D.C power; Knowledge of iron core windings in the transformation of electrical energy; and knowledge of inductors), the basic skill “TC2”, (ability to construct simple series wiring circuits) must be acquired first by the students.

Based on Rasch Analysis, employing the partial credit model indicates that each item has its own rating scale [60], [61]. Thus, the higher-order item of TT2 TT3 TT4 cannot be attained without first achieving the basic and the most Important, Important, Moderately Important, and the Less important Item.

Similarly, NI4 NI2 NI5 NP5 NP6 NP4 NP2 ON1 ON4 and NE1 are located below the hierarchy as the basic and most important item to be mastered before the next level of ‘Important skills’ can be attained by Electrical Technology students in Colleges of Education in Nigeria. TG1 ‘ability to interpret electrical symbols and its application’ is the least item to be mastered by Electrical Technology student within the array of Non-technical skills. TG1 is located at the topmost part of the hierarchy and it is a sub-construct of Technology.

X. CONCLUSION

The world of work had become very complex nowadays due to the advancement in occasioned by the level of technological changes. It is on record that most of the available framework on graduate employability is substantially broad. One of the very good ways of dealing with the situation is the development of item hierarchy that helps the instructor to plan and organize his instruction in a more orderly and precise manner.

Moreover, the study is unique because it employs rigorous efforts to ensure that the validity and reliability of the items in the instrument were attained and worthy enough to be used for this study.

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