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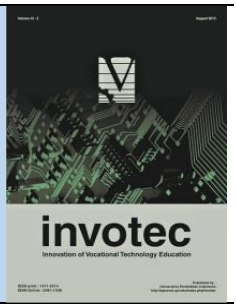

ICT COMPETENCE MODEL FOR SUSTAINABLE DEVELOPMENT OF TECHNICAL EDUCATION IN HIGHER INSTITUTIONS IN NIGERIA

Rufus Sunday Olojuolawe[1*], Adegboye Olalekan Oluwadamilola[2]

[1]Vocational and Industrial Technology Education, Bamidele Olumilua University of Education Science and Technology, Ikere-Ekiti, Nigeria

[2]Educational Leadership and Counseling, Prairie View A&M University, United States of America

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Authors email:
olojuolawerufus4@gmail.com

ABSTRACT

The relevance of Information Communication Technology adoption in the programme of technical education has broadly been canvassed. It seems no particular study has focused on the ICT model for the sustenance of technical education especially, in Nigeria. Therefore, this study aims to develop an ICT model suitable for the development of Technical Education in Higher Institution in Nigeria. The sample for the study was obtained from among the academics at the Bamidele Olumilua University of Education Science and Technology, Ikere-Ekiti and the Ekiti State University, Ado-Ekiti. A structured questionnaire was used to elicit responses from the critical stakeholders. The questionnaire consists of two sections (A and B). Section A was devoted to the demography of the respondents, and B was based on the constructs and sub-constructs of Information Communication Technology required for the effective functioning of the Technical Education curriculum. The data for the study was analysed using the Rasch Measurement Model. The Rasch Measurement Model is most effective for determining the item that best fits the model rather than self-elimination. Only the items with the model value of -5.44 (Slide presentation and LCD Projector), -5.44 (CDS and flash drives) and -13.33 (Scanners, cameras cellphones to acquire digital images) were found to be fit for inclusion in the ICT competence model for sustainable development of Technical Education in Nigeria. It recommended that future studies should be discipline based.

1. Introduction

The world of work is vastly changing. Many populations in the developing world keep complaining about the absence of jobs. The Nigerian government, in its bid to arrest the tide, extended technical education programmes into tertiary institutions. Just recently, various Higher Institutions started the introduction of Entrepreneurship into their curriculum when the rate of unemployment remained unabated. All these seem to have yielded little or no meaningful results due to the persistent lamentations of the graduates about the lack of jobs on the one hand and the complaints by the employers that the graduates are not employable on the other side (Bornioli et al., 2020; Holmes & Holmes, 2015; Olojuolawe et al., 2019). The curriculum of technical education has been said to require remodelling (Hassan et al., 2021). This is aimed at upskilling both the students and the graduates to enhance their employability. Many countries have accreditation bodies for their

graduates' employability. This allowed them to move with the global trend, and thus keep the unemployment rate at the barest minimum. The University must move away from social exclusion to social inclusion in the workplace (Alfalih & Ragmoun, 2020; Guàrdia et al., 2021; Hassan et al., 2021b; Kalfa & Taksa, 2015; Sima et al., 2020).

Research indicates that technology has taken over the jobs of humans. Hence, people now refer to the displacement occasioned by the massive deployment of technology to perform human activities with less rigour, time and effectiveness as technology-unemployment. This invariably means that fewer people are required for the performance of a specific duty. Robotics, artificial intelligence, big data and data science are now the vogue. To prepare technical students to meet the dynamics of technological changes, there is a need to adjust their training to suit the needs of the employers. Otherwise, we shall continue to produce graduates who are not graduates (Khuzainey et al., 2020; Onyeike & Onyeagbako, 2018). They will be certified but will not be relevant to the demands of the labour market. Consequently, this study aims to use the Rasch Measurement Model to determine the ICT competence that would make the technical education students roundly trained and globally fit for the world of work. This no doubt will contribute to reducing the rate of youth unemployment in the country and thus engender a safer society for the citizenry.

Based on the extensive review of the literature, the conceptual framework for the study is provided in Figure 1.

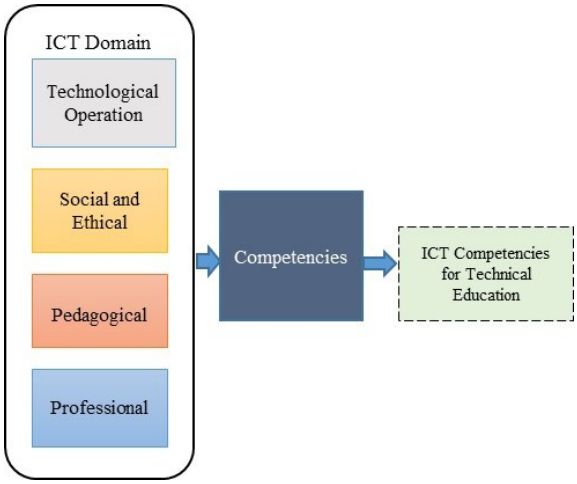

Figure 1. Conceptual Framework for Technical Education Competency

Research shows that the acceptance of technical education by Nigerian parents was lukewarm (Mamman et al., 2021; Ogunade & Mohammed, 2024; Rufus et al., 2020; Ubogu, 2020). Despite its numerous advantages to individuals and society at large, the acceptability of technical education today in Nigeria is further pushed to the background relative to its peers in the academic community. This is not unconnected to its weak implementation and the inability of the graduates to live up to the expectations of society. The graduates now roam about the streets looking for jobs they were not adequately trained to perform. The facilities and machines in the majority of the Universities are not only obsolete but also insufficient and unserviceable due to the unavailability of parts. Thus, the students are being trained with whatever is left to salvage. This invariably implies that they are not being exposed to the best knowledge that will make them competitive and employable in the labour market. Technical education has advanced at a global pace, it is therefore unfashionable for technical education students to rely solely on hammers and chisels. Automation and high-tech have taken over the global workspace. Consequently, for a technical education programme to have its price of place restored in Nigeria, the programme must be upskilled to meet global standards. Since Information Communication Technology plays a vital role in today's global economy, it is important to embed in technical education the ICT skills that would mirror the programme to the youth and

ensure their employability. Therefore, the central focus of this study would be to develop an ICT competency model for the sustenance of technical education in Nigeria's Higher Institutions.

The main objective of the study is to develop an ICT competency model for sustaining Technical Education in Higher Institutions (HIs) in Nigeria. Specifically, the study seeks to:

1. Determine the constructs and sub-constructs of ICT competence required for the sustenance of Technical Education in Higher Institutions.
2. Develop the ICT competence model for the sustenance of Technical Education in Nigeria.
3. Develop the hierarchy of ICT competence for Technical Education.

Information and communication technology is referred to as ICT. It is a collection of various technological resources and tools used for communication as well as for the creation, sharing, storing, and management of information. Computers, the Internet, television and radio broadcasting, and telephones are some examples of these technologies. ICT's primary constituents are categorized into four primary domains. These include the pedagogical, professional, social and ethical, and technological operations domains. Competencies pertaining to technical operations and concepts, as well as the efficiency of different ICT tools, such as computers and communication devices, as well as offline and online applications, are included in the technological operations domains. Competencies pertaining to social, ethical, legal, and human issues as well as community connections are included in the social and ethical domain. Competencies pertaining to the use of technology in the teaching process are also included in the pedagogical domain. The instruction process covers the planning and designing of effective learning environments and experiences supported by technology; implementing, facilitating and monitoring teaching and learning strategies that integrate a range of information and communication technologies to promote and enhance student learning; assessing and evaluating student learning and performances (Jandi Mary Joy, 2023; Pardo-Garcia & Barac, 2020).

The use of technology is very important in enhancing pedagogy and cannot be downplayed, especially in vocational and technical education (Jamil et al., 2023). Due to the acute shortage of facilities in instructional delivery, there is an urgent need to seek ways of integrating ICT into the teaching of technical education programmes in Nigerian higher institutions. The e-learning that could be deployed is learning that utilises hardware (e.g. PCS, tablets, printers, digital cameras, digital videos, scanners, overhead projectors), software (e.g. operating systems, cloud technologies, applications, writing, editing, MS Office) and CD textbooks that fall in the category of courseware, e-contents, USB drives, CD-ROM (Dumbiri & Nwadiani, 2020).

Som (2021) observes that the deployment of ICT offers both opportunities and challenges. He canvassed the adoption of digital learning as against the traditional Blackboard system. Digital tools for offline and online teaching are very important in this era of IR4.0 to ensure that the students are ready for the labour market (Asaju, 2014; Ayub, 2017; Rajarapollu et al., 2022). This will bolster teaching and learning in Technical Education in Nigeria. Moodle, Canvas, Google Classroom or on Collpoll. Matlab and digital image monitoring are some of the tools that are available for use. Information Communication Technology has a tremendous role to play in advancing the programmes of Technical Education (Chovanová et al., 2023). ICT is a global tool that, if integrated into TVET, will enhance its economic, industrial, and human resource development both in the public and private sectors (Wahab et al., 2019; Emmanuel, 2029). The authors recognise the importance of the adoption of ICT in TVET but fail to recommend the essential aspect or tool to be included. In the same vein, Jasmine (2014) advocated for the inclusion of ICT in TVET, but no mention was made of the tool that is relevant for adoption in the TVET programme. A common deduction is that the majority of the researchers believed that the inclusion of ICT in TVET would enhance the teaching and learning of Technical Education. Therefore, this study is designed to develop an ICT model for enhancing the development of Technical Education in Nigerian Universities.

2. Method

The study was carried out in Ekiti State of Nigeria. Specifically, the study was conducted among the academic members of staff in the Department of Industrial Technology Education and Computer Science in the two public Universities in the State because of the time frame available for the study. The survey research that employs a quantitative study was used for the study. An ICT Instrument was adapted for the study because the time frame available might not permit the development of a new Instrument. The sample for the study was selected from among the academics in the Department of Industrial Technology Education and Computer Science at the Bamidele Olumilua University of Education Science and Technology, Ikere-Ekiti (BOUESTI), and Ekiti State University, Ado-Ekiti (EKSU), because of the objective of the study.

A structured questionnaire based on the results of the qualitative study was used to elicit responses from employers and academics. The questionnaire consists of two sections (A and B). Section A was devoted to the demography of the respondents, and Section B was based on the constructs and sub-constructs of ICT required for the effective functioning of the Technical Education curriculum. Specifically, the instrument was distributed to all the Technical Education and Computer Science lecturers in the 2 state-owned Universities in Ekiti state because of the size of the population. The instrument was distributed to the respondents personally and with the help of research Assistants because of the spread of locations and the need to ensure ease of maximum recovery. The cooperation of the Heads of the Department of Electrical Technology and Computer and Information Science in each of the two Universities in Ekiti State was sought for ease of distribution and retrieval of the instruments because of their close relationship with the academic staff.

The data for the study were analysed using the Rasch Measurement Model. The Rasch Measurement Model is most effective for determining the item that best fits the model rather than self-elimination. Rasch analysis is a psychometric technique that researchers use to improve the precision of their instrument design, instrument quality evaluation, and performance calculations. The assessment needs to be precise, methodologically sound, and produce trustworthy data for well-informed decision-making in every situation (Saidfudin et al. 2010). Therefore, the Rasch Measurement Model was chosen for this study because of its sophisticated methodology for examining item efficacy and scale and item response patterns (Linacre, 2002; Asaju, 2014).

The researcher adopted the ± ½ logit with a 95% confidence level, and the sample size for most purposes is 100, while the sample size for most purposes is between 64 and 144. The Rasch analysis sample size of at least 100 respondents and a minimum of 20 items is suggested for attaining stable indices (Saidfudin et al., 2010). Table 1 describes the sample size based on the Rasch Measurement Model.

Table 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	99½%	108 - 243	150

3. Results and Discussion

Objective 1: Determine the constructs and sub-constructs of ICT competence required for the sustenance of Technical Education in Higher Institutions.

Based on document analysis, the results and findings for objective 1 are shown in Figures 2 and 3. These show the frequencies of the words used in this study. Figure 1 shows that ICT use and

learning received more counts than the other constructs in the study. The analysis was obtained using NVIVO Software.

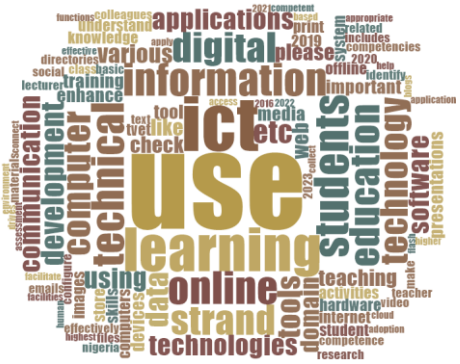

Figure 2. Query for Word Cloud.

Figure 2 provides the word count of the document analysis on ICT requirements necessary for inclusion in Technical Education.

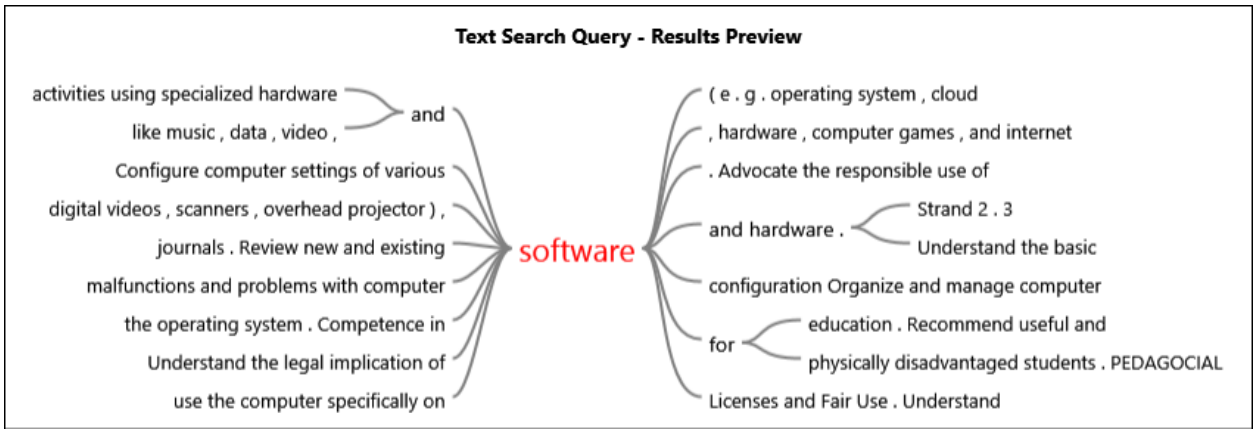

Figure 3. Software Word Search.

Figure 3 provides the query search for the software essential for inclusion in the technical Education programme. These results are the output of NVIVO 11 used for the document analysis.

Objective 2: Develop the ICT competence model for the sustenance of Technical Education in Nigeria.

```
                          ZOU396WS.TXT  Feb  2 10:41 2025
INPUT: 47 PERSON  76 ITEM  REPORTED: 4 PERSON  6 ITEM  4 CATS    WINSTEPS 3.74.0
-------------------------------------------------------------------------------

    Table of STANDARDISED RESIDUAL variance (in Eigenvalue units)
                                            -- Empirical --    Modeled
Total raw variance in observations     =       2076.2 100.0%          100.0%
  Raw variance explained by measures   =       2070.2  99.7%           94.7%
    Raw variance explained by persons  =        787.9  37.9%           36.1%
    Raw Variance explained by items    =       1282.3  61.8%           58.7%
  Raw unexplained variance (total)     =          6.0    .3% 100.0%     5.3%
    Unexplned variance in 1st contrast =          4.1    .2%  68.4%
    Unexplned variance in 2nd contrast =          1.9    .1%  31.6%
    Unexplned variance in 3rd contrast =           .0    .0%    .0%
```

Figure 4. ICT_Ibr2024.sav

Figure 4 provides the diagnostic analysis conducted to proceed with the Rasch measurement model. The initial raw variance explained by measure of 6.9% and unexplained variance in the 2nd contrast of 5.1%, the data has to be treated (Linacre, 2002).

Table 2. Summary of 6 Measured Items

	Total Score	Count	Measure	Model Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	10.8	4.0	.00	3.41	.04	-.9	.03	-1.0
S.D.	2.2	.0	8.90	.56	.03	.1	.02	.1
Max.	14.0	4.0	13.40	3.73	.10	-.7	.06	-.8
Min.	7.0	4.0	-13.33	2.16	.03	-1.0	0.2	-1.1
Real RMSE	3.46	True SD	8.20	Separation	2.37	ITEM	Reliability	.85
Model RMSE	3.46	True SD	8.21	Separation	2.37	ITEM	Reliability	.85
S.E. of Item Mean = 3.98								

With a separation index of 2.37 and a reliability of .85, it therefore means that the full-scale analysis is good to be conducted. This is quite unlike the initial discovery of 1.40 for the separation index and a reliability of .66 before treatment. A good separation must be greater than 2 (Linacre, 2012). This is given in Table 3

Table 3. ICT ibr2024.sav

Input: 47 Person 76 Item Reported: 4 Person 6 Item 4 Cats Winsteps 3.74.0

DIF class specification is: DIF=$S1W1

Person Class	Observations		Baseline		DIF Score	DIF Measure	DIF Size	DIF S.E	DIF t	Prob.	Item Number	Name
	Count	Average	Expect	Measure								
1	4	.75	.75	13.40	.00	13.40	.00	2.16	.00	1.000	14	OTP5
1	4	2.00	2.00	-5.44	.00	-5.44	.00	3.73	.00	1.000	19	OTP10
1	4	2.00	2.00	-5.44	.00	-5.44	.00	3.73	.00	1.000	20	OTP11
1	4	2.50	2.50	-13.33	.00	-13.33	.00	3.67	.00	1.000	24	OTP15
1	4	1.50	1.50	5.40	.00	5.40	.00	3.59	.00	1.000	25	OTP16
1	4	1.50	1.50	5.40	.00	5.40	.00	3.59	.00	1.000	40	OLP3

Table 4 provides the outlook for the partial credit Model for determining the items that should be retained in the model. The sub-constructs with negative values are fit enough to be included in the ICT competence model for Technical Education. This is clearly shown in Table 4 and Figure 5.

Table 4. Infit and Misfit Value for Model

Construct code	Model Value	Description
OTP5	13.40	Ability to use spreadsheets.
OTP10	-5.44	Slide presentation and LCD Projector.
OTP11	-5.44	Ability to use CDS and flash drives.

OTP15	-13.33	Use Scanners, cameras cellphones to acquire digital images.
OTP16	5.40	Use optical media to store digital images.
OLP3	5.40	Copyright, Trademark, and patent of various products, identification and differentiation.

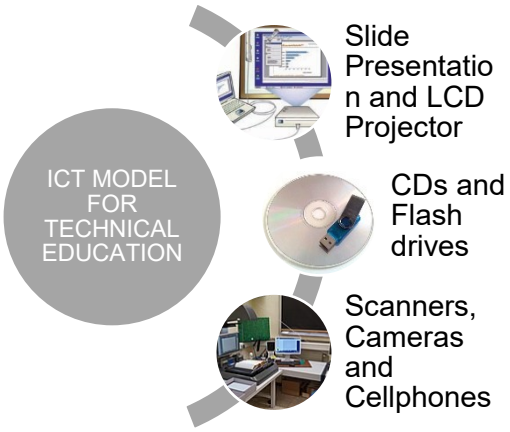

Figure 5. ICT Competence Model for Sustainable Development of Technical Education

Objective 3: Develop the item hierarchy of ICT competence for Technical Education.

```
TABLE 12.2 ICT_IBR2024.sav                    ZOU396WS.TXT  Feb  2 10:41 2025
INPUT: 47 PERSON  76 ITEM  REPORTED: 4 PERSON  6 ITEM  4 CATS    WINSTEPS 3.74.0
-------------------------------------------------------------------------------

MEASURE PERSON - MAP - ITEM
        <more>|<rare>
             T|  OTP5
              |
              |
   10         +
              |S
         XX S|
              |
              |  OLP3   OTP16
              |
            M|
              |
    0       X  +M
              |
            S|
              |
          X   |
              |  OTP10  OTP11
              |
            T|
              |S
  -10         +
              |
              |
              |  OTP15
              |
              |
              |
              |T
              |
  -20         +
        <less>|<frequent
```

Figure 6. Variable Map for the Items

The hierarchy of the items is a product of the variable map as shown in Figure 6.

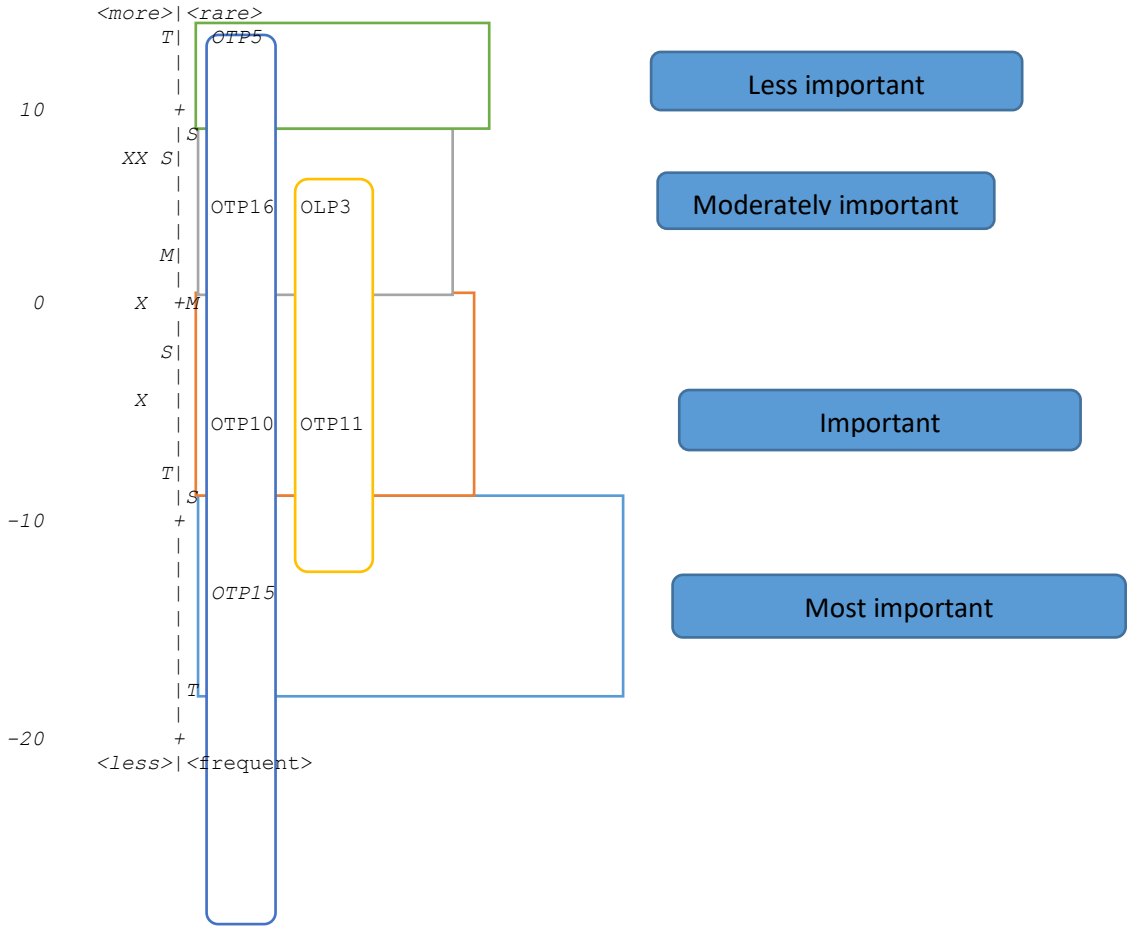

Figure 7. Measure Person Map Item

The item map in Figure 7 indicates that the easiest item to be introduced to the students at the bottom layer (Most Important) is OTP 15, while the most difficult in the hierarchy is OTP 5. This is located at the top-most part of the variable map.

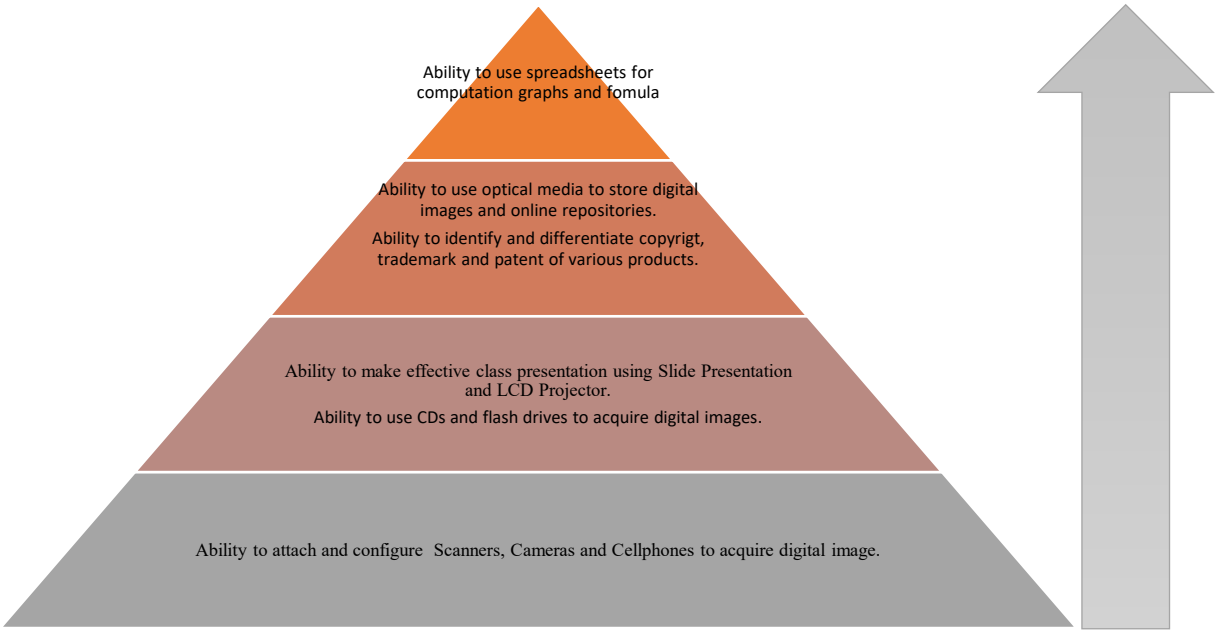

Figure 8. Item Hierarchy of ICT Competence for Technical Education.

Figure 8 shows the hierarchy of the items from the less difficult to the most difficult as indicated by the arrow.

For the items to be categorized into the different levels of difficulty, the item hierarchy is necessary. The less challenging or simple items are categorized at the bottom of the scale, while the more challenging items are found in the upper portion above the mean. In the center, close to the mean, is the moderate item to support. From "Most Important" to "Less Important Item," the technical skill item hierarchy is arranged according to importance in Figure 4.4. The hierarchy lists the most fundamental skills that students should learn, starting with the ability to connect and set up scanners, cameras, and cell phones to capture digital images. From the more significant ones (the ability to use spreadsheets for formulas and computation graphs) to the less significant ones. From the most crucial to the least crucial, these are the ICT competencies. These demonstrate the appropriate office and teaching productivity tools to enhance the sustainable development of Technical Education in Nigeria. This is in agreement with the position of Babalola et al., (2020) for the adoption of technology for the teaching of Technical Education. However, to be able to achieve the less important skills, the Knowledge of how to configure scanners, cameras and cell phones to acquire digital images; use optical media to store digital images and online repositories, identify and differentiate copyright, trademark and patent of various products use CDs and flash drives to acquire digital images," must be acquired first by the students.

Based on Rasch 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 use of spreadsheets for computation, graphs and formulas cannot be attained without first achieving the basic and the most Important, Important, Moderately Important, and the Less important Item. The difficulty level of the item is depicted in this order.

Although most of the constructs fit the Item Hierarchy of ICT competence for Technical Education. It is important to remember that constructs with a mean greater than zero should not be included in the final model that is suggested as clearly shown in Table 4 and Figure 4, respectively. The fit constructs in the model have negative mean values (Omar et al., 2010; Saidfudin et al., 2010). The inclusion of these skills in Nigeria will douse the long fear of unemployability of the graduates, and move the programme towards meeting the recommendations of researchers for curriculum remodelling of the technical education programme to be compliant with the 21st-century job needs of the employers (Jamil et al., 2023; Jandi Mary Joy, 2023; Olojuolawe et al., 2019; Das, 2019; Rajarapollu et al., 2022).

4. Conclusion

The disruptions in the world order have brought a drastic change in the way and manner students are prepared for the labour market. Thus, each programme must be fashioned along with the global trend. This is more important with the realisation that the outputs (graduates) are being prepared to compete in the large labour market. The findings of this work might not be exhaustive due to the research design. However, it has justified the proposition for a curriculum remodelling campaign. The tool propositions for inclusion in the curriculum of Technical Education will strengthen the capacities of both the learners and the teachers to upskill and prepare for other future emerging challenges in the technological world. The study has been able to establish the fact that not all the aspects of ICT tools are essential for inclusion in the curriculum of Technical Education, especially at this time. The curriculum planner for Technical Education therefore endeavours to integrate the findings of this study into the curriculum of Technical Education for the implementation of the programme in Nigerian Universities. The mixed-methods research design is recommended for a deeper study of the concept.

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Conflicts of Interest

The authors declare no conflict of interest regarding the publication of the paper. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Appendix A