



# Competency Reskilling Model for Improved Performance of TVET and Science Workshop Managers in Higher Institutions

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**Abstract** - The existence of the workshop attendants in technical education is aimed at complementing the job of the lecturers to ensure that a well-grounded and employable graduate is produced. Over the years, the complaints about the poor quality of the output have been shifted to the lecturers teaching methods and techniques, workshops and facilities without recourse to the competencies of the workshop attendants. The focus of this study is to develop a model that will boost the technical proficiency of the personnel that is employed to work in the technical workshops and laboratories. The exploratory sequential mixed method was used for the study. 8 participants were involved in the qualitative phase of the study while the quantitative phase involved 44 respondents from among the Workshops experts and Academics. The sample for the study was selected from among the workshop attendants and academics in the 3 universities and 4 Colleges of Education in South-Western Nigeria. The validity and reliability of the instrument were achieved through subject matter experts from the Industry and Academics, and the Fleiss Kappa calculator, which gave reliability of 85.83%. The purposive sampling technique was used for the qualitative phase. The Rasch Measurement Model was used to analyze the item in the instrument by examining the person and item separation and reliability, dimensionality, item fit statistics to determine the item that fits the model using the Partial Credit Model. The item in the instrument was recorded an item separation of 3.32 with a reliability of .92. The model will have implications for the Universities, the technicians, the students and society.

**Keywords** – Competency, Reskilling, Performance.

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## 1. Introduction

Economic Competency is a fundamental characteristic that affects an individual's way of thinking and behaviour, as well as, facing all situations encountered in life as human beings [1]. The term competency was first used in an article written by Craig Lundberg in 1970 [2]. The term was widely used for personnel and human resources [3]. Competency is a distinguishing feature that makes an organization to progress. It serves as a source of competitive advantage and baseline for achieving success. In Europe, competency is known as "Learned capacity to perform" and vastly spreading and growing in the educational sector. In the United State of America, competency is regarded as any characteristics that are related to superior work

performance. [4] define competency as "an underlying characteristic of an individual that is causally related to criterion-referenced and or superior performance in a job or situation".

In this sense, competency refers to the basic features a person possesses that associate him with superior performance in a task or situation. The five features of competency identified by [4] are motives, traits, self-perception, knowledge, and skills. Motives drive behaviour towards a specific goal. A trait is an element of personality that is relatively throughout the lifespan and across contexts. Self-perception refers to personal attitude. Knowledge is the information that a person has in his range. While skills are the ability to perform mental and physical tasks. The model

is relevant to the current study because it emphasizes personnel human development. It is concerned with the skills required for superior performance in a task.

Hazards are a common phenomenon among employees and students in the workplace [5]. These are not unconnected with the nature of the work environment such as the presence of hazardous dusty air, poor ventilation and in most cases too hot and cold weather conditions. A workable competence model will bring about an improved security and safety management in the school workshops and laboratories [5]. Competently trained individuals in higher institutions serve to gain the qualifications necessary to succeed in the labour force. This makes them responsive to changes in the labour market as an essential force in the productive economy [6].

Competencies and Competency models are today commonly practiced in most organizations. There is a strong business case for competencies at work as they lead to significant human resource development that provides organizations with a competitive edge [7], [8].

[9] conducted a study on the employability of Hospitality graduates to determine the perception of students 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. Equally, [10] 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's economy.

[11] 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 [4]. Out of the 23 competencies identified by the study, only 9 competencies made the model for the Department of Agriculture in Thailand. This corroborates [7] that the enormous broad number of employability skills frameworks 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 [12] 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. [13] 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. [13] 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, [13] observed that the positive foresight relationship between educational attainment and the labour market outcomes of human capital theory did not consider such factors as 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.

[14] 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. [14] argue 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. A strong self-concept in a specific framework may be a strong requirement for perceived employability among other employed individuals [14].

## **2. Materials and Methods**

### **2.1 Materials**

The research design was an exploratory sequential mixed method. The qualitative method involving document analysis and interview protocol was used to determine the constructs and sub-constructs of the competencies required by the Workshop technicians. The analysis was done thematically. 8 participants were involved in the study. The sample for this phase of the study was based on theoretical [15]-[17]. The educational research utilizes interviews and inquiries about the respondent's feelings, attitudes, motivation, experiences of individuals and accomplishments [18], [19].

The open-ended interview was used to elicit a self-report on the competencies from the participants. Personal contacts were employed for the data collection. The Fleiss Kappa calculator was deployed to obtain the experts' agreement on the items in the instrument. The instrument recorded an "Almost Perfect Agreement at 85.83%. The responses were audio-recorded for transcription. The transcribed

information was taken back to the participants for confirmation and authentication. This is to ensure the validity of the data. Table 1 shows the Fleiss Kappa interpretation. The 44 sample size for the quantitative study conformed with the  $\pm 1$  logit item calibration stability of 99% of Rasch minimum sample size of between 27-61 for best targeting [20]–[22]. The item separation of 3.32 and the item

reliability of .92 indicates that the sample size was enough and the instrument was capable of measuring what it was designed to measure on repeated application [23]. The Rasch Partial Credit Model was used to obtain the item that is suitable for inclusion in the competency reskilling model after screening. According to [24], only the item with negative values is considered fit.

Table 1. 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
0.81 to 0.99	Almost perfect	Almost perfect agreement

Source:(Viera, & Garrett, 2005; Fleiss Kappa, 1971)

Table 2. Criteria for Rasch AnalysisModel

Criteria	Statistical Information	Range
Reliability	Item reliability	Value of item reliability >0.8
	Item separation index	Value of separation index >2.0
	Person reliability	Value of person reliability >0.8
	Person separation index	Value of person separation index >2.0
Validity	Item polarity	PTMEA CORR >0.3
	Item fit	MNSQ infit outfit in range of 0.6 – 1.4
	Item dimensionality	Standardized residual variance >40%, Unexplained variance in 1 <sup>st</sup> contrast < 15%, Eigenvalue < 5
	Item calibration	Structure calibration range 1. 4< SC < 5
	Differential item functioning	Critical t value range +2.0 $\geq t \geq$ -2.0 and +0.5 $\geq$ DIF contrast $\geq$ -0.5 at 95% confidence level
	Standardized residual correlation	Value of residual correlation < 0.70

Table 3. Interview Findings for Technical Personnel

Examples of Responses	Participant	Code	Theme
...new innovations. We need further training....management looked down on technicians. Tools being used are obsolete and hinders student level of achievement. ...digital age. Time for workshop practice is not enough.	TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8	Digital age	Innovation
...good office accommodation and working environment for technical staff. Absence of modern working tools, machines and equipment. Equip staff with new skills and knowledge about technology. Fund technical education adequately.	TP1 TP2 TP4 TP5 TP6	Obsolete tools	Automation
Troubleshooting was by a try by error....exposure to modern equipment. All the staff should enjoy seminars and workshops.	TP1 TP2 TP4 TP5 TP7	Retraining	Professionalism
We shall continue to be relevant...the process is going to be gradual. We shall continue to work with machines and men. We need skills in managing all the resources.	TP1 TP2 TP5	Manage resources	Management
The admin staff is rated more than technical staff...we need equal treatment and exposure like them. Give us good offices...none of us is made to head any committee in the University ....majority of us are University graduates.	TP1 TP2 TP4 TP5 TP8	Leadership position	Leadership

Table 4. Summary of Interview Protocol for technical personnel

Constructs	Technicians							
	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8
Innovation	*	*	*	*	*	*	*	*
Automation	*	*	*	*	*	*	*	*
Professionalism	*	*	*	*	*	*	*	*
Management	*	*	*	*	*	*	*	*
Leadership	*	*	*	*	*	*	*	*

### 2.2 Initial Results

Five major constructs which depict the area of training needs of the workshop personnel emanated from the interview protocol and document analysis is shown in Figure 1.



Figure 1. Initial Competency Reskilling Model for Workshop Managers in TVET and Sciences

### 2.3 Data Analysis and Findings

#### SUMMARY OF 20 MEASURED ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	117.2	40.0	.00	.14	1.02	.0	1.02	.0
S.D.	27.4	.0	.50	.02	.21	1.2	.20	1.1
MAX.	176.0	40.0	.96	.19	1.47	1.5	1.43	1.6
MIN.	68.0	40.0	-1.18	.12	.61	-2.5	.62	-2.5
REAL RMSE	.15	TRUE SD	.48	SEPARATION	6.32	ITEM RELIABILITY	.92	
MODEL RMSE	.14	TRUE SD	.48	SEPARATION	3.51	ITEM RELIABILITY	.92	
S.E. OF ITEM MEAN = .12								

DELETED: 5 ITEM

UMEAN=.0000 USCALE=1.0000

ITEM RAW SCORE-TO-MEASURE CORRELATION = -1.00

800 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 2332.77 with 738 d.f. p=.0000

Global Root-Mean-Square Residual (excluding extreme scores): 1.1865

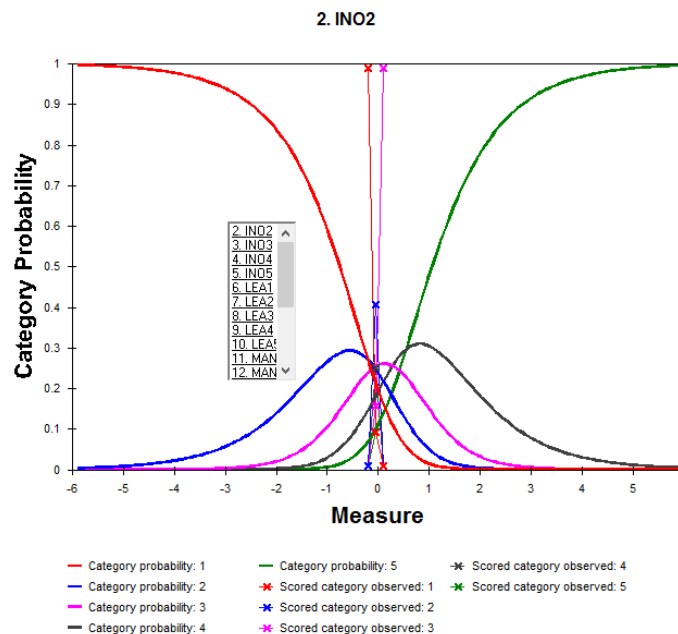


Figure 2. Category probability of item measure

Table 5. Results of Partial Credit Model

Innovative Skills	Model		
INO2	-.63	MAN2	1.11
INO3	.24	MAN3	-.84
INO4	.57	MAN4	-.29
INO5	.18	MAN5	.07
Leadership Skills	Model	Professionalism Skills	Model
LEA1	-.40	PRO1	.30
LEA2	-.56	PRO3	-.36
LEA3	.15	Automation Skills	Model
LEA4	.31	AUT1	.03
LEA5	.47	AUT2	-.69
Management Skills	Model	AUT3	-.18
MAN1	-.35	AUT4	.87

### 3. Results and discussion

#### 3.1 The Model for Reskilling Technical and Science Workshop Managers in HEIs

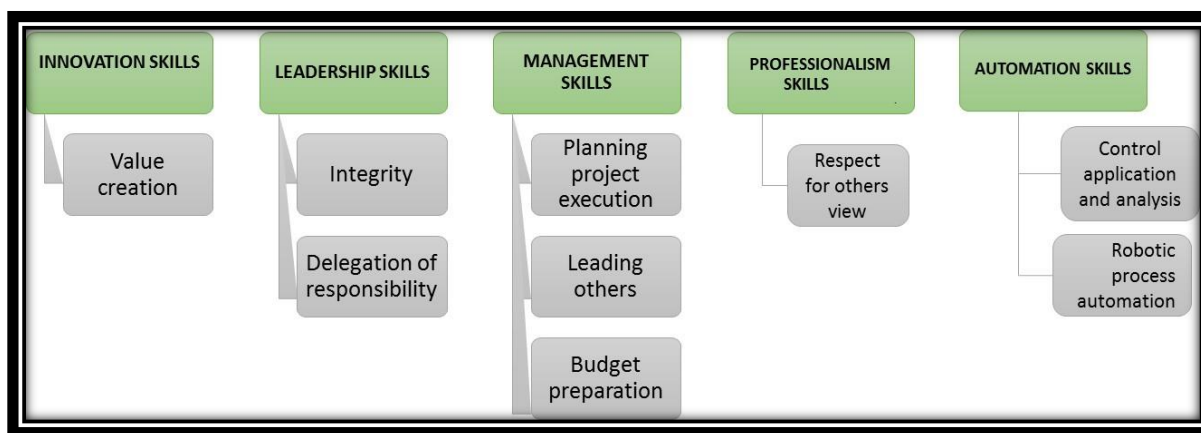


Figure 3. Competency Reskilling Model for TVET and Science Managers in HEIs

Findings from literature and interview protocol reveal that innovativeness, leadership skills, management skills, professionalism and automation skills are very crucial for the effective performance of the duties of science and technical managers (P1, P2, P3, P4, P5, P6, P7, P8). This was corroborated by [5], [6] in terms of success in the labour market. However, to avert being subjective, the Rasch measurement model was used to screen and obtain the specific item that fit the model. The sub-constructs obtained are value creation, integrity, delegation of responsibility, planning, leading others, budgeting, respect for others robotic process automation and control application and analysis. These formed the view of [7][7] for a narrow and disciplined framework for growing graduate employability. The 21<sup>st</sup> century requires workers to be adequately trained and be competitive to be useful to themselves and benefit others [5], [26], P1, P2. The 9 sub-constructs had their mean below the threshold of less than zero. These constructs were, therefore, considered suitable for inclusion in the model for reskilling science and workshop managers in HEIs. These are items with a mean of less than zero. In a bid to ensure that appropriate skills emerge in the development of the model, the Rasch Measurement Model was used for the diagnosis and validation of the constructs to ensure that a valid and useful outcome is achieved. The use of the Rasch Measurement Model produced a reliable scale measuring respondents'

perception of the constructs required for the competency reskilling model for workshop managers in higher institutions in Nigeria. A strong collaboration should exist between the HEIs and the Employers so that areas of intervention and assistance could be identified for the benefit of the workers, students, employers, and the society at large.

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#### References

- [1] Irawan, "The Design of Spencer Generic Competency as a Model for Banking Supervisors Position Specification in Surabaya," *J. Econ. Bus. Account. Ventur.*, vol. Volume 14, no. 3, p. pages 217 – 224, 2009.
- [2] V. Parts, M. Teichmann, and T. Rüttemann, "Would Engineers Need Non-technical Skills or Non-technical Competences or Both?," *Int. J. Eng. Pedagog.*, vol. 3, no. 2, pp. 14–19, 2013.
- [3] E. Buehler, W. Easley, S. McDonald, N. Comrie, and A. Hurst, "Inclusion and Education: 3D Printing for Integrated Classrooms," in *Proceedings of the 17th International ACM SIGACCESS Conference on Computers and Accessibility*, 2015, pp. 281–290.
- [4] S. . Spencer, L.M & Spencer, *Competence at Work: Models for Superior Performance*, 1st ed. USA: John Wiley & Sons, 1993.
- [5] M. A. Yasim, A. Hatib, L. M. Tahir, and N. Rosmin, "A Framework for Assessing the Work Environment," September, pp. 1707–

- 1711, 2018.
- [6] H. Shun and K. Wang, "The Application of a Managerial Competency Model in Employee Promotion—Combination of AHP and VIKOR Methodology," *Int. J. Bus. Manag.*, 2020.
- [7] M. Jollands, "A Framework for Graduate Employability Adapted for Discipline Differences," *Res. Dev. High. Educ. Learn. Life Work a Complex World*, 38, vol. 38, pp. 246–255, 2015.
- [8] Nitin Vazirani, "Review Paper Competencies and Competency Model-A Brief overview of its Development and Application," *SIES J. Manag.*, vol. 7, no. 1, pp. 121–131, 2010.
- [9] Y.-F. Wang and C.-T. (Simon) Tsai, "Employability of Hospitality Graduates: Student and Industry Perspectives," *J. Hosp. Tour. Educ.*, vol. 26, no. 3, pp. 125–135, 2014.
- [10] I. Ibrahim and N. Hasnan, "Development and Application of Competency Model in Manufacturing Operations: an Overview," no. 3, pp. 141–150, 2014.
- [11] V. Vathnophas and J. Thai-ngam, "Competency Requirements for Effective Job Performance in The Thai Public Sector," *Contemp. Manag. Res.*, vol. 3, no. 1, pp. 45–70, 2007.
- [12] P. Bouchard, "Human capital theory: Intersecting Educational and Economic Theories," *Adult Educ. Res. Conf.*, p. 1 to 7, 2008.
- [13] Y. Cai, "Graduate Employability: A conceptual framework for understanding employers' perceptions," *High. Educ.*, vol. 65, no. 4, pp. 457–469, 2013.
- [14] S. Kim, H. Kim, and J. Lee, "Employee Self-Concepts, Voluntary Learning Behavior, and Perceived Employability," *J. Manag. Psychol.*, vol. 30, no. 3, pp. 264–279, 2015.
- [15] E. Berman, "An Exploratory Sequential Mixed Methods Approach to Understanding Researchers' Data Management Practices at UVM: Integrated Findings to Develop Research Data Services," *J. eScience Librariansh.*, vol. 6, no. 1, p. e1104, 2017.
- [16] N. V Ivankova, "Implementing Quality Criteria in Designing and Conducting a Sequential QUAN ! QUAL Mixed Methods Study of Student Engagement With Learning Applied Research Methods Online," 2014.
- [17] R. B. Johnson and A. J. Onwuegbuzie, "Mixed Methods Research: A Research Paradigm Whose Time Has Come," 2016.
- [18] C. Anderson, "Presenting and Evaluating Qualitative Research: Strengths and Limitations of Qualitative Research," *Am. J. Pharm. Educ.*, vol. 74, no. 8, pp. 1–7, 2010.
- [19] N. V. Ivankova, "Implementing Quality Criteria in Designing and Conducting a Sequential QUAN → QUAL Mixed Methods Study of Student Engagement With Learning Applied Research Methods Online," *J. Mix. Methods Res.*, vol. 8, no. 1, pp. 25–51, 2014.
- [20] J. M. Linacre, *Winsteps Help for Rasch Analysis*. 2011.
- [21] J. M. Linacre, "Optimizing Rating Scale Category Effectiveness," *J. Appl. Meas.*, vol. 3, no. 1, pp. 85–106, 2002.
- [22] A. A. Aziz, *Rasch Model Fundamentals: Scale Construct and Measurement Structure*, 1st ed. Malaysia: Integrated Advance Planning Sdn Bhd, 2011.
- [23] J. . Creswell, *Research Design Qualitative, Quantitative, and Mixed Methods Approaches*, 4th ed. California: SAGE Publications, Inc, 2013.
- [24] J. M. Linacre, "Understanding Rasch Measurement: Optimizing Rating Scale Category Effectiveness," *J. Appl. Meas.*, vol. 3, no. 1, pp. 85–106, 2002.
- [25] J. M. Viera, A.J. & Garrett, "Understanding Interobserver Agreement: The Kappa statistics," [http://www.bwgriffin.com/gsu/courses/edur9131/content/Kappa\\_statistic](http://www.bwgriffin.com/gsu/courses/edur9131/content/Kappa_statistic), 2005.
- [26] T. Köhler et al., "Supporting Robust, Rigorous, and reliable Reviewing as the Cornerstone of our Profession: Introducing a Competency Framework for Peer Review," *Industrial and Organizational Psychology*. 2020.