

Development and Validation of the University Undergraduate Employability Scale – A Psychometric Approach

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Abstract

The development of contextually valid instruments is essential for generating credible evidence on graduate employability. This study developed and validated the University Undergraduate Employability Scale (UUES), a multidimensional measure of employability competencies among Nigerian undergraduates. A cross-sectional survey design was adopted using a sample of 1,594 undergraduate students drawn from federal, state, and private universities across three geopolitical zones in Nigeria. The sample was randomly split into two independent subsamples for cross-validation purposes. Exploratory Factor Analysis (EFA) and Exploratory Graph Analysis (EGA) were conducted on the first subsample, while Confirmatory Factor Analysis (CFA) was performed on the second subsample using robust maximum likelihood estimation in R. Parallel analysis, EFA, and EGA consistently supported a seven-factor solution. CFA confirmed the seven-factor structure and demonstrated satisfactory model fit, $\chi^2(7,979) = 19,168.59$, $p < .001$, CFI = .856, TLI = .854, RMSEA = .042, and SRMR = .033. Standardised factor loadings exceeded .50, composite reliability coefficients ranged from .743 to .981, and average variance extracted values ranged from .372 to .576. The findings provide strong evidence that the UUES is a reliable and valid instrument for assessing graduate employability and offer a useful tool for research, curriculum evaluation, and evidence-based policy development in higher education.

Keywords: *Graduate employability, Scale development, Validation, employability scale, Exploratory Graph Analysis*

Introduction

Graduate employability has emerged as one of the most pressing challenges confronting higher education systems globally, particularly in developing economies where youth unemployment persists despite rising tertiary enrolment rates. Higher education institutions are conventionally expected to equip students with the knowledge, competencies, and skills necessary for successful labour market entry. Yet evidence from numerous countries reveals a widening gap between what universities impart and what employers demand (Tomlinson, 2017; Yorke, 2006), intensifying debates about the relevance of university curricula and the urgency of skills-based education for sustainable work-life preparedness. This disconnect is not merely an academic concern; it carries profound social and economic consequences for individuals, institutions, and nations alike.

Employability is broadly understood as a set of knowledge, skills, attitudes, and personal qualities that enhances individuals' capacity to

obtain and retain employment while responding adaptively to evolving labour markets (Fugate et al., 2004; Hillage & Pollard, 1998). Beyond academic credentials, contemporary employers increasingly prioritise transferable competencies, including communication, problem-solving, teamwork, digital literacy, critical thinking, and adaptability (Jackson, 2014; World Economic Forum, 2020). In knowledge-based and technologically sophisticated economies, graduates are expected not only to demonstrate disciplinary mastery, but to translate that knowledge into professional effectiveness. Employability is therefore not a static acquisition, but a dynamic, multidimensional capacity that must be deliberately cultivated across the undergraduate experience.

This challenge is especially acute in Nigeria. Despite producing hundreds of thousands of graduates annually, the country continues to record persistently high levels of graduate unemployment and underemployment (National

Bureau of Statistics, 2022). Empirical studies attribute this trend to curriculum irrelevance, insufficient practical exposure, and inadequate development of workplace skills during undergraduate education (Obanya, 2019; Okwilagwe & Falaye, 2014). Employers consistently report that graduates lack the job-ready competencies required for effective workplace performance, resulting in prolonged job searches, skills mismatch, reduced organisational productivity, and costly post-hiring retraining programmes (Adebakin et al., 2015; Bamiro & Adediji, 2011). These outcomes represent not only a failure of individual preparation but a systemic underperformance of the higher education sector in fulfilling its developmental mandate.

These concerns have catalysed growing calls for comprehensive reforms in curriculum design, pedagogy, and assessment. Outcome-based education, experiential learning, industry partnerships, and competency-based frameworks are increasingly being adopted with the goal of embedding employability skills explicitly within academic programmes (Bridgstock, 2009; Yorke & Knight, 2006). Yet meaningful reform demands more than structural changes to course content or teaching methodology. It requires reliable empirical instruments capable of measuring employability competencies with sufficient precision to identify where gaps exist, how severe they are, and whether interventions are producing the intended outcomes. Without valid and contextually sensitive measurement tools, skill gaps cannot be systematically diagnosed, educational programmes cannot be rigorously evaluated, and policymakers cannot be adequately informed in their decision-making. The development of instruments to measure graduate employability has consequently attracted considerable scholarly attention over the past two decades. Researchers have constructed various scales and frameworks reflecting multidimensional conceptions of employability that encompass personal attributes, career management skills, academic engagement, and labour market awareness (Holmes, 2013; Rothwell et al., 2008). Psychometric validation, encompassing exploratory and confirmatory factor analysis,

reliability testing, and stakeholder consultation, remains the gold standard for ensuring that such instruments adequately represent the intended constructs and yield consistent results across different populations (Boateng et al., 2018; DeVellis, 2017). The rigour of scale development is therefore inseparable from the quality of the empirical conclusions drawn from its application.

Despite this proliferation of graduate employability measures, significant conceptual and methodological limitations persist. Most existing instruments were developed within Western higher education contexts and conceptualise employability predominantly as an individual-level attribute, emphasising personal skills and dispositions while affording limited attention to contextual determinants such as labour market conditions, institutional quality, policy environments, and socio-economic constraints that are especially salient in developing economies (Clarke, 2018; Holmes, 2013). This individual-centric framing is increasingly recognised as insufficient. Employability is better understood as a systemic outcome, shaped by the interplay of institutional quality, curriculum relevance, pedagogical practice, labour market dynamics, and national policy frameworks (Tomlinson & Holmes, 2017). Instruments that capture only individual competence therefore offer a partial and potentially misleading portrait of employability in contexts where structural and institutional factors exert considerable influence on graduate outcomes.

Compounding this conceptual limitation is the narrow stakeholder basis upon which many existing instruments rest. Most scales rely predominantly on the perspectives of students or employers, rarely integrating the views of educators, policymakers, and industry leaders simultaneously (Tomlinson, 2017). This stakeholder gap limits the comprehensiveness and legitimacy of the constructs being measured, particularly in policy-relevant research where diverse voices must be represented if findings are to drive systemic change. The cross-cultural applicability of Western-derived instruments is also uncertain, and there is limited empirical evidence that they

adequately capture the multidimensional and context-specific factors shaping graduate employability within the Nigerian higher education and labour market ecosystem (Okolie et al., 2020). Adapting Western frameworks without empirical validation in local contexts risks producing measurement tools that are structurally sound but contextually hollow.

Within Nigeria specifically, locally developed and empirically validated employability measurement tools that are responsive to the country's unique higher education and labour market realities remain notably scarce. The majority of frameworks in use are of Western origin and may fail to adequately reflect the socio-economic, institutional, and policy-related factors that shape graduate trajectories in developing economy contexts (Okolie et al., 2020). This gap is consequential. Without a reliable, contextually grounded instrument, diagnosing skill deficits, comparing institutional performance, evaluating educational reforms, and designing targeted policy interventions remain fundamentally constrained. Graduate unemployment in Nigeria continues to rise against the backdrop of expanding higher education access, raising urgent questions about the fitness for purpose of university training and the tools used to assess it. Employers persistently report that graduates lack the competencies required for effective workplace performance, yet the absence of a valid, multi-stakeholder, and psychometrically robust local instrument means that the precise nature, scope, and distribution of these deficits remain poorly understood.

It is against this backdrop that the present study aims to develop and validate a University Undergraduate Employability Scale specifically designed for the Nigerian higher education context. Drawing on an extensive review of existing literature and broad stakeholder input, the study employs a rigorous, multi-method psychometric validation framework consistent with established best practice in scale development (DeVellis, 2017; Kline, 2016). Specifically, Exploratory Factor Analysis (EFA) was used to uncover the underlying factor structure of the scale, Exploratory Graph Analysis (EGA) was applied to further

interrogate its dimensionality, and Confirmatory Factor Analysis (CFA) was conducted to verify structural integrity. Construct validity was further strengthened through Average Variance Extracted (AVE), while internal consistency was assessed using Cronbach's alpha, collectively representing the most robust available methods for instrument validation. In pursuing these procedures, the study seeks to deliver a theoretically grounded, contextually responsive, and empirically defensible instrument capable of reliably measuring undergraduate employability competencies within the Nigerian higher education context. By doing so, it contributes to the growing literature on employability measurement, addresses a critical gap in the Nigerian educational research landscape, and supports evidence-based efforts to align university education more effectively with the demands of a rapidly evolving and competitive labour market.

Research Questions

The following research questions guide the study:

1. What dimensions underlie the University Undergraduate Employability Scale?
2. To what extent do the scale items validly measure the construct of University Undergraduate Employability?
3. How reliable is the University Undergraduate Employability Scale in measuring employability competencies among undergraduates?
4. Can the developed scale serve as a robust instrument for assessing employability skills in Nigerian higher education institutions?

Method

Research Design

This study adopted a quantitative, cross-sectional survey design to develop and validate the Graduate Employability Scale (GES) among undergraduate students in Nigerian universities. Specifically, the study employed a psychometric instrument development and validation design aimed at examining the dimensionality, reliability, and construct validity of a newly developed measure of graduate employability.

The validation process combined exploratory and confirmatory approaches, using exploratory factor analysis (EFA), exploratory graph analysis (EGA), and confirmatory factor analysis (CFA) to establish the instrument's latent structure and psychometric properties.

Item Development

Item generation was guided by a comprehensive and systematic review of the graduate employability literature, spanning foundational theoretical frameworks and contemporary empirical studies across education, organisational psychology, labour economics, and public policy. This approach is consistent with established scale development protocols that anchor item generation firmly in theory and prior empirical evidence (DeVellis, 2017; Kline, 2016). Given that employability is a contested and multidimensional construct that has attracted extensive debate across diverse disciplinary and geographical contexts, the review was deliberately broad, integrating varying viewpoints to ensure the conceptual comprehensiveness of the proposed employability framework (Bridgstock, 2009; Fugate et al., 2004; Hillage & Pollard, 1998; Yorke & Knight, 2006).

Following the initial literature review, a pool of candidate items was generated by the research team, who subjected each item to iterative cycles of drafting, critical scrutiny, and revision until an inter-rater agreement threshold of 80% was reached among team members, providing a systematic and transparent basis for resolving ambiguities and ensuring conceptual clarity across items (Lynn, 1986; Polit & Beck, 2006). Recognising the contextual complexity of graduate employability in Nigeria, the team subsequently convened a one-day Stakeholder Analysis Workshop involving representatives from four key constituencies: university lecturers, undergraduate students, employers of labour, and human resource managers. This multi-stakeholder approach ensured that the items reflected not only theoretical rigour but also the practical realities of the Nigerian higher education and labour market environment (Tomlinson, 2017). The research team further reviewed the stakeholder feedback, making targeted refinements to item wording, relevance,

and clarity before finalising the instrument for pilot administration, which also facilitated an assessment of appropriate administration time. The resulting instrument comprises four sections. Section one captures the demographic characteristics of respondents. Section two addresses the individual dimensions of the Graduate Employability Skills Model, while sections three and four cover the institutional and policy dimensions respectively. The final draft consisted of 129 items, subsequently scripted on the Open Data Kit platform for pilot testing.

Content and Face Validity

Content and face validity were established through a systematic, multi-stage expert review process designed to ensure that the items adequately represented the full domain of graduate employability across its individual, institutional, and policy dimensions. Content validity was first grounded in a comprehensive review of the theoretical and empirical literature on employability, after which a panel of seven subject matter experts, drawn from test and measurement, management, policy, and educational research backgrounds, was constituted to evaluate the generated items (DeVellis, 2017; Polit & Beck, 2006). The panel engaged in more than five structured review sessions, working individually, in sub-groups, and in open-house plenary sessions where the principal investigator collated and synthesised all feedback, progressively refining items across each cycle consistent with best practice in content validity assessment (Lynn, 1986; Polit & Beck, 2006). The refined items were subsequently presented to a broader stakeholder validation panel comprising university lecturers, undergraduate students, employers of labour, and human resource managers during a one-day Stakeholder Analysis Workshop, where stakeholders rated each item for appropriateness and retention, providing an empirical basis for content validity judgements that extended beyond expert opinion alone (Lawshe, 1975). Face validity was concurrently strengthened through this iterative expert and stakeholder engagement process, ensuring that items were not only theoretically sound but also meaningful, accessible, and appropriate to the target population of Nigerian undergraduates.

Population and Sampling

The study involved 1,594 undergraduate students drawn from federal, state, and private universities across three geopolitical zones in Nigeria. A multistage sampling procedure was employed to select the participants. First, purposive sampling was used to select one private university and one federal university in the South-West, one state university in the South-South, and one federal university in the North-West geopolitical zones of Nigeria. These zones were selected because they contain a substantial concentration of educational institutions and economic activities and provide a diverse representation of undergraduate students. Thereafter, stratified sampling was used to select participants from major disciplinary clusters, including the sciences, science and technology, behavioural sciences, and the humanities. Finally, simple random sampling was employed to select penultimate and final-year students within the selected disciplines. The final sample comprised 1,594 undergraduate students from the 300 and 400 levels.

For cross-validation purposes, the dataset was randomly divided into two approximately equal subsamples. The first subsample ($n = 798$) was used for exploratory analyses, including EFA and EGA, while the second subsample ($n = 796$) was reserved for confirmatory analyses. The use of independent subsamples for model exploration and confirmation reduces the likelihood of overfitting and provides more robust evidence for the factorial validity of the instrument.

Data Collection

Data were collected electronically using Kobo Toolbox, an online data collection platform that supports both online and offline administration through the Open Data Kit (ODK) application. The questionnaire link was distributed to participants through designated coordinators in the selected universities. Most respondents completed the instrument using their personal smartphones, while tablets were provided to participants who did not possess compatible devices. Research assistants also provided internet connectivity and technical support, where necessary. Prior to data collection,

participants were informed of the purpose of the study, assured of the confidentiality and anonymity of their responses, and their informed consent was obtained.

Data Analysis

Data analyses were conducted using the R statistical computing environment (Version 4.4.2; R Core Team, 2025). Preliminary analyses involved screening the data for missing values, invalid responses, and data entry errors, as well as examining item distributions and univariate normality. The suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity.

To permit cross-validation of the factor structure, the total sample was randomly divided into two independent subsamples. The first subsample was used for exploratory analyses. Exploratory factor analysis (EFA) was performed using minimum residual (MINRES) estimation with oblique rotation because the dimensions of graduate employability were theoretically expected to be correlated. Decisions regarding factor retention were based on multiple criteria, including eigenvalues greater than one, parallel analysis, inspection of the scree plot, and theoretical interpretability of the resulting solution. To further investigate the dimensionality of the instrument, exploratory graph analysis (EGA) was conducted using network psychometric procedures to identify communities of highly interconnected items and to provide an independent estimate of the number of latent dimensions.

The factor structure identified through EFA and EGA was subsequently cross-validated using confirmatory factor analysis (CFA) on the second subsample. CFA models were estimated using robust maximum likelihood estimation (MLR) to account for potential deviations from multivariate normality. Model fit was evaluated using the chi-square statistic (χ^2), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval, and the Standardised Root Mean Square Residual (SRMR). Following established guidelines, CFI and TLI values of .90 or higher were considered indicative of acceptable model fit and values of

.95 or higher indicative of good fit, whereas RMSEA and SRMR values of .08 or lower indicated acceptable fit and values of .06 or lower indicated good fit.

The psychometric properties of the final instrument were further evaluated by examining reliability and construct validity. Internal consistency reliability was assessed using Cronbach's alpha (α) and McDonald's omega (ω) coefficients, with values of .70 or higher considered acceptable. Composite reliability (CR) and average variance extracted (AVE) were calculated to assess convergent validity, with CR values of .70 or higher and AVE values of .50 or higher indicating adequate convergence. Discriminant validity was examined using the Fornell-Larcker criterion and inter-factor correlations. Standardised factor loadings were inspected to evaluate item performance, with loadings of .50 or higher considered practically meaningful. Where relevant, measurement invariance across key demographic groups (e.g., gender and institution type) was assessed through multigroup CFA by sequentially testing configural, metric, and scalar invariance.

Results

Research Question One: What dimensions underlie the University Undergraduate Employability Scale?

KMO and Bartlett's Test

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy produced an overall MSA of 0.99, which is considered "marvellous" according to Kaiser's criteria. This indicates that the correlation patterns among the variables are highly compact, and that factor analysis is likely to yield distinct and reliable factors. All individual item MSAs are also extremely high (ranging approximately from 0.96 to 0.99), showing that every item contributes well to the underlying factor structure and none fall below acceptable thresholds. Overall, these results provide very strong evidence that the dataset is highly suitable for factor analysis.

Bartlett's test of sphericity is highly significant ($\chi^2 = 86,882.05$, $df = 8,256$, $p < .001$), indicating that the correlation matrix is not an identity matrix. This means that there are sufficient inter-

item correlations among the variables to justify the use of factor analysis. In practical terms, the test confirms that the variables share enough common variance to support structure detection, and therefore dimensionality reduction techniques, such as EFA, are appropriate for this dataset.

Parallel Analysis

The parallel analysis scree plot, as shown in Figure 1, suggests the presence of a multidimensional structure underlying the University Undergraduate Employability Scale. In parallel analysis, factors are retained when the eigenvalues obtained from the actual data exceed those generated from randomly simulated and resampled datasets. The plot shows that the first several observed eigenvalues are substantially larger than the corresponding simulated eigenvalues, indicating that these factors explain more variance than would be expected by chance. Specifically, the point at which the actual-data eigenvalue curve intersects and falls below the simulated and resampled eigenvalue curves occurs at approximately the seventh factor, suggesting the retention of a seven-factor solution. Beyond the seventh factor, the observed eigenvalues are comparable to or lower than those derived from random data, indicating that additional factors are unlikely to represent meaningful latent dimensions. Therefore, the parallel analysis provides empirical support for a seven-factor structure of the University Undergraduate Employability Scale, corroborating the findings obtained from the exploratory factor analysis and exploratory graph analysis.

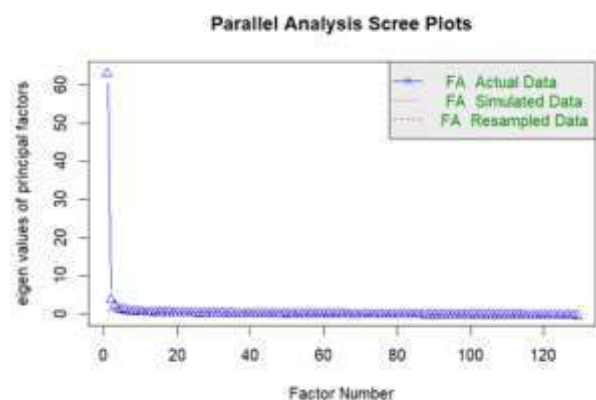


Figure 1: Scree Plot showing 7 factor structure

Exploratory Factor Analysis

The exploratory factor analysis (EFA) using minimum residual estimation with oblimin rotation and a seven-factor solution reveals a well-defined but highly correlated multidimensional structure among the 129 items. The pattern matrix shows that most items load strongly on their respective latent factors, with primary loadings generally ranging from approximately 0.33 to 0.79, indicating acceptable to strong item–factor relationships. Factor 1 is the most dominant dimension, accounting for the largest share of variance and attracting a large cluster of high-loading items (e.g., SC116A–SC129A), while Factors 2 and 3 also demonstrate substantial and coherent item groupings with strong loadings across their respective item sets. Factors 4 through 7 are comparatively weaker but still retain identifiable item clusters, though with fewer items showing moderate-to-strong loadings, suggesting more marginal or specialised constructs. The factor correlation matrix indicates substantial inter-factor relationships (generally ranging from 0.30 to 0.70), implying that the extracted dimensions are not independent but rather reflect related underlying aspects of a broader construct domain, which is consistent with the use of oblique rotation. Item communalities are mostly moderate, indicating that a meaningful proportion of variance in each item is explained by the factor solution, although some items exhibit lower shared variance and higher complexity values, suggesting minor cross-loading or less clearly defined structure for those indicators. Overall, the results support a multidimensional but interrelated factor structure, with strong evidence for several core factors and weaker but interpretable secondary dimensions, indicating that the scale captures a coherent yet hierarchical construct domain.

Table 1: Summary of Exploratory Factor Analysis Primary Loadings by Factor

Factor	k items	Loading range	Mean loading
MR1	44	0.12–0.79	0.54
MR2	18	0.37–0.75	0.57
MR3	12	0.33–0.58	0.50
MR4	6	0.30–0.69	0.45
MR5	18	0.32–0.51	0.41
MR6	21	0.24–0.65	0.45
MR7	9	0.32–0.46	0.38

Note. k = number of items with their highest (primary) loading on that factor; a loading was considered salient at ≥ 0.32 . Loading range and mean reflect each item's loading on its assigned (primary) factor only.

Research Question Two: To what extent do the scale items validly measure the construct of University Undergraduate Employability?

Exploratory Graph Analysis

The Exploratory Graph Analysis (EGA) using the Walktrap algorithm identified a 7-community structure, indicating that the dataset is best represented by seven distinct but interrelated dimensions. The community allocation shows a clear and highly ordered clustering of items, with each group of variables forming coherent blocks that correspond to latent psychological constructs. Specifically, Items SC1A–SC18A form the first dimension, SC19A–SC25A form the second, SC26A–SC46A the third, SC47A–SC56A the fourth, SC57A–SC82A the fifth, SC83A–SC112A the sixth, and SC113A–SC129A the seventh. This pattern demonstrates strong local connectivity within each cluster, suggesting that items within each community share substantial partial correlations and likely measure the same underlying construct. The relatively clean separation between communities further indicates that the scale has a stable multidimensional structure, with minimal overlap between most item clusters, although a minor inconsistency is observed for SC90A, which loads into a different community (5 instead of 6), suggesting a possible cross-construct linkage or instability in that item's association. Overall, the EGA results support a robust 7-dimensional structure consistent with the EFA solution, providing convergent evidence that the instrument

captures seven distinct but related latent constructs.



Figure 2: EGA scree Plot Supporting 7-Factor Structure

Both the exploratory factor analysis (EFA) and exploratory graph analysis (EGA) converge on a consistent seven-factor structure, providing strong convergent evidence for the multidimensionality of the scale. The EFA results (minres with oblimin rotation) demonstrate a clearly interpretable pattern matrix in which items predominantly load on their respective latent factors with moderate to strong loadings (generally $\geq .33$ to $.79$), alongside acceptable communalities and a coherent simple structure across most item groups. Although factors 1–3 are more strongly defined and factors 4–7 are comparatively weaker, the overall loading pattern still supports a stable seven-factor solution with meaningful conceptual grouping and substantial inter-factor correlations, indicating that the constructs are related but distinct. In parallel, the EGA using the Walktrap algorithm independently identifies seven distinct communities that closely mirror the EFA structure, with items clustering into nearly identical groupings (SC1A–SC18A, SC19A–SC25A, SC26A–SC46A, SC47A–SC56A, SC57A–SC82A, SC83A–SC112A, and SC113A–SC129A), thereby reinforcing the robustness of the dimensional structure from a network perspective. The minor anomaly observed in SC90A, which slightly deviates in its community assignment, suggests a potential item-specific instability but does not substantially weaken the overall structure. Taken together, both techniques provide strong

convergent validity evidence for a seven-dimensional construct space, supporting the theoretical adequacy of the measurement model. Given that the majority of items load above the conventional threshold of 0.30 in EFA and are consistently assigned within coherent EGA communities, there is no immediate statistical justification for item removal at this stage; however, minor refinement could focus on reviewing weak or cross-loading items (particularly those with lower loadings or higher complexity) to improve parsimony and conceptual clarity in future iterations of the scale.

Confirmatory Factor Analysis

The confirmatory factor analysis (CFA) provided substantial support for the seven-factor structure of the University Undergraduate Employability Scale. The model yielded a statistically significant chi-square statistic, $\chi^2(7,979) = 19,168.59$, $p < .001$; however, the significance of the chi-square test was expected given the large sample size and the considerable complexity of the model, as this statistic is highly sensitive to sample size and model complexity. More importantly, the model demonstrated excellent absolute fit, with an RMSEA of .042 (90% CI [.041, .043]) and an SRMR of .033, both of which are well below the recommended cut-off values and indicate that the hypothesised model reproduces the observed covariance matrix well. The incremental fit indices, CFI (.856) and TLI (.854), were below the conventional criterion of .90. Nevertheless, these values should be interpreted cautiously because incremental fit indices are known to be adversely affected in highly parameterised models with a large number of indicators, such as the present 129-item instrument. Considering the excellent absolute fit indices, the strong standardized factor loadings, and the theoretical coherence of the seven-factor structure, the CFA results provide adequate evidence supporting the structural validity of the University Undergraduate Employability Scale and suggest that the proposed seven-factor measurement model offers a satisfactory representation of the underlying construct.

Table 2: Summary of Confirmatory Factor Analysis Standardized Loadings by Factor

Factor	k items	Std. loading range	Mean std. loading
MR1	44	0.68–0.78	0.74
MR2	18	0.60–0.72	0.67
MR3	12	0.66–0.77	0.73
MR4	6	0.50–0.73	0.63
MR5	18	0.70–0.79	0.75
MR6	21	0.66–0.75	0.71
MR7	9	0.72–0.79	0.76

Note. k = number of items retained per factor in the CFA model. All standardized loadings were statistically significant, $p < .001$.

Research Question Three: How reliable is the University Undergraduate Employability Scale in measuring employability competencies among undergraduates?

Table 3. Composite Reliability and Average Variance Extracted of the University Undergraduate Employability Scale

Factor	Number of Items	Composite Reliability (ω)	AVE
MR1	44	0.981	0.541
MR2	18	0.936	0.452
MR3	12	0.932	0.537
MR4	6	0.743	0.372
MR5	18	0.958	0.560
MR6	21	0.956	0.504
MR7	9	0.926	0.576

Table 3 indicates that the seven dimensions of the University Undergraduate Employability Scale demonstrate satisfactory to excellent internal consistency and adequate convergent validity. The composite reliability coefficients (ω) ranged from .743 to .981, exceeding the recommended threshold of .70, thereby indicating that all seven factors possess acceptable reliability and consistently measure their intended constructs. In particular, MR1, MR2, MR3, MR5, MR6, and MR7 exhibited exceptionally high reliability coefficients ($\omega > .90$), while MR4 demonstrated acceptable reliability ($\omega = .743$). Regarding convergent validity, the average variance extracted (AVE) values ranged from .372 to .576. Five factors (MR1, MR3, MR5, MR6, and MR7) exceeded the recommended benchmark of .50, indicating that these latent constructs explain more than half of the variance in their respective indicators. Although the AVE values for MR2 (.452) and MR4 (.372) fell below the conventional criterion, their composite reliability coefficients remained well above the recommended threshold, suggesting that convergent validity is still acceptable according to the Fornell and Larcker criterion. Overall, the findings provide strong evidence that the University Undergraduate Employability Scale possesses robust reliability and adequate convergent validity across its seven dimensions.

Research Question Four: Can the developed scale serve as a robust instrument for assessing employability skills in Nigerian higher education institutions?

The psychometric evaluation of the University Undergraduate Employability Scale (UUES) provides substantial evidence that the instrument can serve as a robust measure of employability skills among Nigerian university undergraduates. Exploratory Factor Analysis (EFA) and Exploratory Graph Analysis (EGA) consistently supported a seven-factor structure, with the EGA identifying seven distinct item communities that closely corresponded with the factor analytic solution. This structure was subsequently cross-validated through Confirmatory Factor Analysis (CFA) conducted on an independent subsample. The CFA demonstrated excellent absolute model fit, $\chi^2(7,979) = 19,168.59$, $p < .001$, RMSEA = .042,

90% CI [.041, .043], and SRMR = .033. Although the incremental fit indices (CFI = .856 and TLI = .854) fell below the conventional .90 criterion, these values were interpreted cautiously given the large number of indicators and the complexity of the 129-item model, conditions that are known to depress incremental fit statistics.

Furthermore, all items exhibited substantial standardised factor loadings exceeding .50, indicating strong relationships between the observed items and their respective latent constructs and supporting the retention of all 129 items. Composite reliability coefficients ranged from .743 to .981, demonstrating acceptable to excellent internal consistency across the seven dimensions of the scale. Average Variance Extracted (AVE) values ranged from .372 to .576, providing evidence of adequate convergent validity for most dimensions. Although two factors produced AVE values below the recommended .50 threshold, their high composite reliability coefficients suggest that the constructs retain adequate convergent validity.

Taken together, these findings demonstrate that the UUES possesses a stable and theoretically meaningful seven-factor structure, strong internal consistency, and satisfactory construct validity. Therefore, in response to Research Question Four, the evidence indicates that the developed scale is a psychometrically sound and robust instrument for assessing employability skills in Nigerian higher education institutions and can be confidently used for research, programme evaluation, and employability assessment within the Nigerian context.

Discussion

The findings of this study provide robust psychometric evidence that the University Undergraduate Employability Scale (UUES) is a valid, reliable, and contextually appropriate instrument for assessing employability competencies among Nigerian undergraduates. The convergence of multiple analytical techniques across the full validation sequence offers a level of empirical confidence that no single method could independently sustain, and the emergent seven-factor structure represents

both a psychometric finding and a theoretical statement about the nature of graduate employability in developing economy contexts. The suitability of the data for factor analysis was beyond questioning, and the parallel analysis criterion for factor retention provided an empirically grounded basis for identifying the seven-dimensional solution that was subsequently corroborated by both EFA and EGA. The decision to employ parallel analysis rather than the conventional eigenvalue-greater-than-one rule reflects methodological best practice, given well-documented evidence that the latter systematically overestimates the number of meaningful factors (Hayton et al., 2004; Horn, 1965). That two methodologically distinct traditions, the factor analytic and the network psychometric, converged independently on the same seven-factor solution is particularly compelling. EGA does not presuppose the latent variable framework that underpins EFA, and its agreement with the factor analytic solution therefore constitutes genuine convergent evidence rather than methodological circularity (Golino & Epskamp, 2017; Christensen & Golino, 2021). This convergence substantially strengthens confidence in the stability and replicability of the dimensional structure beyond what either technique could establish alone.

The seven-factor structure is theoretically coherent and extends existing employability frameworks in an important direction. Prominent conceptualisations in the literature have tended to locate employability primarily within the individual, whether as an integration of career identity, personal adaptability, and human capital (Fugate et al., 2004), a competence portfolio encompassing occupational expertise and personal flexibility (Van der Heijde & Van der Heijden, 2006), or a composite of degree knowledge, generic skills, and emotional intelligence (Pool & Sewell, 2007). While these frameworks have generated valuable empirical work, their predominantly individualistic orientation limits their explanatory adequacy in contexts where structural and institutional factors are equally, if not more, determinative of graduate outcomes. The UUES departs from this tradition by explicitly incorporating institutional and policy

dimensions alongside individual competencies, reflecting the growing theoretical consensus that employability is a systemic outcome co-produced by personal capability, institutional quality, and enabling policy environments (Clarke, 2018; Tomlinson & Holmes, 2017). In this respect, the factor structure of the UUES is not merely a psychometric artefact; it embodies a theoretically richer conception of employability that is particularly responsive to the Nigerian higher education and labour market context, where socio-economic constraints, institutional variability, and policy gaps are well-documented mediators of graduate trajectories (Okolie et al., 2020).

The CFA results warrant careful interpretive nuance. The excellent absolute fit indices situate the UUES among instruments with strong structural integrity, confirming that the hypothesised seven-factor model reproduces the observed covariance structure with high fidelity (Hu & Bentler, 1999). The incremental fit indices, falling marginally below the conventional .90 benchmark, should not be read as evidence of structural inadequacy. It is well established that incremental fit statistics are progressively penalised as model complexity and the number of indicators increase, making the .90 criterion an inappropriate absolute standard for large, multi-dimensional instruments of this nature (Marsh et al., 2004). Evaluating the CFA evidence in its totality, including strong standardised factor loadings across all items, excellent absolute fit, and the prior convergent evidence from EFA and EGA, the structural validity of the UUES is well supported.

The reliability and convergent validity findings reinforce this conclusion. The composite reliability coefficients are consistently strong, and the AVE values, while falling below the .50 threshold for two factors, remain acceptable when considered alongside their corresponding composite reliability estimates, consistent with the Fornell and Larcker (1981) criterion. The comparatively modest psychometric performance of MR4, reflected in both a lower composite reliability and a below-threshold AVE, is worth noting. With only six items, this dimension may benefit from targeted item

development in future iterations, and its conceptual boundaries warrant closer theoretical scrutiny to determine whether it represents a genuinely distinct construct or a transitional dimension that partially overlaps with adjacent factors. This is a productive direction for future research rather than a fundamental limitation of the current instrument.

The retention of 129 items also invites reflection on parsimony. Very high composite reliability coefficients, particularly those approaching .98, can occasionally reflect item redundancy rather than enhanced measurement precision, and bloated instruments carry practical burdens for large-scale administration (DeVellis, 2017). Future work should explore systematic item reduction guided by factor loadings, inter-item correlations, and content representativeness, with the goal of producing a shorter form of the UUES that retains its construct coverage and psychometric integrity while improving administrative efficiency. Longitudinal and cross-institutional validation studies would also strengthen the generalisability of the current findings, and discriminant validity analyses would further consolidate the instrument's construct validity evidence.

In summary, the UUES makes a substantive contribution to the literature on graduate employability measurement by delivering a theoretically grounded, multi-stakeholder-informed, and psychometrically robust instrument validated specifically for the Nigerian higher education context. Its seven-dimensional structure, strong internal consistency, and satisfactory construct validity position it as a credible and practically useful tool for diagnosing employability skill gaps, evaluating educational programmes, and informing evidence-based curriculum and policy reform in Nigerian universities and, potentially, across comparable developing economy higher education systems.

Conclusion

This study developed and validated the University Undergraduate Employability Scale (UUES) and provided strong evidence of its psychometric adequacy as a multidimensional

measure of graduate employability among Nigerian undergraduates. The findings supported a stable seven-factor structure through the convergence of exploratory factor analysis, exploratory graph analysis, and confirmatory factor analysis, while reliability and validity analyses demonstrated satisfactory internal consistency and construct validity. By incorporating individual, institutional, and policy dimensions of employability, the UUES offers a theoretically grounded and contextually relevant framework for understanding graduate employability in developing economies. Consequently, the instrument represents a valuable tool for researchers, higher education institutions, and policymakers seeking to assess employability competencies, identify skill gaps, and inform evidence-based curriculum development and policy interventions aimed at improving graduate outcomes.

Recommendation

Based on the findings of this study, the following recommendations are made to enhance the assessment and development of undergraduate employability.

- Universities should adopt the University Undergraduate Employability Scale as a tool for periodically assessing students' employability competencies in order to identify skill gaps and guide targeted interventions.
- Higher education institutions should strengthen their curricula by integrating employability-focused learning experiences such as internships, work-integrated learning, entrepreneurship education, and industry-based projects.
- Universities should promote stronger collaboration with industry partners to provide mentorship opportunities, practical exposure, and career guidance that can enhance students' workplace competencies.
- Education policymakers and regulatory agencies should encourage institutions to prioritize employability development through policies that support career development programmes and stronger university–industry partnerships.
- Researchers and educational practitioners could adopt the scale in different university contexts to generate

evidence that can inform strategies for improving graduate employability outcomes.

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