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Psychometric evaluation of the behavioral intention to use blended learning scale for Nigerian university lecturers

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ABSTRACT

Universities in Nigeria are not an exception to the growing trend of blended learning (BL) as a promising approach to higher education. The purpose of this study is to create and assess the psychometric qualities of a behavioral intention to use blended learning (BIUBL) scale designed for university lecturers in Nigeria. Data were gathered from 368 lecturers representing federal, state, and private universities using a descriptive survey design. The scale items were refined and the scale's underlying structure was evaluated through the use of exploratory factor analysis (EFA) in SPSS 22.0. The factor structure was then validated by confirmatory factor analysis (CFA) using AMOS 20.0. The scale's reliability of 0.835 was obtained by using the Cronbach's alpha coefficient, suggesting strong internal consistency. The results demonstrated the validity and reliability of the scale in gauging the behavioral intention of lecturers to employ BL in Nigerian university settings. In order to evaluate and encourage university lecturers to use BL practices, this scale can be a useful tool for researchers and educators globally. The process of the creation of the scale followed the established rules for a tool construction which could also assist researchers with guidedance. These would ultimately improve the standard of higher education delivery in Nigeria and beyond.

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1. INTRODUCTION

Recently, the atmosphere of tertiary education has experienced a significant shift with the integration of technology into traditional teaching methodologies [1]. Since the start of the Fourth Industrial Revolution (4IR), technology has been progressively changing the face of education. Academic institutions are striving to enhance the pedagogical strategy that leverages educational technology to enable learners to design and oversee their educational journeys. Teachers are also searching for innovative ways to better mentor pupils in light of the rapid advancement of technology worldwide [2]. Blended learning (BL), a pedagogical approach that combines face-to-face instruction with online learning activities, has emerged as a promising avenue for enhancing the educational experience in tertiary institutions [3]. As the global educational community navigates these changes, it becomes imperative to explore the factors aiding the acceptance of BL, particularly among educators in specific cultural and institutional contexts.

Although the majority of higher education programs mandate the use of technology in instructional management has not made the necessary efforts to guarantee that faculty members have learned the skills

necessary for BL [4]. The traditional teaching and learning approaches are centered on the physical learning environment and that form the basis of the majority of Nigeria's educational system. However, the COVID-19 pandemic has brought to light the shortcomings of this conventional educational system in Nigeria, as well as in the majority of developing countries. When it comes to social, economic, and, more lately technical investigation, universities in less developed countries are falling behind their counterparts in the developed countries [5], [6]. The dilapidated level of infrastructural development in Nigeria remains a source of concern, in terms of energy and internet connectivity, and also lingers to establish a hindrance for the implementation of the e-learning system in the country [7]. Of the over 170 universities in Nigeria, only 11 were operating virtual learning systems in the country whereas most of the institutions remain ill-equipped [6].

Many developing countries are undergoing a dynamic evolution in their educational sector. The advent of digital technologies and the increasing availability of online resources present new opportunities for universities to enrich their teaching methods. However, the successful integration of BL depends not only on the technological infrastructure but also on the willingness and intention of educators to embrace this pedagogical shift. Understanding the factors that influence the behavioral intention of Nigerian university teachers to use BL is essential for fostering a successful transition to modern instructional strategies [8], [9]. While the literature on BL is expanding, there remains a noticeable gap in the understanding of the behavioral intentions of university teachers.

Previous research has primarily focused on technological adoption in broader settings, neglecting the unique challenges and opportunities within the Nigerian higher education system. The present study aims to address this gap by developing and psychometrically evaluating a specialized instrument behavioral intention to use blended learning (BIUBL) scale. By creating and psychometrically assessing the BIUBL scale, which is specifically designed for Nigerian university lecturers, this study makes a novel contribution. Although the adoption of BL has been the subject of previous research, there is a lack of validated tools to assess lecturers' behavioral intention in this context. By methodically creating a culturally appropriate scale, evaluating its validity and reliability using strong psychometric methods, present study fill-in that gap. The results offer a special tool for comprehending and improving the use of BL in higher education, which will help Nigerian universities make informed policy decisions and professional development plans.

The primary purpose of this research is to come up with a reliable and valid scale that measures the behavioral intention of university lecturers to use BL in their teaching practices. By creating a context-specific instrument, we aim to capture the intricacies and nuances that influence educators' intentions to adopt BL. Additionally, the study seeks to contribute to the existing body of knowledge by providing insights into the factors shaping the behavioral intentions of university lecturers in higher education setting to adopt the BL system. The study aims to investigate how the psychometric evaluation of the BIUBL scale aligns with established standards of reliability and validity. The development of a psychometrically sound scale adds a valuable tool to the toolkit of researchers and practitioners interested in assessing and enhancing the adoption of innovative teaching approaches like BL.

BL, characterized by the integration of traditional face-to-face instruction with online learning components, has become a focal point in contemporary higher education [10], [11]. Several delivery strategies are used in BL, an educational approach that aims to maximize learning results at the lowest possible cost. Nonetheless, it is imperative to focus on the results of instruction rather than merely combining various methods of delivering knowledge [12]. BL is a popular strategy used in higher education to offer more flexible learning options which equally gives students greater flexibility over the time, place, and speed of their education [13]. However, virtual learning facilities are not adequately utilized in many higher institutions due to the lack of insufficient training of operators and or lecturers [14].

The literature on BL underscores its potential to enhance lecturers' engagement, flexibility, and teaching outcomes [15]. Numerous studies have explored the impact of BL in various academic disciplines and cultural contexts, demonstrating its efficacy in promoting active learning and addressing diverse learning styles [16]. Technology, computer-assisted learning, and BL should be the main focuses of teaching and learning at the post-secondary level [17]. Although BL has many benefits, yet, there is a level of inadequacy of research that particularly examines the factors influencing university lecturers' behavioral intentions to use BL in higher education. The majority of the work currently in publication focuses on students' perspectives and experiences in mixed-learning environments [18]. In higher education, university lecturers play a critical role in the success of BL. Few have created a scale to explain what influences lecturers' intention to teach in this mode (the BL). The scarcity of research on the behavioral intentions of university lecturers in Nigeria is a significant gap that justifies the need for the present study. Previous studies have often treated the adoption of technology in education as a uniform process, overlooking the unique contextual factors influencing the intentions of educators in different regions [19], [20].

For many years, there has been extensive research on the challenges faced by university lecturers in implementing BL in higher education institutions (HEIs) [21]. Furthermore, while some studies have explored the factors influencing the use of technology, BL, in particular, has been studied by educators worldwide, including those in Nigeria [22], the various interplay of these factors within the Nigerian cultural and educational context remains largely unexplored by scholars in the field. The current study aims to develop the behavioral intention to use a BL scale to study the behavioral intention of university lecturers to implement the BL system. The scale would be used to study lecturers' behavioral intention to adopt the use of BL in the instructional venture.

2. METHOD

2.1. Research design

Descriptive survey design guides the study. It involves the generation of data using a survey design approach. A survey is a suitable methodology as it allows for the efficient gathering of quantitative data on the behavioral intention to use BL, facilitating the development and psychometric assessment of the proposed scale. The study employed a representative sample of Northern Nigerian university lecturers, aimed at a diverse and inclusive participant pool, a sample of 368 university lecturers were contacted for the study, and the samples were drawn from 3 federal, 3 state, and 3 private universities' faculties (departments) through the stratified random sampling technique. Lecturers from Northern Nigeria were selected for efficiency considering time and cost effects and because research regarding the behavioral intention to use BL is lacking from Northern Nigeria [23].

The demographic information collected includes participants' gender, academic discipline, teaching experience, and academic qualification. These variables helped in understanding potential variations in behavioral intention to use BL across different demographic groups. There were 368 participants with work experience ranging from up to 5 years to 30 years, with an average working experience of 10 years and up to 5 years with the highest which amounts to 41.3% of the sample and the lowest are between 20-25 years which recorded 2.4%. Lecturers having masters' degrees made the highest with 54.9% and the lowest are those having a degree 21.2% and those with PhD 23.9%. There were 73.1% male lecturers and 26.9% female lecturers who participated in the survey. Faculty of education had 50.3% being the highest with management sciences having 21.5% and faculty of sciences having 28.3% of participating lecturers. Descriptive statistics was employed to summarize the demographic characteristics of the participants and provide an overview of the scale's scores. The software package of SPSS 22.0 was used for descriptive statistics, exploratory factor analysis (EFA), and structural analysis while AMOS 20.0 was used for the confirmatory factor analysis (CFA).

2.2. Tool development and validation

The 7 steps guidelines for the construction of a survey questionnaire/scale outlined by the Association for Medical Education in Europe (AMEE) as cited in Artino Jr., *et al.* [24] have been followed in the development of the BIUBL scale. The steps are:

2.2.1. Literature review

Literature was reviewed to find available scales/questionnaires or items to adapt for a survey study concerning the behavioral intention of Nigerian university lecturers to use BL in teaching. The absence of an existing tool motivated the researchers to the next step of the study.

2.2.2. Conduct of interviews on focus groups

The population of interest was interviewed with the construct of interest (the BL), where it was found that very few of the population of interest from the education department were familiar with the meaning of BL. Other respondents from departments of sciences and management sciences were not familiar with the concept of BL and that necessitates the scale to carry a simple definition of the concept of BL for all respondents to be fully informed of what they are responding to.

2.2.3. Synthesis of literature review

Literature was once again synthesized to confirm that constructs' conceptualization is in agreement with the theoretical frameworks given by scholars in the field of educational technology. Items generation: assembling and/or creating items for the initial pool, is a step-in scale development, along with defining the format for responses [25]. A pool of items reflecting uni-dimension of behavioral intention to use BL was generated. These items were generated from a synthesis of existing literature/scales, experts' opinions, and qualitative insights from Nigerian university lecturers.

2.2.4. Expert validation

A 13 experts' panel across educational technology, psychometric, and pedagogy were contacted for the evaluation of the content validity of the scale, where 10 evaluated and returned the copies for the content validity of the scale. Their feedback guided the refinement and selection of items to ensure the scale's relevance and comprehensiveness. The experts were provided the items and the objectives of the research study, and they were asked to rank each item's relevance to the objectives on a scale of 1 to 4: not relevant (NR) as 1, somewhat relevant (SR) as 2, quite relevant (QR) as 3, and highly relevant (HR) as 4 and to equally comment/make suggestions on each item of the scale. The total number of experts divided by the number of experts with positive ratings yields the content validity index (CVI) of an item (i.e., 3 or 4) [26]. Content validity ratio (CVR) is a measure of how valid the instrument was calculated by using the following formulae [27]–[29]:

$$CVR = \left(\frac{N_e - \frac{N}{2}}{\frac{N}{2}}\right)$$

where N_e is the number of experts with a rating of 3 or 4 and N is the total number of experts. An acceptable CVR for 10 experts was defined as 0.62 or higher [27]. The 9 items were presented to the panel and only one was removed as it could not reach a CVR of 0.62, therefore making the scale to contain eight items.

2.2.5. Cognitive interviews

After the items, researchers personally met some of the population of interest and interviewed them using the developed scale. The responses were satisfactory especially when they read the attached definition of the construct "BL". Items were conceived as meant.

2.2.6. Pilot testing

Having developed the BIUBL, the finalized scale was responded to by 368 Nigerian University lecturers electronically. A cover note was attached to the survey, explaining the purpose of the study, and responses were recorded on Google Forms. Data were generated on a 5-Likert scale of 1-5 (strongly disagree-strongly agree).

3. RESULTS AND DISCUSSION

3.1. Exploratory factor analysis

EFA is used to limit the number of measured variables to study the structure between the variables, and the increasing statistical efficiency. It is utilized when the relationship between observed variables and factors has not been conceptually defined or logically arranged. Assuming that every factor influences every other variable and that every variable is related to every other factor, an observed variable that has a strong correlation with one factor and a low connection with other factors is taken out to minimize the total number of variables [30]. The 368 responses were divided into 2 for the EFA and CFA. The first 184 responses were subjected to EFA to identify the underlying factor loading of the BIUBL scale. Factor analysis was adequate for this data set, as indicated by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy 0.845 ($p<0.001$), which was higher than the acceptable value [31]. Bartlett's test result of sphericity has a chi-square value of (631.531), as ($p<0.001$). The total variance explained stood at 52.517%. Figure 1 is the scree plot for the BIUBL scale showing the eigenvalue and the component number. The values of factor loading of different items of the BIUBL scale are shown in Table 1.

3.2. Confirmatory factor analysis

CFA is a type of psychometric evaluation that computes the relationship between latent constructs that have been adjusted for measurement errors and enables the systematic comparison of an alternative a priori factor structure based on systematic fit assessment procedures [32]. To do CFA, factors with low explanatory power were eliminated and the model fit should be sufficient. Several model fit indices exist, each with a unique set of requirements. There is no agreement in the literature regarding the proper index, and none of the indexes have offered a flawless explanation of the model fit. Consequently, it is advised to evaluate the model fit using a range of indices [28]. CFA for the BIUBL scale, as in Figure 2, was conducted using AMOS 20.0 statistical software to assess the validity of the measurement of BIUBL scale. The fit indices results are presented in the Table 2 [33]. The particular study has a model fit of standardized root mean residual (SRMR) 0.0424 which is good when compared to the threshold for an acceptable model fit which stands at SRMR≤0.08 as indicated by Park and Kim [30].

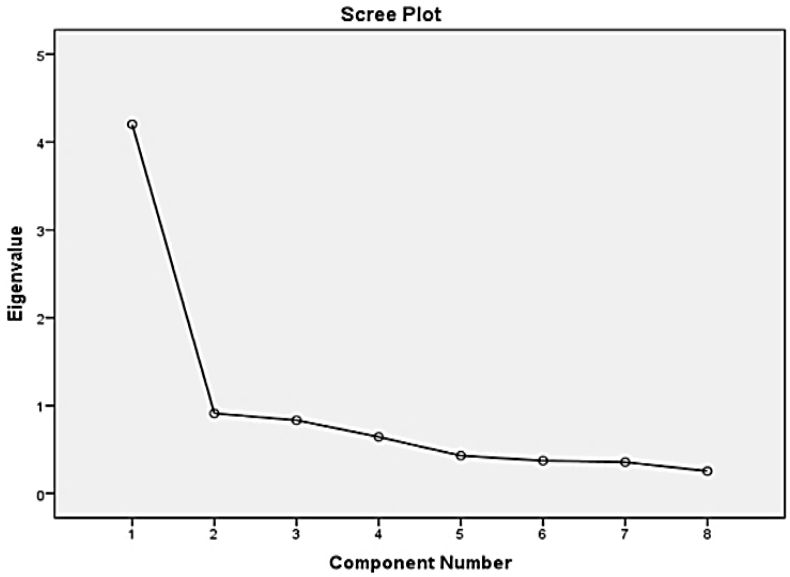

Figure 1. Scree plot for BIUBL scale

Table 1. Factor loading of different items of BIUBL scale

Item no.	Factor loading
BI3	0.801
BI2	0.785
BI8	0.775
BI7	0.712
BI6	0.701
BI1	0.685
BI5	0.684
BI4	0.638

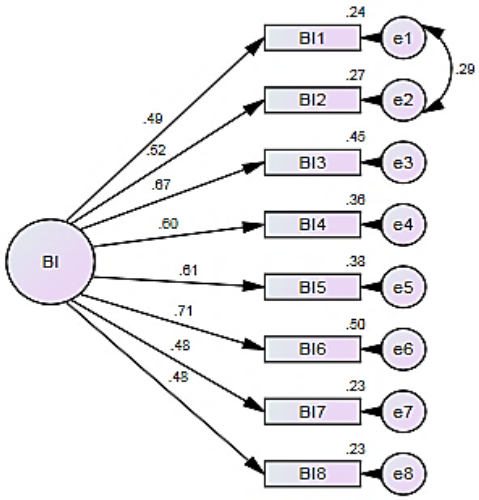

Figure 2. CFA for BIUBL scale

Table 2. Model fit indices for BIUBL [33]

Measure Calculated values for	CMIN/DF	p-value	GFI	AGFI	TLI	CFI	RMSEA	SRMR
BIUBL	1.417	0.106	0.965	0.934	0.964	0.976	0.048	0.0424
Threshold values	<3 or <5	>0.05	>0.90	>0.80	>0.90	>0.80	<0.08	<0.08

Note: CMIN/DF: minimum discrepancy function/degrees of freedom, p-value: probability value, GFI: goodness of fit index, AGFI: adjusted goodness of fit index, TLI: Tucker-Lewis fit index, CFI: comparative fit index, and RMSEA: root mean square error of approximation.

3.3. Internal consistency

For the evaluation of the scale's internal consistency, Cronbach's alpha (α) was computed. According to Boateng *et al.* [34] the reliability coefficient varies between 0 and 1, with higher values signifying enhanced internal consistency of the scale. Table 3 presents the reliability coefficients of different scales included in the BIUBL scale. To validate the factor structure, internal consistency, or reliability, assessed by using Cronbach's alpha, 0.835 was found to be the reliability value of the 8-item scale. Cronbach's alpha ranges from 0.764 to 0.770 [31]. It is commonly accepted that an alpha coefficient of 0.70 indicates reliability; nevertheless, for scales' psychometric quality, values between 0.80 and 0.95 are ideal [35]. BIUBL scale demonstrates a good level of internal consistency i.e., 0.835. Therefore, it can be concluded that the BIUBL scale exhibits strong internal consistency.

Table 3. Interpretation of BIUBL Scores

Raw scores	Range of Z-score	Interpretation
38 and above	+1σ and above	High
30-37	-1σ to+1σ	Average
29 and below	-1σ and below	Low

3.4. Norms

The BIUBL scale comprises a 5-point Likert scale formulated specifically for identifying the behavioral intention of Nigerian lecturers to use BL. It consists of 8 items. Each statement is accompanied by 5 response options namely strongly disagree, disagree, neutral, agree, and strongly agree which are scored as 1, 2, 3, 4, and 5 respectively. Top of form: the minimum and maximum scores of the BIUBL scale can be 8 and 40 respectively. The mean and standard deviation for the collected data in the case of the BIUBL scale are 33.07 and 4.02 respectively. The researchers estimated z-score norms for the BIUBL scale based on the raw scores obtained by the representative sample using the formula:

$$Z - score = (\frac{Raw\ Score - Mean}{Standard\ Deviation})$$

the Z-scores are further categorized into three levels of BIUBL as shown in Table 3.

4. CONCLUSION

The thorough development and rigorous psychometric assessment of the BIUBL scale for university lecturers was made possible by this all-encompassing technique. The scale exhibits robustness and reliability with a Cronbach's alpha value of 0.835, showing strong internal consistency, and content validity determined by feedback from ten experts. Furthermore, all statistical values from EFA and CFA were higher than predetermined cutoff points and values i.e., the threshold, confirming the validity of the scale in assessing university lecturers' behavioral intentions towards BL. These results highlight the scale's potential as a useful instrument for evaluating and comprehending lecturers' attitudes and preparedness for implementing BL strategies. Tools like this scale will help institutions incorporate technology into their pedagogical practices the more especially in the developing countries, by helping guide strategic choices and interventions that support the successful execution of BL programmes.

Additionally, more validation studies and longitudinal research may improve the generalizability and usefulness of the measure in a variety of Nigerian and international contexts. Additionally, investigating the connection between the scale-measured behavioral intentions and the actual adoption and use of BL strategies may yield important information on the variables affecting the integration of technology in higher education. Overall, the BIUBL scale is a useful tool for furthering the field of technology-enhanced teaching and learning research and practice. Considering the standardized process followed to achieve the tool construction, the study has given an intensive guide on how to construct a tool for survey research. University management and policy makers could always use the BIUBL scale to measure university lecturers' BIUBL strategy for their instruction anywhere across the globe.

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Dinesh Kumar	✓	✓		✓						✓				
Aisha Bello Sadiq	✓						✓	✓		✓		✓		

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

After presenting the research proposal and reviewing the application form, research protocol, informed consent form, and current curriculum vitae of the principal investigator, the researchers received approval from the Institutional Ethical Committee, Lovely Professional University (IEC-LPU). The registration number EC/NEW/INST/2022/3110 was granted by the Committee.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [ASA], upon reasonable request. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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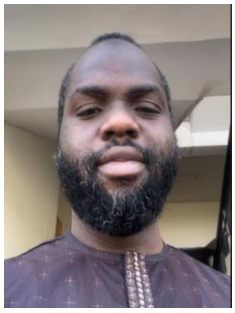

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