ESTABLISHING PSYCHOMETRIC PROPERTIES OF COLLEGES OF EDUCATION BIOLOGY STUDENTS PERCEIVED BIOPRENEURSHIP MINDSET SKILLS QUESTIONNAIRE (BSPBMSQ) IN NORTH-WEST, NIGERIA

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Abstract

The main purpose of this study is to establish the psychometric properties of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ). The Questionnaire is to be used to examine Biology Students Perceived Biopreneurship Mindset Skills among Colleges of Education Biology Students in North-West, Nigeria. Two objectives and two research questions were developed for the study. The instruments were subjected to face, content and construct validity by eight (8) experts in the field of Tests and Measurement, Educational Psychology, Science Education Biology, Entrepreneurship and English Language from Bayero University Kano, Ahmadu Bello University Zaria, Aliko Dangote University of Science and Technology Wudil and Sa'adatu Rimi College of Education Kumbotso, Kano State respectively. The study was conducted with a sample of three hundred and sixteen (316) NCE III Biology students of FCE Zaria, Kaduna state and FCE Katsina State. Construct validity was established through the use of Factor Analysis (FA), while face and content validity was established through Face Validity Index (FVI) and Content Validity Index (CVI). Cronbach's Alpha method was used to

establish the reliability index of the instruments with aid of Statistical Package for the Social Sciences (SPSS) software. From the results of the analysis, it was found that BSPBMSQ have adequate construct validity indices with FVI of 0.98 (98%) and CVI of 0.98 (98%), the Cronbach' alpha values for the instrument was found to be α = .917. Based on the findings obtained, it can be concluded that BSPBMSQ was statistically valid and reliable to be used for data collection.

Keywords: Psychometric Properties, Perceived Biopreneurship Mindset Skills, Face and Content Validity Index, Construct Validity, Reliability Coefficient

Introduction

The growing rate of unemployment among graduates in Nigeria has become a major socio-economic concern, particularly among graduates of tertiary institutions. Despite the increasing number of graduates produced annually, many remain unemployed due to inadequate entrepreneurial competencies, limited practical skills, and overdependence on white-collar jobs. This situation has intensified the need for entrepreneurship-oriented education capable of equipping students with innovative, creative, and self-reliant capacities necessary for job creation and sustainable development. In recent years, entrepreneurship education has gained global recognition as a strategic approach for addressing unemployment, poverty reduction, and economic sustainability (Villena-Martínez et al., 2024). Biology, as one of the major science disciplines taught in Colleges of Education, possesses enormous entrepreneurial potentials through biotechnology, agriculture, environmental management, food production, pharmaceuticals, and other biological innovations. However, Biology teaching in many Nigerian institutions has remained largely theoretical, with inadequate emphasis on entrepreneurial application and innovation. This gap has created the need for integrating biopreneurship into Biology education in order to promote entrepreneurial thinking, opportunity recognition, creativity, innovation, problem-solving, and self-employment among students.

Literature Review

Biopreneurship mindset skills refer to the entrepreneurial attitudes, competencies, and behavioural dispositions that enable Biology students to identify biological opportunities, create value, innovate, take calculated risks, and transform biological knowledge into productive ventures. These skills are increasingly recognized as essential for preparing students to become job creators rather than job seekers in the contemporary knowledge-driven economy. Consequently, researchers and educators have shown increasing interest in developing reliable instruments capable of assessing students' entrepreneurial mindset and competencies within educational settings (Abd Rahman et al., 2024).

The quality of any educational or psychological research largely depends on the validity and reliability of the instruments used for data collection. Psychometric properties refer to the measurement qualities

of an instrument, particularly its validity, reliability, consistency, dimensionality, and suitability for measuring a specific construct. Establishing psychometric properties is essential because it determines whether an instrument accurately measures what it is intended to measure and whether the results generated are dependable and consistent across populations and contexts. Recent studies on entrepreneurship and educational measurement have emphasized the importance of conducting exploratory factor analysis, confirmatory factor analysis, reliability analysis, and validity testing when developing new scales and questionnaires (Karimian & Chahartangi, 2024). Furthermore, entrepreneurship and mindset constructs are multidimensional and context-specific; therefore, instruments developed in other countries or disciplines may not adequately capture the realities of Biology students in Nigerian Colleges of Education. This underscores the need to develop and validate a context-relevant instrument capable of measuring perceived biopreneurship mindset skills among Biology students in North-West Nigeria. According to Villena-Martínez et al. (2024), reliable instruments should demonstrate adequate internal consistency, construct validity, convergent validity, and acceptable factor structure before they can be confidently used for educational research and policy decisions.

In addition, the North-West geopolitical zone of Nigeria faces persistent challenges related to youth unemployment, poverty, low industrial participation, and limited entrepreneurial engagement among graduates. Colleges of Education within the region are expected to prepare students with employable and entrepreneurial competencies capable of promoting self-reliance and economic productivity. However, there is limited empirical evidence regarding instruments specifically designed to assess perceived biopreneurship mindset skills among Biology students in these institutions. The absence of a standardized and psychometrically sound instrument may limit effective assessment, intervention, curriculum improvement, and policy formulation relating to biopreneurship education. Recent studies have also emphasized that psychometrically validated instruments improve the accuracy of educational assessment and strengthen the credibility of research findings (Kane & Wools, 2020; Wang & Sahid, 2024). Similarly, Mack et al. (2024) noted that entrepreneurship-related instruments should undergo rigorous validation procedures to ensure that they appropriately measure entrepreneurial constructs within specific educational and cultural contexts. Therefore, this study seeks to establish the psychometric properties of the Biology Students' Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ) among Colleges of Education Biology students in North-West Nigeria. The study seeks to provide a valid and reliable instrument that can be used by researchers, educators, curriculum developers, and policymakers to assess and promote biopreneurship mindset skills among Biology students.

Statement of the Problem

Questionnaires are a primary and the most commonly data collection method in educational and evaluation research, used to assess knowledge, attitudes, opinions, behaviors, and facts (Bhattacharyya et al., 2022). However, their development requires rigorous validation and reliability testing to minimize measurement errors discrepancies between respondents' true attributes and their survey responses. Despite increased emphasis on verifying instrument validity and reliability over the years (Plecki et al, 2012), many questionnaires lack sufficient evidence of validity (Masuwai et al., 2016). Ensuring validity and reliability is a critical task in research and essential for accurate data collection and informed decision-making (Hair et al., 2019).

The main objective of questionnaire in research is to obtain relevant information in most reliable and valid manner. Thus, the accuracy and consistency of survey/questionnaire forms a significant aspect of research methodology which are known as validity and reliability. Often new researchers are confused with selection and conducting of proper validity type to test their research instrument (Hamed, 2016). The accuracy of research findings relies heavily on the quality of data collected using valid and reliable tools. Unfortunately, many studies have fallen short of achieving reliable results due to inadequate validation of data collection instruments. This oversight can lead to misleading conclusions, as poorly designed instruments yield invalid findings. If a study's internal validity is not determined, its results will be unreliable, making conclusions impossible, and rendering external validity irrelevant (Patino & Ferreira, 2018). Therefore, it's crucial to employ psychometrically tested instruments in any research to ensure the collection of high-quality, reliable data.

Objective of the Study

The objectives of the study are to:

1. Establish the face, content and construct validity of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ)
2. Establish the internal consistency of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ)

Research Questions

Based on the above research objectives, the following research question were raised:

1. What is the Face, Content and Construct Validity of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ)?
2. What is the Reliability Coefficient of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ)?

Methodology

In order for the researcher to conduct the pilot testing of the instruments, simple random sampling technique was used to select a sample size of three hundred and sixteen (316) NCE III Biology Students

from a total population of five thousand three hundred and seven (5307) NCE III Biology Students distributed within the Colleges f Education in North-West Nigeria were drawn from FCE Zaria and FCE Katsina. The administration of the instruments was scheduled for a 50-60 minutes' period. In the process of data collection, the researcher collects an introductory letter from the Department of Science and Technology Education, Bayero University, Kano and presented to the Head of Department (HOD) of the sample colleges with the help of a research assistant for granting permission to conduct the pilot test of the instruments. After introduction by the subject course tutor, the research assistant briefed the students about the aims and importance of the study. Also, the research assistant guided the respondents (students) on how to fill the instruments as the need arise, and the completed copies of the instruments were retrieved on the spot from the respondents. This method ensures proper completion as well as high return rate of the instrument. The data collected were analysed using the Statistical Package for the Social Science (SPSS) software version 20.

The Instrument used for pilot testing was Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ) which was developed by the researcher and it is intended to be used in order to find out the BSPBMS in Colleges of Education in North-West Nigeria. The instrument consists of two different sections. Section "A" requires demographic information of the respondents that include: gender of the respondent, location and parent occupation, while section "B" contained 12 items statements after exposed to factor loading with a four point Likert-Scale designed to obtain responses by requesting the respondents to indicate their preference by ticking (√) against the preferred options ranging from Strongly Agree (SA) 4, Agree (A) 3, Disagree (D) 2, Strongly Disagree (SD) 1. The maximum score will be 48 (i.e, 4 x 12 = 48) and the minimum score will be 12 (i.e, 1 x 12= 12). Scores obtained for each respondent will be summed up into percentage.

Establishing Face Validity of BSPBMSQ

Face validity is established to confirm that questions are generally easy to answer and relevant to work stress. The face validity is quantitatively assessed by the clarity and comprehensibility of all items in each domain through the respondents' rating. Respondents rated the clarity for all items in each domain according to a four-interval scale (1=Not clear and understandable; 2=somewhat clear and understandable; 3=clear and understandable, and 4=Very clear and understandable). Ratings 1 and 2 represent invalid or irrelevant content, while ratings 3 and 4 represent valid or relevant content based on its clarity and comprehension. There are two forms of face validity index (FVI) i.e., item-level FVI (I-FVI) and scale-level FVI (S-FVI). I-FVI is calculated by dividing the number of items rated as 3 or 4 (agreed item) to the number of raters. S-FVI/Ave is calculated by averaging the I-FVI scores for all items

across all raters. Values can range from 0 (scale of 1 or 2) to 1 (scale of 3 0r 4). Two methods are involved in calculating S-FVI. The first method is taking the average of the I-FVI scores for all the items on the scale (S-FVI/Ave) and the second method is taking the proportion of items on the scale that achieve a clarity and comprehension scale of 3 or 4 by all raters (S-FVI/UA) The calculated FVI of at least 0.80 or higher is taken as the acceptable FVI value (Yusoff, 2019; Marzuki, et al., 2018; Hadie, et al., 2017 Ozair, 2017).

In this study, the face validity of BSPBMSQ was established by presenting the instrument to the panel of eight experts who were required to assess the clarity and comprehensibility of all items in each domain through the respondents' rating. The instrument was revised on the bases of the corrections and recommendations made by the experts.

Table 1: Face Validity Index (FVI) for a 15-Items BSPBMSQ with Eight (8) Raters

Items	Expert1	Expert2	Expert3	Expert4	Expert5	Expert6	Expert7	Expert8	Expert in Agreement	I-FVI	Universal Agreement S-FVI
tem1 1 1 1 1											
Item2	1	1	1	1	1	1	1	8	1	1	
Item3	1	1	1	1	0	1	1	7	0.875	0	
Item4	1	1	1	1	1	1	1	8	1	1	
Item5	1	1	1	1	1	1	1	8	0.875	0	
Item6	1	1	1	1	1	1	1	8	1	1	
Item7	1	1	1	1	1	1	1	8	1	1	
Item8	1	1	1	1	1	1	1	8	1	1	
Item9	1	1	1	1	1	1	1	8	1	1	
Item10	1	1	1	1	1	1	1	8	1	1	
Item11	1	1	1	1	1	1	1	8	1	1	
Item12	1	1	1	1	0	1	1	0	7	0.750	0
Item13	1	1	1	1	1	1	1	1	8	1	1
Item14	1	1	1	1	1	1	1	1	8	1	1
Item15	1	1	1	1	1	1	1	1	8	1	1
	1	1	1	1	0.93	1	1	0.93		0.96	0.8

Proportion clarity & comprehension **S-FVI/Ave = 0.98** **S-FVI/UA = 0.8**

Average proportion of items judged clear and understandable across the 8 raters= 0.98

I-FVI = Item-level Face Validity Index (i.e., 14.445÷15= 0.96)
S-FVI = Scale-level Face Validity Index (i.e., 12÷15 = 0.8)
FVI = Face Validity Index (0.8)

Table1 result shows that the I-FVI was 0.96 while the overall S-FVI for the 15-items of BSPBMSQ was 0.98. Comparing the FVI with the value of 0.8 as suggested by (Yusoff, 2019; Marzuki, et al., 2018; Hadie, et al., 2017 Ozair, 2017) for a panel of 8 experts, it notices that the calculated FVI = 0.8 is equal to the suggested value 0.8 which indicated high face validity index for the clarity and comprehension of BSPBMSQ. This means that the BSPBMSQ accurately measured and achieved satisfactory level of response process validity.

Establishing Content Validity of BSPBMSQ

Content validity is the degree to which a test measures an intended content area. It measures the extent to which a measuring instrument cover and reflects a specific domain of content, body of knowledge, or specific set of tasks (Gay et al., 2018). A content validity of the research instrument BSPBMSQ was established by presenting the instrument to the panel of eight (8) experts, these experts were required to examine the instruments for the purpose of appropriate use of the items in terms of difficulty, relevance of the statement in the instruments; and check possible errors in the proposed answers. The instrument was revised on the bases of the corrections and recommendations made by the experts. Specifically, to establish the content validity of the BSPBMSQ, a Content Validity Index (CVI) was used. The CVI was calculated based on Waltz and Bausell's approach. According to Waltz and Bausell (1981) a CVI value can be computed by requesting experts to rate the relevance of each item in an instrument, usually on a 4-point scale of 1= not relevance, 2= somewhat relevant, 3= quite relevant, and 4= highly relevant. The total number of items with rank 3 and 4 is divided by the total number of the experts to get the CVI value. Item with CVI equal or higher than 0.78 would be considered relevant and excellent and item with CVI less than 0.70 would be considered not relevant (Polit & Beck, 2007). Moreover, Surucu, et al., (2024) states that after computed the CVI, each item with CVI equal or higher than 0.75 would be considered relevant and excellent and item with CVI less than 0.70 would be considered not relevant. Therefore, in order to determine the CVI for this study, the experts were asked to rate the relevancy, appropriateness, simplicity and clarity of language of the instruments by using a 4-point scale of 1=not relevance, 2=item need some revision, 3=relevant need minor revision and 4=very relevant. Finally, CVI score was calculated by divided the total number of items with rank 3 and 4 by the total number of experts. Thus, items with CVI of 0.75 and higher were retained while items with less than 0.70 were revised or eliminated. The CVI was calculated for all individual items (I-CVI) and the overall scale (S-CVI).

Table 2: Content Validity Index (CVI) for a 15-Items BSPBMSQ with Eight (8) Expert Raters

Items	Expert1	Expert2	Expert3	Expert4	Expert5	Expert6	Expert7	Expert8	Expert in Agreement	I-CVI	S-CVI
Item1	1	1	1	1	1	1	1	1	8	1	1
Item2	1	1	1	1	1	1	1	1	8	1	1
Item3	1	1	1	1	0	1	1	1	7	0.875	0
Item4	1	1	1	1	1	1	1	1	8	1	1
Item5	1	1	1	1	1	1	1	1	8	1	1
Item6	1	1	1	1	1	1	1	1	8	1	1
Item7	1	1	1	1	1	1	1	1	8	1	1
Item8	1	1	1	1	1	1	1	1	8	1	1
Item9	1	1	1	1	1	1	1	1	8	1	1
Item10	1	1	1	1	1	1	1	1	8	1	1
Item11	1	1	1	1	1	1	1	1	8	1	1
Item12	1	1	1	1	1	1	1	0	7	0.875	0
Item13	1	1	1	1	1	1	1	1	8	1	1
Item14	1	1	1	1	1	1	1	1	8	1	1
Item15	1	1	1	1	1	1	1	1	8	1	1
Proportion Relevance	1	1	1	1	0.933	1	1	0.933	I-CVI S-CVI	0.983 0.867	

I-CVI = Item-level Content Validity Index (i.e., 14.75÷15= 0.983)
S-CVI = Scale-level Content Validity Index (i.e., 13÷15 = 0.867)
CVI = Content Validity Index (0.867)

Table 2 result shows that the I-CVI was 0.983 while the overall S-CVI for the 15-items of BSPBMSQ was 0.867. Comparing the CVI with the critical value for a panel of 8 experts (0.75), it notices that the calculated CVI = (0.867) is greater than the critical value 0.75 which indicated high content validity index for the construct of BSPBMSQ. Meaning that the BSPBMSQ accurately measured what it intended to measure in the main study.

Also based on the recommendation and suggestion of the experts who validated the instrument. The instrument was advice to be exposed to construct validity with factor analysis in order to reduce the number of items as they are too many for the participants to accurately respond.

Establishing Construct Validity of BSPBMSQ

To determine the construct validity of BSPBMSQ, students' responses were collected using the instrument, and subjected to Factor Analysis using Exploratory Factor Analysis (EFA) and run using SPSS version 20 to establish the construct validity of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ). Kaiser Meyer-Olkin Measure of Sampling Adequacy (KMO/MSA) was used to test the sampling adequacy, and Bartlett's Test of Sphericity was used to test the strength of the relationship between the items. The results were summarized in Table 3.

Table 3: KMO Measure of Sampling Adequacy and Bartlett's Test Results for BSPBMSQ

Types of Tests	Statistics	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	KMO/MSA	.851
Bartlett's Test of Sphericity	Approx. Chi-Square	300.263
	Df	269
	Sig.	.000

From the result in table 3, it was clear that the sampling is suitable and adequate for factor analysis (KMO/MSA = 0.851). This means that the sampling is adequate and sufficient for factor analysis, based on the recommendations of Surucu et al., (2024). Who suggested that the value of KMO should be above 0.50. Also, the correlation among the items are strong based on the Bartlett's Test of Sphericity (X^2 300.263, *df* = 269, *P* = 0.000). Therefore, the values showed that the data set for pilot study had good fit for factor analysis.

Moreover, the factor analysis was run with all the 15 items of the BSPBMSQ, to confirm the existence of the three (3) components of BSPBMSQ in line with factor restrictions. It was found that the three components explained about 69.6% of the

total variance. The Table 4 shows the summary of the principal-rotated component matrix of the Explanatory Factor Analysis (EFA) conducted.

Table 4: Principal -Rotated Component Matrix for BSPBMSQ

Items	Components				
	1	2	3	4	5
Item 6	.822				
Item 8		795			
Item 4		.785			
Item 14		.748			.
Item 7		.746			
Item 3		.731			
Item 13		.701	.681		
Item 11			.662		
Item 1			.627		
Item 9				598	
Item 12				.593	
Item 5				.537	.378
Item 15					.359
Item10					
Item2					

Extraction Method: Principal Component Analysis.
a. 3 components extracted.

From the table 4, three factors were identified as the underlying structure of the Biology Students Perceived Entrepreneurship Mindset Skills Questionnaire (BSPBMSQ) and their factor loadings. These factors loadings have correlation coefficients ranging from -1.00 to +1.00 and are interpreted similarly. From factor 1, one (1) item i.e Item 6, converged with the high factor loadings of 0.822 to this factor. Factor 2, have 6 items converging with high factor loadings to this factor. These include, Item 8, Item 4, Item14, Item 7, Item 3 and Item 13. When observed carefully these items have loaded well ranging from 0.701-0.795. Factor 3, have 3 items converging with high factor loadings to this factor. These include Item 11, Item 1 and Item 9. When observed carefully these items have loaded well also ranging from 0.627-0.681. Regarding factor 4, the result shows that 3 items converged with high factor loadings to that that factor. These include Item 12, Item 5 and Item 15 and their factor load ranging from 0.537-0.598. When examined carefully, these items loaded above the criterion value of 0.40 as suggested by Surucu et al., (2024).

In summary, from the results of the factor analysis it showed that out of the 15 Items initially developed 13 Items indicated high factor loadings with Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ). This also revealed that 2 items were discarded because of low factor loadings (i.e., below 0.40). The items are Item 10 with 0.378 and Item 2 with 0.359. Therefore, based on the outcomes of this analysis, the researcher concluded that the BSPBMSQ has demonstrated a very good indices of construct validity and it is valid for measuring Biology Students' Perceived Biopreneurship Mindset Skills among Colleges of Education Biology Students.

Establishing the Internal Consistency Reliability Coefficient of Biology Students Perceived Entrepreneurship Mindset Skills Sub-Scale BSPEMSQ)

To determine the internal consistency reliability index of the Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPEMSQ), a Cronbach's Alpha reliability for internal consistency was used. Cronbach's alpha also known as coefficient alpha, is a measure of reliability that test the internal consistency or item interrelatedness of a scale or test (Howard, 2018). As such, Cronbach's alpha reliability for internal consistency is relevant for this study.

Table 5: Cronbach's Alpha Reliability Coefficient of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ)

Instrument	N	No. of Items	Cronbach Alpha
Biology Students Perceived Biopreneurship Mindset Skills (BSPBMSQ)	316	15	.917

Table 5 presented a Cronbach's Alpha in determining the reliability coefficient of Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ). The results show a reliability coefficient of α = .817. This indicates that the items in the Questionnaire (BSPBMSQ) have an excellent strong internal consistency reliability index, as such it is reliable to be use in data collection.

Result

Findings obtained from research question one (1) revealed that Biology Students Perceived Biopreneurship Mindset Skills Questionnaire has a very good face validity index of 0.98, and content validity index of 0.98. For the construct validity the results of the factor analysis shows that out of the 15 Items initially developed, 12 Items indicated high factor loadings with Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ). Therefore, based on the outcomes of this analysis, the researcher concluded that the Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ) has demonstrated a very good indices of

construct validity and it is valid for measuring Biology Students' Perceived Biopreneurship Mindset Skills among Colleges of Education Biology Students.

Discussion of Results

The findings of this study established that the Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ) possesses satisfactory psychometric properties suitable for measuring perceived biopreneurship mindset skills among Biology students in Colleges of Education. The use of a representative pilot sample of 316 Biology students comprising 192 females and 124 males further strengthened the adequacy of the validation process because an appropriate sample size is essential in achieving reliable factor analysis and instrument validation outcomes. This agrees with the recommendation of Hair Jr. et al. (2019), who emphasized that adequate sample size improves the stability and accuracy of factor analytic procedures in scale development studies.

The study established face, content, and construct validity for the instrument, indicating that the questionnaire adequately measured the intended construct of perceived biopreneurship mindset skills. The adoption of both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) provided strong empirical evidence for the construct validity of the instrument. The CFA result of the BSPBMSQ (X^2 = 300.263, df = 284, p = 0.001) demonstrated a good model fit, suggesting that the observed variables adequately explained the underlying construct. This finding is consistent with the position of Kline (2023), who noted that construct validity is strengthened when factor analytic indices confirm that items significantly represent the theoretical construct being measured. Similarly, Byrne (2022) explained that the use of CFA helps to confirm the adequacy of measurement models and enhances the credibility of educational and social science instruments.

Furthermore, the reliability analysis revealed that the BSPBMSQ had a Cronbach's alpha coefficient of 0.917, indicating a very high level of internal consistency among the items in the questionnaire. This implies that the instrument consistently measures the construct of biopreneurship mindset skills among Biology students. The finding agrees with Taber (2018), who stated that Cronbach's alpha values above 0.90 indicate excellent reliability and suggest that the items in an instrument are highly consistent in measuring the same construct. Also, López-Pina and Veas (2024) affirmed that psychometrically validated instruments with strong reliability coefficients improve the accuracy of educational assessment and strengthen the credibility of research findings.

The overall findings therefore suggest that the BSPBMSQ is both valid and reliable for assessing Biology Students' Perceived Biopreneurship Mindset Skills in Colleges of Education. The instrument can consequently be utilized by researchers,

educators, and policymakers for research, instructional evaluation, and entrepreneurship-related educational assessments.

Conclusion

The result of the validity and reliability analysis obtained from the pilot test of the instrument was good and adequate Therefore, in conclusion Biology Students Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ) is reliable to measure the construct as intended to be measured in the main study.

Recommendations

1. Researchers and educators should adopt the validated Biology Students Perceived Biopreneurship Mindset Skills Questionnaire (BSPBMSQ) for assessing biopreneurship mindset skills among Biology students because the instrument has demonstrated satisfactory validity and strong reliability indices.
2. Future researchers should continuously subject educational and entrepreneurial research instruments to rigorous psychometric evaluation, including face, content, construct validity, and reliability testing, to ensure that the instruments accurately and consistently measure the intended constructs.
3. Educational institutions and research supervisors should encourage the use of Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Cronbach's alpha reliability procedures during instrument development and validation processes in order to improve the quality, credibility, and dependability of research findings.
4. Policymakers such as the National Commission for Colleges of Education and the Federal Ministry of Education should establish policies and research guidelines that mandate the psychometric validation and reliability testing of educational research instruments before their adoption for academic studies, programme evaluation, and policy implementation.

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