West African Journal of Education, Vol. XXXIX 2019 Page 24-37

West African Journal of Education
Vol. XXXIX 2019 ISSN: 0043-2997
Website: http//www.instituteofeducui.com

Constructs and Dimensionality of Instruments on Undergraduates' Personal Variables and Academic Performance in the Faculty of Science, University of Ibadan, Nigeria

Benedicta Omeghie, Isunueo
Nigerian Institute of Social & Economic Research (NISER), Ibadan.
P.M.B. 05, UI Post Office, Ojoo, Ibadan, Oyo State, Nigeria.
bennydtus@yahoo.com

Submitted January 8, 2020; Revised February,24, 2020; Accepted June, 19, 2020

Abstract

Preferential use of cognitive measures such as Senior Secondary Certificate Examinations (SSCE), Unified Tertiary Matriculation Examination (UTME) and Post-Unified Tertiary Matriculation Examination (Post-UTME) scores over non-cognitive measures such as students' personal variables (interest in university education, career aspiration and mental ability) to assess candidates prior admission into the university has caused much concern. Some first year university undergraduates who had outstanding results in these examinations were advised to withdraw because of poor performance in their first year examinations. Therefore, this paper determined the constructs dimensionality of instruments designed to measure students' personal variables and academic performance of first year undergraduates in the Faculty of Science, University of Ibadan, and its suitability to determine undergraduates who will do well in their studies. Primary data was the source of information while SEM-PLS was used to validate the instruments. Findings revealed that the 3 dimensional model was the highest dimensionality model that produced an approximately 10% or greater percentage reduction in the RMSR (Root Mean Square Residual). The instruments can suitably measure undergraduates' interest in university education, career aspiration and mental ability at three sub-constructs or abilities. Instruments for measuring undergraduates' personal variables should be implemented by university management for effective selection of candidates who will cope with their studies after admission.

Keywords: Academic performance, Undergraduates, Mental ability, Interest in University education, Career aspiration.

Introduction

Qualitative university education, often measured by the performance of undergraduates during and after the close of a programme, is a tool for realising the sustainable development goals of a nation as well as the fulfillment of individual

student's dreams and aspirations. The performance of university undergraduates permeates all domains of learning such as cognitive, affective and psychomotor and is a benchmark for determining the competencies of a learner from which his hidden capabilities can be inferred.

However, the performance of undergraduates in Nigerian universities has raised great concern lately because of their poor academic output even as early as the first year in their programmes. According to Kpolovie (2010), there have also been reports of dropout, probations, spending of extra years and even withdrawals from the university. It becomes questionable if after learners go through rigours to qualify for admission into the university, their academic performance is described as poor.

Employers of labour are also bothered because some of the graduates' performance at their duty posts fall below expected standards. This is because by the time the learners graduate from the university and are employed, their skills, performances and productivity are relatively poor. In Nigeria, the entry examinations include the Senior Secondary School Certificate Examinations (SSCE), Unified Tertiary Matriculation Examinations (UTME) and Post Unified Matriculation Examination organised by the universities. Over the years, measuring, assessing, determining and predicting academic performance of undergraduates have brought much concern to universities, the governments, parents and even undergraduates. The concern have been linked to the use of only cognitive measures to determine academic performance of candidates aspiring to gain admission into the universities (Akiri and Ugborugbo, 2009; Bamidele and Bamidele, 2013). In spite of several efforts and policies introduced and implemented by the federal government to address the issue of undergraduates' poor academic performance, reports and researches still show inconsistencies (Kpolovie 2010).

In educational testing today, assessment is typically a measure of learner's learning judged by a set of academic standards (Vansickle, 2008). It is also a measurement tool in education administered on a learner to obtain information through which the learner's performance is evaluated in a given period of time (Adegbile, 2009). For instance, the results are used to take important decisions about learner's performance and educational programmes including determining levels of curriculum mastery, report card grades, grade level promotions, honours, and graduation (Carter, Webby, Hughes, Johnson, Plank, Barton-Arwood and Lunsford, 2005). However, mandatory and periodical measurement of undergraduates' personal variables such as undergraduates' interest in university education, career aspiration and mental ability is yet to be introduced by Nigeria universities and other tertiary institutions.

Akinlana (2013), identified mental ability as an important variable that portrays a person's brain power in diverse areas of competencies like verbal, mathematical, spatial and logical reasoning. Psychomotor skills such as reaction time are also taken to be cognitive abilities. Psychologists agree that mental ability refers to an individual's

capability to study as well as recall information, identify, ideas and their response and apply the information to their own conduct in an adaptive manner (Neiserr, et.al. 1996).

Akinlana (2013) investigated the relative and composite contributions of academic optimism, mental capability and motivation towards secondary school performance in Ogun East Senatorial District, Nigeria. The work adopted the descriptive design of ex-post facto type using five hundred and eighty-eight (588) learners selected through stratified random sampling technique. The results revealed that mental ability, academic optimism and motivation affect performance as " a strong desire to do something".

Career aspiration of learners in the university determines how much effort learners can put into academics in order to achieve a career in the future. It is a person's strong desire to become what one likes after university education. Vanden-Boss (2007) described career aspiration as a long-term goal. Miler, DeBackar, and Green (1999) claimed that it is a learner's future goal which shape their views on the worth of both the contents being studied and their academic achievement.

Onuoha and Unegbu (2013) investigated career aspiration as a predictor of students' performance in cataloguing and classification with the major objectives of identifying the link between the career aspiration of students and their academic performance. The study employed descriptive design, while the population comprised one hundred and twenty-nine (129) learners in the Information Resources Management Department, Babcock University, Nigeria. The findings revealed that very few undergraduates desired to work as librarians or archivists. However, participants who chose librarians as a career were consistent in their perceived use of classification and cataloguing. They even did better in achievement tests compared to those seeking to be bank staff and system analysts.

Interest can be defined as the attention received or given with a sense of concern, empathy, and the power to sustain such attention (Typhoon International Corp, 2004). Interest plays a major role in psychology where recent studies found that it has to do with motivation, personality, reasoning, growth, reaction, career, quality, conduct, hobbies, and information processing (Silvia, 2006). Interest has also been found to affect readability and the processing of texts that have coherence and clarity as they tend to stimulate the reader unlike texts lacking such features.

Kpolovie and Okoto (2014) applied multiple prediction design to determine the extent of correlation and likelihood that learners' interest and disposition to school individually and collectively have on their performance. The finding revealed that there was a significant correlation and multiple prediction of performance.

In Nigeria, a common quantitative approach used for impact evaluation, such as survey method of enquiry, has been found to be the most appropriate, transparent and accountable research method (Guthrie and Klauda, 2014). The survey type of research

presents a broad overview of the status of a research body which enhances easy comparison among variables, easy data analysis and minimizes researcher bias. Careful wording and question construction increases the reliability of resulting data (Guthrie and Klauda, 2014). The dimensionality and construct of items for the development of instruments are key to answering research questions as well as achieving research objectives. The construction of scales is to design a questionnaire that provides a quantitative measurement of an abstract theoretical variable. The most obvious key is that a scale uses a moderately large number of items to measure a single construct. The items within a scale are typically interchangeable since the response to one item has exactly the same theoretical meaning as the response to any other item within the scale. Each item is designed to be a different way to "ask" about the same theoretical variable. Some questions may be written so that more positive responses indicate less of the variable in question, but the expectation is that the magnitude of the correlations between items (whether positive or negative) should be relatively high throughout a scale. Additionally, after a participant completes a scale the responses are aggregated in some way, such as by taking the average, to produce the actual measurement. Good scales possess both validity and reliability.

In Nigeria, although cognitive measures such as SSCE results, UTME and Post-Unified Tertiary Matriculation Examinations scores have been found to be the only cognitive measures being to predict academic success of newly admitted undergraduates, how these measures can accurately predict the academic success of undergraduates' GPAs remains unclear. There is a need to determine the dimensionality and construct of scales to measure and investigate the effects of other non-cognitive factors such as undergraduates' mental ability, interest in university education, career aspiration of first year undergraduates in the Faculty of Science, University of Ibadan.

This paper examined the construct dimensionality of instruments designed to measure students' personal variables and academic performance of first year undergraduates in the Faculty of Science, University of Ibadan, and its suitability to determine undergraduates who will do well in their studies.

Research Questions

The following research questions were raised.

1. What is the dimensionality of the latent variables mental ability in determining the academic performance of undergraduates in the faculty of science, University of Ibadan?
2. What is the dimensionality of the latent variables career aspiration in determining the academic performance of undergraduates in the faculty of science, University of Ibadan?
3. What is the dimensionality of the latent variables (mental ability, career aspiration and interest in university education) in determining the academic performance of undergraduates in the faculty of science, University of Ibadan?

Method

The population of the study comprises all undergraduate science students in the faculty of science, University of Ibadan. Multi-stage sampling procedure was used to select participants in the study. Purposive sampling was adopted in selecting two courses (PHY 103 and MATHS 121). At the second stage, purposive sampling was also used to select 6 out of 11 departments in the faculty of science. This was because they were the departments that offered the two selected 100 level courses (PHY 103 and MATH 121) that were used to measure the performance of undergraduates in the faculty of science. At the third stage, all 100 level undergraduate learners in the six departments offering PHY 103 and MATH 131 were purposively sampled. Hence, a total of two hundred and eighty six (286) undergraduates constituted the sample for the study.

Table 1. Undergraduates in the sampled departments in the Faculty of Science who responded to the questionnaires by gender

S/N	Department	No of Males	No Females	Total	% of Males in the Sampled Population	% of Females In the Sampled Population
1.	Chemistry	12	28	40	5.56	9.78
2.	Computer Science	45	7	52	20.83	2.44
3.	Geology	31	11	42	14.35	3.85
4.	Mathematics	41	12	53	18.98	4.20
5.	Physics	50	2	52	23.15	0.69
6.	Statistics	37	10	47	17.12	3.67
Total	**6**	**216**	**70**	**286**	**75.54**	**24.46**

Table 1 shows the analysis of the number of respondents by gender from the sampled departments who had met the criteria for selection. A total of 286 undergraduates comprising of 216 males and 70 females responded to the questionnaires. The male undergraduates has 75.5% of the sampled population while 24.46% were female undergraduates in the Faculty of Science, University of Ibadan.

Items on undergraduates' interests in university education were generated by the researcher and from sources in order to build a comprehensive pool of items. Career aspiration items was adapted from O'Brien's Karen (1992) Career Aspiration Scale (CAS) and from a kit of career education assessment and evaluation instruments developed by the Wisconsin k-12 career education consortium which was a third draft of an instrument piloted during the 1974-75 school year in science classes at Medium West High School in the United States. While the Mental Ability test instrument was adopted from the series of Sawaal and India Bix Mental Ability Test. The items were used to capture information on undergraduates' mental ability. The instrument comprises items on logical sequence of

questions and answers, blood relations questions and answers and verification of truth of statements. Cronbach alpha's of 0.78 were obtained for the mental ability test, 0.82 for career aspiration and 0.83 for students' interest in university education.

The study applied a 25-item mental ability test, 18-item interest in university education and a 27-item career aspirations scale version to measure first year undergraduates' mental ability, interest in university and career aspiration in the faculty of science, University of Ibadan. Participants indicated how true each statement was for them on a scale ranging from 'Not at all true of me' to 'Very true of me' for the interest in university education and the career aspiration scale. The mental ability test had 5 options with only one correct answer in the options. After approval and permission from the Dean of Faculty of Science, University of Ibadan, the instrument was distributed to first year undergraduates in the six selected departments in the faculty of science in the university. Analytical procedures were advanced by assessing the viability of the measurement mode.

Results and Discussions

The dimensionality of the latent variables (mental ability, career aspiration, interest in university education) was assessed by subjecting the responses of the respondents to the dichotomous (i.e., cognitive ability) nonlinear factor analysis implemented Normal Ogive Harmonic Analysis Robust Method package (Fraser, McDonald & NOHARM, 2003) and the polytomous based items (career aspiration and interest in university education) to the full information factor analysis implemented in mirt package of R language and environment for statistical computing (Chalmers, 2012). To achieve this feat, the data was calibrated under the hypothesis that one dimension fitted the data. Thereafter, the data set was calibrated under the hypothesis that two dimensions underlie and then the fitness of one and two dimensions were compared. Again, if two dimensions fit the data better than one dimension, the data is further calibrated under the hypothesis that three dimensions fit the data and the fitness of two dimension and three dimensions was compared in a similar manner. This procedure continued until the optimal dimension underlying the model was identified.

Research Ques. 1: What is the dimensionality of the latent variable, mental ability, in determining the academic performance of undergraduates in the faculty of science, University of Ibadan?

Table 2: Dimensionality of mental ability

NO OF DIMEN	GFI	RMSR CRITERION	RMSR	DIFF IN RMSR	REDUCTION IN RMSR	PERCENTAGE REDUCTION
1	0.920	0.0555	0.016			
2	0.938	0.0555	0.014	0.002	0.121	12
3	0.957	0.0555	0.012	0.002	0.167	17
4	0.963	0.0555	0.012	0.001	0.066	7

Table 2 presents the number of dimensions underlying the mental ability. Column 1 represents the dimensions hypothesized to underlie the data. GFI on Column 2 is the Tanaka's (1993) Goodness-of-Fit Index (GFI). McDonald (1999) suggests that a GFI of 0.90 indicates an acceptable level of fit, a value of 0.95 indicates "good" fit, while GFI = 1 indicates perfect fit. The column labeled RMSR CRITERION is the benchmark for judging the overall fitness of a model. The RMSR (Root Mean Square Residual) is the square root of the average squared difference between the observed and predicted covariance. Therefore, small values of RMSR indicate good fit. This overall measure of model–data misfit is evaluated by comparing with the RMSR criterion which is four times the reciprocal of the square root of the sample size (i.e., the "typical" standard error of the residuals; McDonald, 1997).

Table 2 shows that 1-dimension, 2-dimension, 3-dimension and 4-dimension models fitted the data (RMSR for 1-dimension, 0.015568 was less than the criterion 0.05547002. This same trend was observed for 2-dimension, 3-dimension and 4-dimension respectively and the GFI for the four dimensions hypothesized to underlie were greater than 0.90). To identify the optimal dimensions underlying the data, the fitness of the data to the four hypothesized dimensions models were compared. The table shows that from the first dimension to the second dimension, RMSR value decreased by 12%. According to Tate criteria, this is a significant amount of reduction; showing 2 dimensions significantly fitted the data better than the 1 dimension.

Furthermore, the table shows that when 3-dimension was hypothesized to underlie the data set, the percentage in reduction in RMSR between the 2-dimension and 3-dimension model was approximately 17%. This shows that 3 dimensions significantly fitted the data better than 2 dimensions. However, when the fitness of 4 dimensions was compared to that of the 3 dimensions, the reduction in RMSR value was less than the criterion, 10%. Consequently, the highest dimensional model that still produced an approximately 10% or greater percentage reduction in the RMSR over the preceding model was the 3-dimensional model. Thus, 3-dimensional model is the most parsimonious model that fits well. This implies that performance on the mental ability depended on three dimensions or abilities which are logical sequence, quantitative reasoning and situation reaction.

Table 3: Items for the 3 Sub-Constructs in the Mental Ability Test

ITEM NO		F1 Item (Logical Sequence of Words)
1.	MEN 1	1. Elephant 2. Cat 3. Mosquito 4. Tiger 5. Whale
2	MEN 2	1. Heals. 2. Shoulder 3. Skull 4. Neck 5. Knee 6. Chest 7.Thigh 8. Stomach 9. Face 10. Hand
3	MEN 4	1. Adult 2. Child 3. Infant 4. Boy
4	MEN 6	1. Rainbow 2. Rain 3. Sun 4. Happy 5. Child
5	MEN 8	1. Grain 2. Plant 3. Sandwich 4. Bread 5. Dough
6	MEN 9	1. Shoulder 2. Wrist 3. Elbow 4. Palm 5. Finger
7	MEN10	A is B's sister, C is B's mother, D is Cs father. E is D's mother. Then, how is A related to D?
8	MEN 11	Find out the wrong term in the series 2, 5, 10, 50, 500, 5000
		F2 Items (Quantitative Reasoning)
9	MEN 5	1. Ceiling 2. Room 3. Floor 4. Wall 5. Foundation
10	MEN 12	1, 2, 3, 10, ?, 9802
11	MEN 14	How many pairs of letters in the word 'CHAIRS' have as many letters between them in the word as in the alphabet?
12	MEN21	Select the best alternative. Horse: Jockey: Car?
13	MEN 23	Rubber is related to tree in the same way as Silk is related to
14	MEN 24	Select the best alternative Anthropology: Man: Anthology: ?
		F3 Items (Situation Reaction)
15	MEN 15	You are passing by a river and you can swim. Suddenly, you hear the cry of a drowning child. You would:
16	MEN 16	You are in a bus . The bus reaches your stop but still you have not purchased the ticket because of a heavy rush. What will you do?
17	MEN 17	You are a visitor at a diner. The host asks you to take one more chapati after your stomach is full. You would:
18	MEN 18	You are playing football in a park. When you kick the ball, it strikes and breaks the window pane of a nearby house. You would
19	MEN 19	If in an Examination hall, you find that the question paper is too tough to be answered satisfactorily by you, the best thing to do is to:
20	MEN 20	You find that the person whom you call your friend has been cheating you. What would you do?

Research Ques. 2: What is the dimensionality of the latent variable, career aspiration, in determining the academic performance of undergraduates in the faculty of science, University of Ibadan?

Table 4: Dimensionality of Career Aspiration

Dimension	AIC	AICc	SABIC	BIC	LogLik	X2	Df	P
	comparing the fitness of one and two dimensions							
1	14944.49	15057.07	15010.52	15356.25	7363.245	363.297	26	0.000
2	14633.19	14829.56	14714.97	15143.18	7181.596			
	comparing the fitness of two and three dimensions							
2	14633.19	14829.56	14714.97	15143.18	7181.596	174.781	25	0.000
3	14508.41	14826.44	14605.33	15112.84	7094.206			
	comparing the fitness of three and four dimensions							
3	14508.41	14826.44	14605.33	15112.84	7094.206	111.773	24	0.000
4	14444.64	14937.97	14556.1	15139.73	7038.320			

Table 4 reveals the analysis of the number of dimensions underlying the career aspiration scale. The fitness of the hypothesized model was evaluated using Akaike Information Criterion (AIC), Akaike Information Criterion corrected (AICc), Bayesian Information Criterion (BIC) and the sample size adjusted BIC (SABIC). The nested log-likelihood was evaluated by comparing two times the differences of the log-likelihoods from each model. The difference was then compared to a χ^2 distribution with degrees of freedom (df) equal to the difference in the number of items on the scale and the number of dimensions of the simplest model.

According to Sclove, (1987), Depaoli, Tiemensma and Felt, (2018), the information criteria identify the optimal dimension as the model with the lowest values on a specific information criterion (i.e. when AIC, AICc, BIC and SABIC for model 1 and AIC, AICc, BIC and SABIC for model 2 are compared respectively). Table 4 also indicates that when the fitness of one-dimension model was compared to 2-dimension model, 2-dimension model fitted the data better (AIC = 14633.19, AICc = 14829.56, BIC = 15143.18 and SABIC = 14714.97 for 2-dimension was respectively less than AIC = 14944.49, AICc = 15057.07, BIC = 15356.25 and SABIC = 15010.52 for 1 dimension, $\chi 2$ (26) = 363.297, $p < 0.05$). When the fitness of 2 and 3-dimension models were compared, the table showed that 3 dimensions fitted the data better than the less complex 2-dimension model (AIC = 14508.41, AIC = 14826.44, BIC = 15112.84, SABIC = 14605.33 for 3-dimension was respectively less than (AIC = 14633.19, AICc = 14829.56, BIC = 15143.18 and SABIC = 14714.97) for 2 dimensions.

This result showed that 3-dimension fitted the data better than 2-dimension. Also, when the fitness of 3-dimension was compared with 4-dimension, 3-dimension

fitted the data better than the 4-dimension (AIC = 14633.19, AIC = 14829.56, BIC = 15143.18 and SABIC = 14714.97AIC = 14633.19 for 3-dimension, were respectively smaller than AIC =, AICc = 14829.56, BIC = 15143.18 and SABIC = 14714.97 for 3-dimension. The result showed that the three dimension model fitted the data better than the 1-dimension, 2-dimension and the more complex 4-dimension model. Thus, the more parsimonious 3-dimension model fitted the data model better than any other possible dimension. The implication of the result is that there are 3 possible sub-constructs that reflect the career aspirations of the undergraduates. These are career exploration, institutional guidance and career aspiration.

Table 5: Items in the 3 Constructs of Career Aspiration Questionnaire

ITEM NO		F1 Item (Career Exploration)
1.	B23	I have explored my likes and dislikes as they relate to my future career goals.
2.	B24	I have had opportunities to develop skills that will allow entry into an occupation (take a job) immediately after graduation.
3.	B25	I have talked to people now working (employed) regarding on-the-job training.
4.	B26	I have had opportunities to share with my parents discussions concerning my career aspirations.
5.	B27	I have been provided opportunities to identify a primary profession or occupation in which I am interested.
F2 Items (Institutional Guidance)		
6.	B20	I discuss work values (work satisfaction, economic rewards, challenges and security) and the importance of my attitude towards the values with my course adviser.
7.	B21	My department organizes field trips which include observing workers and the conditions under which they work.
8.	B22	My department provides opportunities to discuss my personal work habits (i.e. ability to follow instructions.
F3 Items (Career aspiration)		
9	B1	I hope to become a leader in my field.
10	B2	I want to be among the very best in my field.
11	B3	When I am established in my field, I would like to manage other employees.
12	B4	I plan to reach the highest level of education in my field.
13	B5	I want my work to have a lasting effect on my field.
14	B6	I aspire to have my contributions at my field recognized by my lecturers.
15	B7	I will pursue additional training in my area of interest.
16	B8	I will always be knowledgeable about recent advances in my field.
17	B12	When I am established in my career, I would like to train others.
18	B14	I plan to develop as an expert in my field.
19	B15	I would like to pursue postgraduate training in my career.

Research Que. 3: What is the dimensionality of the latent variables (mental ability, career aspiration and interest in university education) in determining the academic performance of undergraduates in the faculty of science, University of Ibadan?

Table 6: Dimensionality of Interest in University Education

Dimension	AIC	AICc	SABIC	HQ	BIC	logLik	X2	Df	P
	comparing the fitness of one and two dimensions								
1	18937.81	19073.83	19007.96	19113.99	19379.07	-9351.905	431.189	28	0.000
2	18562.62	18804.56	18649.56	18780.97	19109.48	-9136.31			
	comparing the fitness of two and three dimensions								
2	18562.62	18804.56	18649.56	18780.97	19109.48	-9136.31	307.806	27	0.000
3	18308.81	18710.92	18411.95	18567.82	18957.5	-8982.407			
	comparing the fitness of three and four dimensions								
3	18308.81	18710.92	18411.95	18567.82	18957.5	-8982.407	130.78	26	0.000
4	18230.03	18875.97	18348.76	18528.19	18976.78	8917.017			

Table 6 presents the model-data fit assessment showing the dimensionality of interest in university education scale. When the fitness of 1-dimension and 2-dimension models to the data were compared, the result showed that the 2-dimension had AIC = 18562.62, AICc = 18804.56, SABIC = 18649.56, BIC = 19109.48 values that were less than the AIC = 18937.81, AICc = 19073.83, SABIC = 19007.96, BIC = 19379.07 values of the 1 dimension. In addition, the Likelihood that 2 dimensions fitted the data better than 1 dimensions model was statistically significant (χ^2 (28) = 431.189, $p < 0.005$). These results showed that Model 2 fitted the data better than Model 1. In a search for a better model for the data, the fitness of 2 models to the data was in turn compared to the fitness of 3 models to the data. The result showed that the 3-dimension model fitted the data better than the 2-dimension model (3-dimensions model's AIC = 18308.81, AICc = 18710.92, SABIC = 18411.95, BIC = 18957.5 values were respectively less than the 2-dimension model's AIC = 18937.81, AICc = 19073.83, SABIC = 19007.96, BIC = 19379.07; the Likelihood ratio that 3-dimensions model fitted the data better than 2 dimension model was statistically significant, ($\chi^2(28) = 307.806$, $p < 0.005$).

However, when the fitness of 3-dimension was compared with the 4-dimension, the 3-dimension fitted the data better than the 4-dimensions (AIC = 18330.03, AICc = 18875.97, BIC = 18976.78 and SABIC = 18348.76 for 4-dimension, were respectively larger than the AIC = 18308.81, AICc = 18710.92, SABIC = 18411.95, BIC = 18957.5, for 3-dimension. The result showed that 3-dimension fitted the data better than the 1-dimension, 2-dimension and more complex 4-dimension models. Thus, the more parsimonious 3-dimension model fitted the data model better than any other possible dimensions. The implication of the result is that there are 3 possible sub constructs that reflect the interest of undergraduates in university education. They are engagement, motivation and participation of undergraduates.

Table 7: Items for the 3 Sub-Constructs of Interest In University Education

ITEM NO		F1 Item (Engagement of Undergraduates)
1	C9	I enjoy listening to my lecturers.
2	C10	I perform better when I attend lectures.
3	C17	I want to continue with my current discipline because my grades in my course work are above average.
4	C18	I always attend my lectures punctually.
F2 Items (Motivation of Undergraduates)		
5	C1	The university is a place where I feel fulfilled.
6	C2	Attaining a university degree makes me feel fulfilled.
7	C3	I want to go to the university not to please my parents.
8	C4	I want to go to university not because my friends are going to university.
9	C6	I will make more money and faster as a university graduate than being a non-university graduate.
10	C7	Going to school makes me feel important.
F3 Items (Participation of Undergraduates)		
11	C11	I am satisfied with my course grades at the end of the semester.
12	C12	I contribute to class discussion during lectures.
13	C13	My lecturer commends my contributions to class discussion.

Conclusion and Recommendations

The poor academic performance of some first year university undergraduates has given much concern to the federal government and other stakeholders in university education. . Several policies have been introduced over the years to address the issue as the use of only cognitive measures to examine and select candidates for admission into the universities has not been able to tackle the challenge. The cognitive measures include the Senior Secondary School Examinations (SSCE), Unified Tertiary Matriculation Examination (UTME) and Post Unified Tertiary Examinations (Post-UTME). Measuring of non-cognitive measures such as students' personal variables (mental ability test, undergraduates' interest in university education and career aspirations) have great possibilities in determining and enhancing the academic performance of first year undergraduates in the faculty of science.

This paper, therefore, recommends:

(i) The development and use of dimensionality and construct of items of students' personal variables (undergraduates' interest in university education, career aspiration and mental ability) by the federal government and university management for accessing undergraduates during admission process and throughout the years of schooling in the university as they have strong validity and reliability.

(ii) The measurement and assessment of undergraduates' interest in university of education, career aspiration and mental ability scale before admission into the university can enhance early detection and rectification of challenges that might arise in the future after placement into the various departments.

References

Adegbile J.A. (2009). *Evaluation in Curriculum and Instruction*, Powerhouse Publishers. ISBN: 978-35794-6-3.

Akinlana, T. (2013). Academic optimism, motivation and cognitive ability as determinants of performance of secondary school learners in Ogun State, Nigeria. *European Journal of Business and Social Sciences,* Vol. 1, No. 12, pp 68-76, March 2013. URL: http://www.ejbss.com/recent.aspx ISN: 2235 -767X.

Akiri, A. A & Ugborugbo, N. M. (2009). Teachers' effectiveness and learners' academic performance in public secondary schools in Delta State, Nigeria. *Learner Home Community Science*, Vol 3, No 2:107-113.

Bamidele M.A & Bamidele, A. (2013). Influence of cognitive performance on mathematics learners level of achievement. *International Researcher*, Vol 2 No.1 pp 142-150.

Carter, E.W., Webby, J., Hughes, C., Johnson, S.M., Plank, D.R., Barton-Arwood, S.M., & Lunsford, L.B. (2005). Preparing adolescents with high-incidence disabilities for high stakes testing with strategy instruction. *Preventing School Failure*, Vol 2, No 49 pp 55-62

Chalmers, R. P. (2012). Mirt: A multidimensional item response theory package for the R Environment. *Journal of Statistical Software, Vol 6, No. 48, pp 1-29. doi:10.18637/jss.v048.i06*

Depaoli, S., Tiemensma, J., & Felt, J.M. (2018). Assessment of Health Surveys: Fitting a Multi-dimensional Graded Response Model. *Psychology, Health and Medicine,*23 (Suppl. 1), 1299-1317.

Guthrie, J. T. & Klauda, S. L. (2014). Effects of classroom practices on reading Comprehension, engagement and motivations for adolescents. *Reading Research Quarterly*, 49, 387–416.

Kpolovie, P. J. (2010). Effects of information processing styles and types of learning on learners' learning. *Nigerian Journal of Empirical Studies in Psychology and Education. Vol. 1, issue 11, pp 6-16.*

Kpolovie, J.P., Joe, I.A., & Okoto, T. (2014). Performance prediction: Role of interest in learning and attitude towards school. *International Journal of Humanities Social Sciences and Education (IJHSSE) Volume 1, Issue 11, November 2014, PP 73-100 ISN 2349-0373 (Print) & ISN 2349-0381 (Online)* www.arcjournals.org

McDonald, R. P. (1997). Normal-Ogive multidimensional model. In W. J. van der Linden & R. K. Hambleton (Eds.), *Handbook of Modern Item Response Theory* (pp. 257–269). New York, NY: Springer. doi:10.1007/978-1-4757-2691-6_14

McDonald, R. P. (1999). *A Unified Treatment*. Mahwah, NJ: Erlbaum.

McDonald, R. P. & Fraser, C. (2003). NOHARM: A windows program for fitting both unidimensional and multidimensional normal Ogive models of latent trait theory. Niagara College. Welland, Ontario. Retrieved from http://noharm.niagararesearch.ca/nh4man/nhman. html

Miler, B. R., DeBacker, K. T. & Green, A. B. (1999). Perceived Instru-coginitiveity and Academics: The Link to Task University of Ibadan *Journal of Instructional Psychology* 26(4):250-266

Neisser U., Boodoo G., Bouchard T.J., Boykin A.W., Brody N., Ceci S.J., Halpern D.F.,

Loehlin J.C., Perloff R., Stenberg R.J., & Urbina S. (1996). Intelligence: knowns and unknowns. *American Psychologist*; 5:77–101.

O'Brien, K.M. (1996). The influence of psychological separation and parental attachment on

the career development of adolescent women. *Journal of Vocational Behaviour*, 48, 257—274.

Onuoha, U. D., & Unegbu, E. V. (2012). Career aspiration as determinant of performance in classification and cataloguing in university of Ibadan. *Journal on Information Engineering and Application* www.iiste.org. ISN 2224-5782 (print) ISN 2225-0506 (online),Vol.3, No.3, 2013,22

Sclove, S.L. (1987). Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika* 52, 333–343 Springer Link Https://Doi.Org/10.1007/Bf02294360

Silvia, P. I. (2006). *Exploring the Psychology of Interest*. New York: Oxford University Press.

Tate, R (2003). A comparison of selected empirical methods for assessing the structure of responses to items. *Applied Psychological Measurement 27, 159–203*.

Typhon International Corporation, (2005). *International Webster Complete Dictionary of the English Language: Encyclopaedic Edition*. U.S.A: Trident Press.

Tyler, B., Van Sickle, M. L., Harrison, G. W., & Tempel, G. (2008). Lasting impact of a professional development program on constructivist science teaching methods. *Journal of Elementary Science Education*, 20, 49-60.

Tanaka, G. (1993). *The Intercultural Campus; Transcending Culture and power in American Higher Education*. Volume 97, LB2343.4.T35. ISBN 975-0-8204-4150-4.

Vanden-Boss, G.R. (Ed.). (2007). APA Dictionary of Psychology. Washington D.C.: American Psychological Association.