International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Application of Item Response Theory in the Development of Self-Regulated Learning Scale for Undergraduate Students of Universities in Rivers State

[1]Ogolo, A. I.; [2]Prof. Orluwene, G.W.

Department of Educational Psychology, Guidance & Counseling, University of Port Harcourt, Rivers State, Nigeria.

[1]Phone: +234-8068621886, +234-7082733833, Email: dennaragatha6@gmail.com

[2]Phone +234-813946545, +234-8055474248, Email: goodness.orluwene@uniport.edu.org

ABSTRACT

In recent times, it has been observed that amidst so many distractions, some students fail to apportion time to regulating their learning which could lead to examination malpractice and/or backlog of carryovers. It is therefore necessary to have an indigenous instrument that measures undergraduates' self-regulated learning abilities. Against this background, this study examined application of item response theory in developing a self-regulated learning scale for students' of universities in Rivers State. Instrumentation research design was used to develop the scale while adopting Zimmerman's cyclical model. Self-regulated learning and Item response theories guided the study. The population was 71,778, and a sample of 1,440 students was drawn using multi-stage sampling procedure. Four research questions were answered using statistics from excel, SPSS, and R while one null hypotheses were tested using chi square goodness of fit. The scores from the slope parameter were between 0.265 and 1.609; while the lowest and highest threshold parameters were -17.715 under b1 and 4.581 under b3 respectively which signify that answers covered a wide range of the latent trait. 52.5% of the items had RMSEA below 0.05 while 47.5% were between 0.05 and 0.065 so they were rated as good and acceptable values for model data fit. The scatter plot indicated that a non-linear model was used for data analysis. Most of the information provided by the scale is above the mean; hence, capability was indicated more precise at the middle of the ability scale. The researcher recommended among others that item response theory should be applied when developing a measurement scale because of its precision.

Keywords: Self-regulated learning, item response theory, Instrumentation, latent trait, nonlinear.

Introduction

The duration of learning is from birth to death. At birth, all a baby does is to suck and sleep. At a later stage, the infant learns to consume other types of solid food and also learns how to stand, sit, walk, and run. As the kid grows older, the need to attend school arises. Beyond the classroom, learning continues. The same youngster picks up more household tasks, socializes with members of the public, works and conducts business, and so on. The person learns how to age gracefully and maintain happiness even in the face of unpleasant or agreeable experiences that come with moving through different stages of life, even as they become older. Any step skipped has a substantial impact on the others.

Meyer (2002) noted that even with our extensive knowledge in many domains, there are always new things to discover or previously acquired information that needs to be reviewed. Since education is a lifelong process, the urge to learn never goes away regardless of one's age, social standing, income, or popularity (Onyenemezu, 2017). Learning can be defined as a sequence of actions taken to bring about a difference due to knowledge acquired and contribute to a better accomplishment (Ambrose, Bridges, Dipietro, Lovett & Norman, 2010). As soon as a person stops learning, he starts to gradually fade away {Eisten (n.d); Kiyosaki; 2017 and Towne (n.d.}. It suggests that several activities combine to produce learning; as long as there is a change in behavior and improvement, learning has taken place.

Nzeneri (2010) opined that the essence of acquiring knowledge is to liberate a person from oppression, adversity, illiteracy, and dependency on others. Learning expatiates a person's understanding. It enlightens people about relevant instructions on diverse areas of knowledge. It is costlier to be illiterate than to acquire knowledge (William, 2008).

Understanding and control over what one learns are key components of self-regulated learning (Schraw, Crippen & Hartley, 2006). It indicates that the individual chooses how to succeed rather than feeling forced to learn new things. With reference to Zimmerman (2002), self-regulated learning occurs when an individual consciously and routinely plans a course of action, works towards accomplishing the goal; reviews what has been done, looks back on the whole process, and make adjustments as needed.

A self-regulated learner comprehends and efficiently manages his or her studies as well as the environment (Schraw, Kauffman, & Lehman, 2006). They have the talent and enthusiasm required for studying (Murphy & Alexander, 2000). Self-regulated learners are enthusiastic about learning; they love to explore new grounds. They learn beyond what they are taught in the regular classroom setting. Woolfolk, Hughs & Walkup (2008) view them as resolute persons, this is because they are determined, and focused, on achieving success in their field of endeavours.

Self-regulated learning enables students to think ahead, make adjustments where necessary, continuously learn for life, be determined for success, be focused, develop problem-solving techniques, form an attitude of accountability, be ready for studies and thereby get better grades (Claire, 2021). Furthermore, self-regulated learning allows students to apportion their time adequately and develop a reading culture that will be beneficial throughout their lifetime (Rich, (n.d.). Ifenthaler (2012) opined that self-regulated learning is a necessary talent that enables one to learn throughout a lifetime. The desire to learn more emanates from the ability to acquire more knowledge. It makes learners keep getting better in life. The more a person gets committed to learning for life, the easier learning becomes. Hence, Self-regulated learners and everyone should open their minds to learning new insights, talents, and attitudes.

The dependent and independent variables are self-regulated learning and item response theory respectively. Various models of self-regulated learning have been developed by different renowned educational psychologists though the researcher found the cyclical model proposed by Zimmerman B. J. in the twentieth century to be more beneficial for this study. Students who practice self-regulated learning using the cyclical model have to first of all have a pre-knowledge of what they intend achieving from the learning process and put-together necessary materials that will enable them achieve the goal, then carry out the task and finally reflect on the outcome to ascertain if the goal was achieved. The process is repeated in the event of any shortcomings. On the other hand, item response theory examines the connection between the items that make up a measurement instrument, the response patterns provided by respondents, and the unobserved trait that is being assessed. It is a strategy used in analyzing the authenticity of a measuring instrument (Yang & Kao, 2014). There are various models used for dichotomous and polytoomous response instruments. The model selected depends on the type of analysis required, the pattern of responses, and the parametric properties measured, hence the IRT models include the one-parameter, two-parameter, three-parameter, four-parameter, and non-parametric logistics models out of which the researcher used graded response model which is a non parametric model used for polytomous items.

Amid continuous interference from peer groups, social activities, phones, social media, and other technological facilities, it is worrisome to note that some undergraduates have not seen the need to apportion time for regulating their learning. They neither set learning goals or study time for themselves; nor do they have any specific method that will guide them in learning new materials. Some do not see the need to seek help from fellow students or even create time for visiting the school library because of misplaced priorities. They only indulge in rote memorization during tests or semester examinations. They are therefore unable to analyze their performances. The result is that they are unable to cope with their school chores, hence they fall back to examination malpractice or even carry over some courses which eventually leads them to graduate with weak passes or even end up as school dropouts.

The problem of apportioning more time to other activities at the expense of learning could be credited to the fact that students have not imbibed the culture of regulating their learning, hence other activities take more of their time. This problem has attracted the attention of the researcher; it is therefore necessary to have an indigenous instrument that measures undergraduates' self-regulated learning abilities. Against this background, the researcher deems it necessary to embark on this research. The application of item response theory will help in ensuring the precision of each item and the test as a whole; hence the researcher hopes to produce a self-regulated learning scale that is indigenous, and worthwhile.

Aim and objectives of the study

The aim of the study is to develop a scale that will be used in assessing self-regulated learning abilities of undergraduates of universities in Rivers State, Nigeria. In specific terms, the objectives of the study include to:-

1. determine the model data fit of undergraduates' self-regulated learning scale
2. determine the item parameter estimate of undergraduates' self-regulated learning scale.
3. determine the residual analysis of undergraduates' self-regulated learning scale
4. determine the test information function of undergraduates' self-regulated learning scale.

Research Questions

The following research questions guided the study:-

1. What is the model data fit of undergraduates' self-regulated learning scale?
2. What are the item parameter estimates of undergraduates' self-regulated learning scale?
3. What is the residual analysis of undergraduates' self-regulated learning scale?
4. What is the test information function of undergraduates'' self-regulated learning scale?

Hypothesis

The following null hypothesis was formulated and tested at the significant level of 0.05.

1. The data from undergraduates' self-regulated learning scale does not fit the multidimensional graded response model.

Methodology

The design used for this study is instrumentation research design. Kpolovie (2018) explained that instrumentation research design is specifically fashioned to ascertain the psychometric properties of test development as well as its authentication and dependability. Instrumentation research design is therefore considered the most appropriate design for developing, authenticating, and determining the dependability of this instrument. This research study was carried out in the three universities within Rivers State namely University of Port Harcourt, Choba; Rivers State University, Nkpolu Oroworoko; and Ignatius Ajuru University of Education, Rumuolumeni. The total population of the three universities as at November, 2022 was estimated 71,778; out of which a sample of 1,440 students was computed using the formula provided by National Educators Association (NEA) formula for sample size and confirmed by free online sample size calculator.

A multi-stage sampling procedure was adopted to draw the sample size. At stage one, purposive sampling technique was used to select universities within Rivers State excluding other higher institutions. Purposive sampling technique was also used to choose similar faculties that were found in the three universities. Finally, in other not to disrupt academic activities within the schools and also give every student in the selected faculties a fair chance, accidental sampling technique was used to select undergraduates that made up the sample size from each of the above mentioned faculties in the universities disregarding their departments and gender.

The instrument employed for data collection was logically constructed by the researcher to elicit information from the respondents. The name of the instrument is undergraduate students' self-regulated learning scale (USSLS). The questionnaire was designed in three subscales namely: forethought, performance, and self-reflection subscales to agree with Zimmerman's cyclical model; and questions were drafted with components of self-regulated learning in mind. The steps involved in developing this measurement instrument is somewhat cumbersome, however, the researcher adhered to the guidelines given by Nwankwo (2016), Opara (2016) and Orluwene (2012b), and later applied item response theory to ascertain its precision.

The steps taken to develop the instrument includes to ascertain the reason for developing the test, determining the specific domain that the instrument is supposed to measure, that is,the affective domain which entails developing interest, adjusting ones behavior and having love for ones educational pursuit (Vikoo, 2003). Determining the item format of the instrument; it is a non-cognitive questionnaire with a four-likert answering format of strongly agreed, agreed disagreed and strongly disagreed The next step was to prepare a test test blue print which helped the researcher to outline the number of test items that will be covered by the test depending on the sub-heads to be addressed. After which the questionnaire items were written out using the homogenous method. This was done by drafting a pool of one hundred and fifty (150) questionnaire items related to self-regulated learning; these questions were used to conduct a pilot test and the data generated was subjected to principal component analysis. Principal component analysis helped to reduce the number of items to a sizeable number so that the major components are formed. Items whose factor loads fell below 0.5 were discarded, while those above 0.5 were retained. Thus, the pool of questionnaire items was reduced from 150 to 77.

The retained items were then assembled under the appropriate subheads, and the 77 items were then administered to a sample size of 1,440 undergraduates chosen for the study, though, 1,390 was retrieved at the end of the process. It represents approximately97% retrieval which is considered good enough. Three research assistants were briefed on how to help the researcher in administering the instruments.The scores from the respondents were then imputed into statistical package for social sciences (SPSS) version 25 and exported to R version 4. 3. 1 statistical programming package, where exploratory factor analysis was carried out. Some of the items did not meet up the pre-determined cut off mark of 0.30; hence 32 items, approximately 42%) were discarded while the data for the remaining 45 items, which is equivalent to 58% were retained. Finally, the item parameters of the remaining 45 items were estimated to ensure that they all had acceptable psychometric properties. From the analysis it was found out that items 41 to 45 had slope items of 0.09 and below so they are not acceptable; they were therefore discarded. The items were then brought down from 45 to 40.

Results

Research question one: What is the model data fit of USSLS?

The above research question was answered by subjecting data from the 40 items to chi square model data fit in R statistical programming package version 4.3.1. The output of the chi square model fit test is presented in table 1

Table 1: A brief section of Chi square model fit for USSLS

Variables	S_X2	df.S_X2	RMSEA.S_X2	p.S_X2
VAR00001	286.413	88	0.040	0
VAR00002	397.222	84	0.052	0
VAR00003	277.914	79	0.043	0
VAR00004	519.880	99	0.055	0
VAR00005	293.423	84	0.042	0

VAR00006	395.730	83	0.052	0
VAR00007	314.873	92	0.042	0
VAR00008	393.752	92	0.049	0
VAR00009	627.684	93	0.064	0
VAR00010	514.518	102	0.054	0

R multidimensional item response theory (mirt) package was used to fit graded response model (GRM) which is the appropriate model for assessing likert scales. The suggested range for root mean square error of approximation (RMSEA) is that scores below 0.05 are regarded as good values. Scores between 0.05 and 0.08 are acceptable while scores between 0.08 and 0.1 are insignificant. Any score that is more than 0.1 is considered as a poor fit (Kim et al, 2016). From the analysis, 52.5% of the items had RMSEA values below 0.05 which are rated as good values while 47.5% of the items had RMSEA values between 0.05 and 0.065 which is rated as acceptable values for model data fit.

Hypothesis one: The data from USSLS does not fit the multidimensional graded response model.

To enable the researcher test the null hypothesis the chi square (X^2) values of each item were compared with its specified critical values at a given degree of freedom (df) under 95% confidence level. Furthermore, the chi square probability (p) value was compared with the significant level of 0.05. The result is presented in table 2 while the table of probabilities for the chi square distribution was viewed online and could not be displayed because there was a copyright injunction clause attached.

Table 2 A compressed version of the Chi square model fit with critical values

Items	S_X²	df.S_X²	Critical values_X²	p.S_X²	Observation
1	286.413	88	110.898	0	Fits
2	397.222	84	106.395	0	Fits
3	277.914	79	100.749	0	Fits
4	519.880	99	123.225	0	Fits
5	293.423	84	106.395	0	Fits
6	395.730	83	105.267	0	Fits
7	314.873	92	115.390	0	Fits
8	393.752	92	115.390	0	Fits
9	627.684	93	116.511	0	Fits
10	514.518	102	124.342	0	Fits

Table 2 reveals that the computed chi square (X^2) values of items 1 to 40 are greater than its equivalent critical values at 0.05 degree of freedom. Similarly, the probability (p) value of the items is zero which is less than 0.05. Therefore the null hypothesis is rejected, indicating that data from undergraduates' self-regulated learning scale fits the multidimensional graded response model.

Research Question two: What are the item parameter estimates of USSLS?

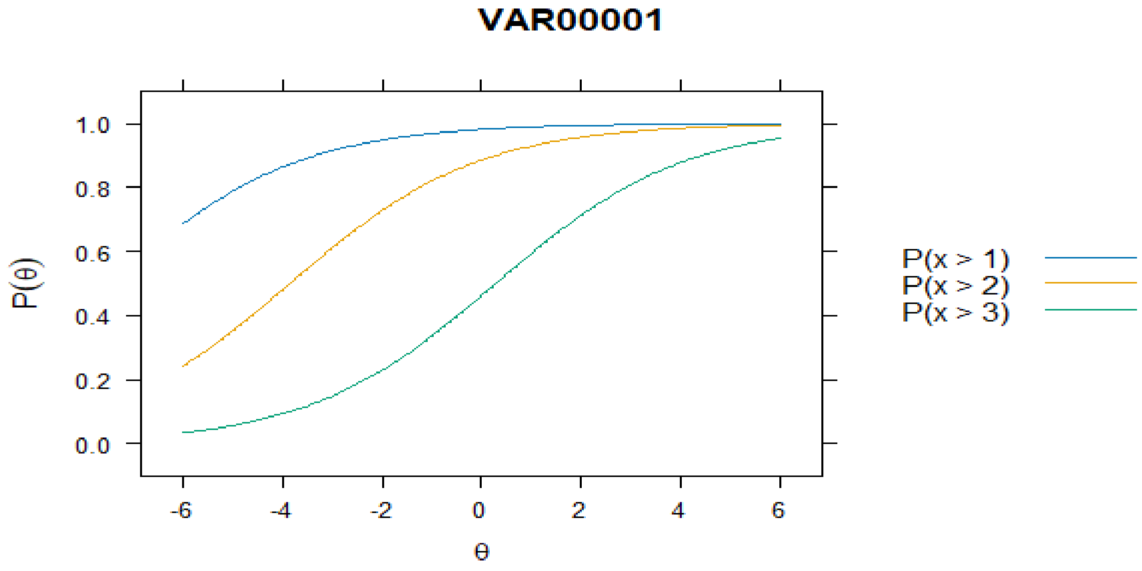
To answer this research question, the data on the 40 items were imported from statistical package for social sciences SPSS) version 25 to Rstata in R statistics programming language where the analysis was run. The result is presented in table 3:

Table 3: A short version of Item parameter estimates of USSLS

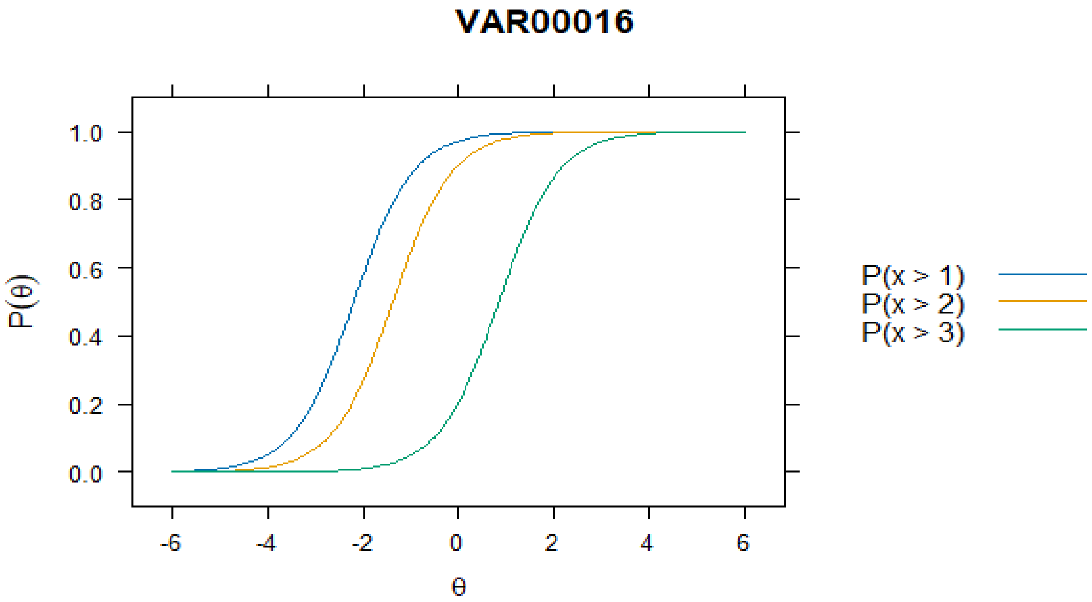
Items	'a' (slope)	b1	b2	b3 (threshold)
VAR00001	0.528	-7.504	-3.866	0.285
VAR00002	0.449	-10.582	-5.661	1.435
VAR00003	0.607	-7.413	-4.188	1.054
VAR00004	0.601	-5.257	-3.095	1.000
VAR00005	0.632	-6.597	-3.683	0.729

Since graded response model was used, the 'a' or slope parameter was displayed along with three 'b' or threshold parameters. The scores from the slope (a-parameter) are between 0.265 and 1.609. Item 37 had the lowest slope value of 0.265 while item 16 was the highest item with a slope estimate of 1.609. This indicates that item 37 had a weak relationship with the latent trait; while item 16 had the strongest interconnection with the unobserved construct and measures self-regulated learning more accurately than other items in the scale. The item characteristics curve showing the peakness of the slopes of the items is presented in figure 3: It is arranged according to the nature of their slopes, meaning that items with similar characteristics curves were grouped together for ease of interpretation.

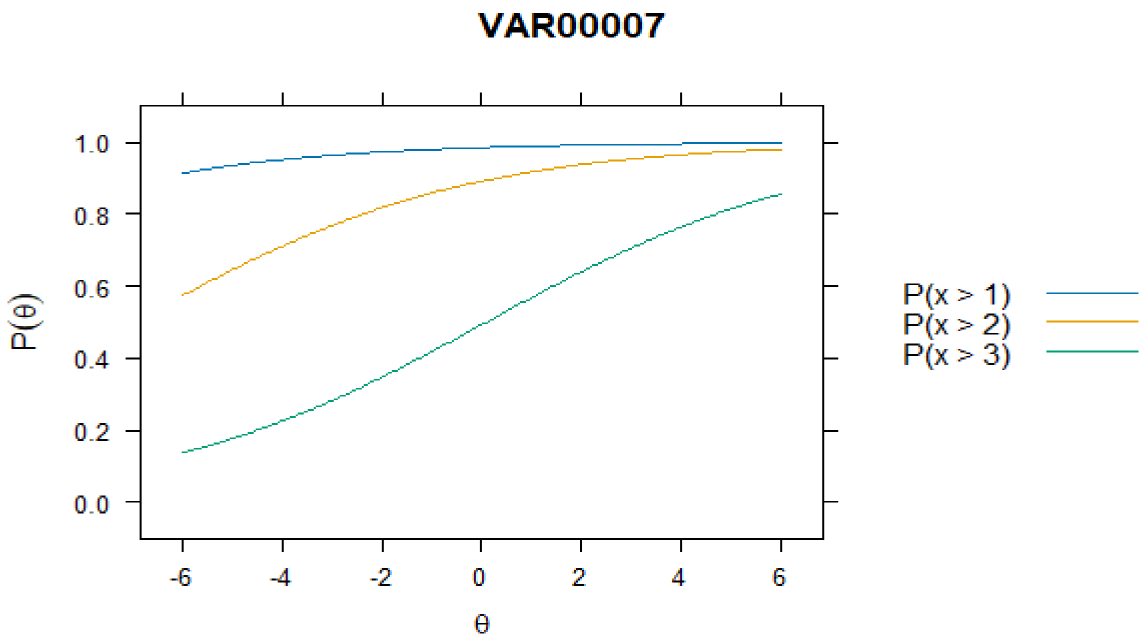
Figure 3 Item characteristics curves for some of the items



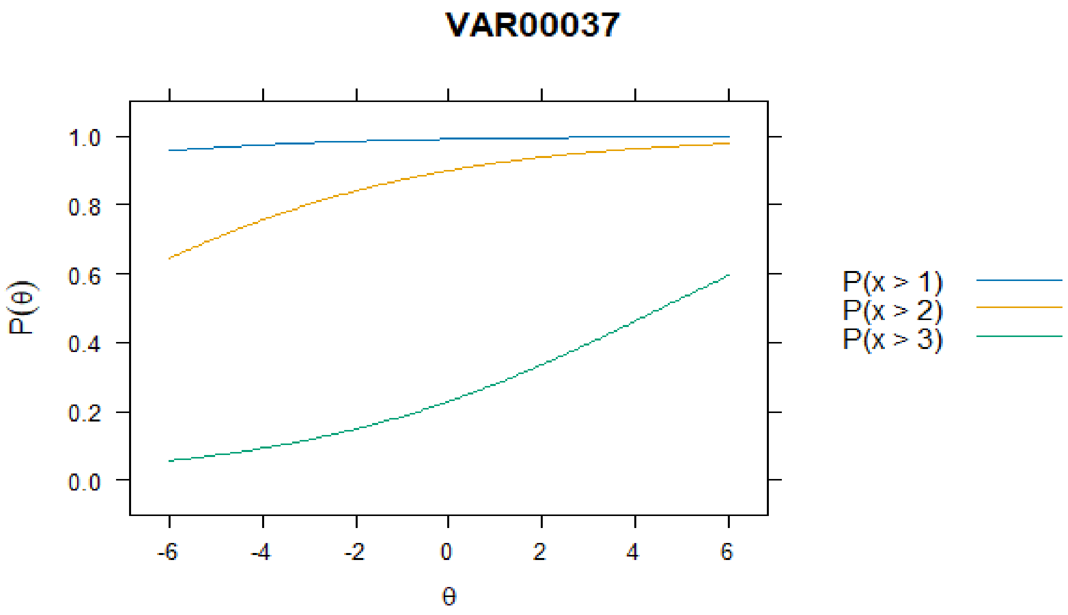
From the graphs, the horizontal (or x-axis) represents the latent trait.. It ranges from -6 to 6. It is represented by the symbol theta (0) which is a Greek alphabet. 0.0 is the average or mean ability of the population studied. The vertical axis (or y-axis) represents the probability of ticking an item. The three lines show that the probability (p) is either less than one, or two, or three. Though items 1 to 8, 10 to 11, 19, 23, 28, 34 and 38 had slope values above 0.40 which is rated as very good value, their values were closer to 0.40 that is why their slopes are not peaked showing that the relationship with the latent trait is not strong.



Items 12 to 18, 20 to22, 24, 27, 29 to(33 had slope values above 0.40 which shows that they are good items. Their slope values were approximately closer to 1.00 that is why their slopes are sharper than the first set of item characteristics curves. Their slopes are peaked which indicates that these items have high connection with the unobserved construct and assesses self-regulated learning more than the other items.. Item 16 had the sharpest peak with a slope parameter of 1.61



The slopes of items 7, 9, 35 to 37 were not peaked; they were only retained because their slope values were approximately between 0.30 and 0.39.



The three threshold parameters (b-parameters) are also indicated in table 3 for the individual items. Threshold or location parameters show the value of theta (0) that aligns with 50% likelihood of answering a particular location on an item. The location parameters are derived by subtracting one (1) from the number of response scale (n-1). Since the undergraduates' self-regulated learning scale is a four (4) likert scale, the b-parameter is four minus one, which is why three b-parameters are given above. Item 37 had the lowest threshold parameter value of -17.715 under b1. It also had the highest threshold parameter value of 4.581 under b3. This indicates that item 37 represents the peak of the threshold whereby there is fifty percent (50%) likelihood of ticking a specific item. The threshold parameters signify that answers covered a wide range of the latent trait.

Research Question three: What is the residual analysis of USSLS?

To answer the above research question, the values of the slope 'a' and locations b1, b2, and b3 in table 3 were subjected to linear regression using statistical package for social sciences (SPSS) version 25. This was done in other to ascertain if the graded response model used to analyze the data is a linear or non-linear model. The system automatically generated the standardized predicted values and standardized residual values. The output for the item parameter estimates, standardized predicted values and standardized residual values is presented in table 4.

Table 4: A small part of Standardized predicted and standardized residual values of undergraduate students' self-regulated learning scale is presented below

Items	Slope 'a'	Threshold 'b1'	Threshold 'b2'	Threshold 'b3'	Standardized predicted Values	Standardized Residual values
1	0.53	-7.50	-3.87	-3.87	-0.31	-0.87
2	0.45	-10.58	-5.66	1.44	-1.40	0.17
3	0.61	-7.41	-4.19	1.05	-0.54	-0.24
4	0.60	-5.26	-3.10	1.00	0.038	-1.00
5	0.63	-6.60	-3.68	0.73	-0.30	-0.45
6	0.75	-4.80	-3.26	0.81	0.09	-0.44
7	0.30	-13.94	-7.03	0.09	-2.19	0.54

Regression

Table 5 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.797[a]	0.636	0.606	0.23569

a. Predictors: (Constant), VAR00004, VAR00003, VAR00002

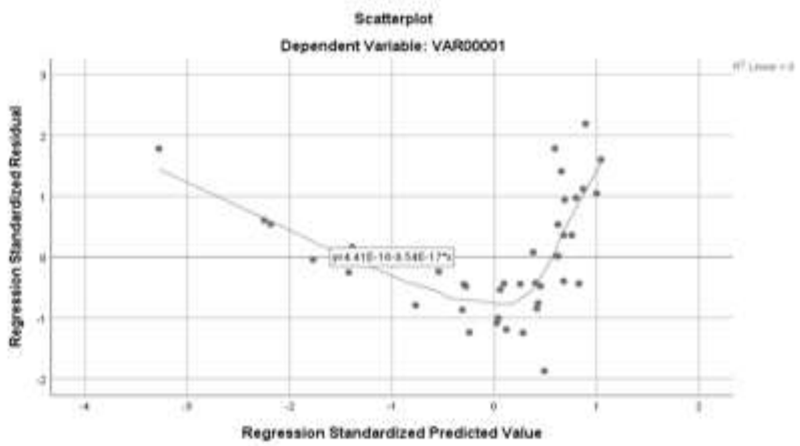
b. Dependent Variable: VAR00001

Table 6 **Residuals Statistics[a]**

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-0.16	1.14	0.83	0.30	40
Residual	-0.44	0.52	0.00	0.23	40
Std. Predicted Value	-3.28	1.04	0.00	1.00	40
Std. Residual	-1.88	2.19	0.00	0.96	40

Table 6 gives the values of residual statistics of undergraduates' self-regulated learning scale. The minimum standardized predicted value is -3.28 and maximum is 1.04; similarly, the minimum standardized residual value is -1.88 and maximum is 2.19.

Figure 4: Scatter plot



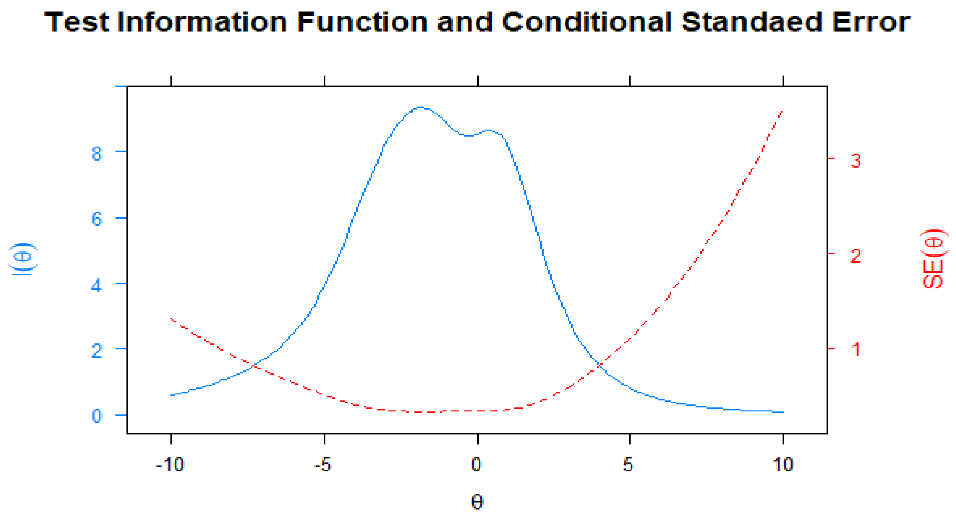
The scatter plot is a picture which shows evidence of model fit. The standardized predicted values (ZPRED) are at the x-axis (horizontal axis) it ranged from -4 to 2, while the standardized residuals (ZRESID) are at the y-axis (vertical axis); it ranged from -2 to 3. The best fit line stems from zero and moves horizontally to the right. Since there are 40 items, it implies that the dots or residuals will also be 40 in number. The dots on the scatter plot did not follow the line of best fit. Furthermore, the correlation coefficient (R squared) linear value at the top right hand of the graph is equal to zero. R square determines how well a linear regression model fits a given data. It is measured on a scale of zero to one . Since the dots did not follow a straight line pattern, and the R squared value is zero, it indicates that a linear model does not fit the data. On the other hand, table 5 shows that the adjusted R squared value is approximately 0.61, this indicates that the data is suitable for a nonlinear model.

A locally weighted smoothing (loess) line was fixed to give a clearer picture of the pattern of the dots which formed a curve. Two outliers were visible. The curve indicates that the interconnection between the dependent and independent variables is nonlinear. Graded response model is a nonlinear model; table 4 shows that an increase in the standardized predicted values does not automatically mean that the standardized residual values will increase and vice versa; this is the case with nonlinear models.

Research Question four: What is the test information function of USSLS?

To answer this research question, a graph of test information function was plotted with probability (I0) of selecting an item on the vertical (y-axis) and latent trait (0) on the horizontal (x-axis). The plot is in figure 6:

Figure 6: Test Information Function



The thick blue line shows the test information function while the red line gives a picture of standard error estimate. The values of the standard error of estimate are on the right hand side of the vertical (y) axis. As shown in figure 6, the information (I0) range was from 0 to 8 while the latent trait (0) range was from -10 to 10. Zero shown on the x-axis is the mean of the graph. Most of the information provided by the scale is above the mean; hence, capability is indicated more precisely at the middle of the ability scale. The blue line (respondents' scores) covered from zero (0) to the top at eight (8) which indicates that the scale is designed for respondents with high scores like undergraduates.

Discussion of findings:

The result of research question one for the current study shows that 52.5% of the items had root mean square error approximation (RMSEA) values below 0.05 which are rated as good values while 47.5% of the items was between 0.05 and 0.065 which is rated as acceptable values for model data fit..This indicates that model fit was good and acceptable. The results obtained from Oz & Sen (2018) revealed a root mean square error of approximation (RMSEA) equal to 0.55 which is rather high.

The null hypothesis which states that the data from undergraduates' self-regulated learning scale does not fit the multidimensional graded response model was rejected This is in agreement with the decision taken by Zanon, Hutz, Yoo & Hambleton (2016) thus confirming that there was an acceptable fit to the scale.

Item 37 had the lowest slope value of 0.265. Item16 was the highest item with a slope estimate of 1.609 indicating that it had the strongest interconnection with the unobserved construct and measures self-regulated learning more accurately than other items in the scale. Item 37 also had the lowest threshold parameter value of -17.715 under b1. It also had the highest threshold parameter value of 4.581 under b3. This indicates that item 37 represents the peak of the threshold whereby there is 50% likelihood of ticking a specific item. The slopes of Zanon, Hutz, Yoo & Hambleton (2016) however, were considered moderate which is also not far from the result obtained by the researcher.

The residual plot indicated that the data from undergraduates' self-regulated learning scale was fitted into a nonlinear model. The scatter plot from the researchers study show a curve as well as that from Zampetakis et al (2015); they both indicate the use of a nonlinear model for fitting of data. The scale is designed for respondents with high scores. The information is well spread over the continuum. The amount of information provided is high and acceptable though some of the items did not provide enough information and could be improved. In contrast, most of the information provided by the scale developed by Zanon, Hutz, Yoo & Hambleton (2016) was below the mean of respondent scores which suggest that their instrument was better designed for respondents with lower scores. Their information was well spread over the continuum, though the amount of information given was less than what was considered acceptable; hence their negative scale needed improvement. The test information function from Zampetakis, Lerakis, Kafetsics & Moustakis (2015) indicated that precision is best at the low levels of theta (0) while precision obtained by the researcher is best at the higher levels of theta (0).

Conclusion

The four research questions were fully answered, and one null hypothesis was tested with their respective results presented in the work. The pool of 150 questions initially drafted was reduced to 40 after undergoing the process of item selection. The 40 items had good psychometric properties as shown in the answers to the research questions.

Recommendations

In view of the findings obtained from the study, the following recommendations were made:

1. The researcher recommends that item response theory should be applied when developing a non-cognitive test because of its numerous advantages.
2. Test developers are also encouraged to get accustomed with various designs and software packages used in the development of measurement scales because it eases the burden of manual statistical computations.

References

Ambrose, S. A., Bridges, M W., Dipietro, M. D. Lovet, M. C. & Norman, M. K. (2010). How learning works, seven research-based principles for smart teahing. San Francisco Jossey-Bass.

Claire, C. (2021). *The importance of self-regulation for learning.* www.educationhub.org

Eisten, A. (n.d.). Cease from learning. www.goodreads.com

Kim, H., Ku, B., Kim, J. Y., Park, Y. S. & Park, Y. (2016). Confirmatory and exploratory factor analysis for valdating he plegm pattern questions for healthy subjects. www.ncbi.nlm.nih.gov.

Kiyosaki, R. (2017). Cease from learning. www.facebook.com

Kpolovie, P. J. (2016). Statistical approaches in excellent research methods in patridge publishing.

Longworth, N. & Davis, W. R. (2006). *Lifelong learning: new vision, new implications, new roles for people, organizations, nations and communities in the 21st century* in Kogan publishers.

Meyer, J. (2002a). *Battlefield of the mind* in Hachema books.

Murphy, P. K. & Alexander, P. A. (2000). *A motivational exploration of motivated terminology.* Contemporary educational psychology, 25, 3 – 53.

Nzeneri, I. S. (2010). *Handbook on adult education principles and practices* in Abigail publishers.

Nwankwo, O. C. (2016). *A practical guide to research writing* in M & J grand orbit and communications limited.

Onyenemezu, E. C. (2017. p. 279). *Adult and lifelong learning (LLL)* in Nigerian journal of empirical studies in psychology of education.. Vol. 19, No. 1. ISSN: 1595 – 4870.

Opara, I. M. (2016). *Test construction and measurement.* Concepts and application in career publisher.

Orluwene, G. W. (2012a). *Fundamentals of testing and non-testing tools in educational* psychology in Harvey publications.

Rich, C. (n.d.). Advantages of self-regulated learning. www.cararich101.wordress.com

Schraw, G., Kauffman, D. $ Lehman, S. (2006). *Self-regulated learning*. doi:10.1002/0470018860.soo671 in book. Encyclopedia of cognitive science.

Towne, I. (n.d). Cease from learning. www.neusnews.com

William, R. (2008). *The 80 unavoidable values of life* in gospel vision publications.

Woolfolk, A., Hughes M. & Walkup, V. (2008). *Psychology in education* in Pearson education.

Yang, F. M. and Kao, S. T. (2014). IRT for measurement validity. Doi:10.3969/j.1ssn.1002-0829.2014.03.010. www.ncbi.nlm.nih.gov