Development and Validation of Instrument for Measuring Secondary School Students'Academic Locus of Control (SSSALC)

Sunday OGBU[1], OluchiJanehilda AGUGOESI[2]

[1]Department of Science Education, Faculty of Education, University of Nigeria, Nsukka,Enugu State, Nigeria.
sunday.ogbu@unn.edu.ng

[2]Department of Science Education, Faculty of Education, University of Nigeria, Nsukka,Enugu State, Nigeria
oluchi.agugoesi@unn.edu.ng

ABSTRACT

The study developed and validated an instrument for measuring secondary school students' academic locus of control. Three research questions guided the development of the Secondary School Students' Academic Locus of Control Scale (SSSALCS). The sample size used for the study was two hundred and eighty (280) secondary students comprised (133 boys and 147 girls) distributed in the 10 sampled school in Nsukka Education Zone, Enugu State. In the development of the SSSALCS, 65 items were, first, written after which the items were subjected to face validation by experts in educational measurement and evaluation. After the face validation, 5 items were dropped while the remaining 60 items were subjected to construct validation using SPSS version 25. Thirty-three (33) factorial pure items that were loaded into four (4) factors emerged. The four (4) factors were: (i) Personal Internal Locus of Control with 10 items, General internal Locus of Control with 8 items, (iii) Personal External Locus of Control with 9 items, and General External Locus of Control with 6 items. The reliability estimates of the 4-factors ranges from 0.79 to 0.91. A 4-factor correlation model was specified with the loaded items on each factor and was subjected to confirmatory factor analysis using lavaan package. The result indicated a harmony between the model and the data (CFI=0.97, TLI=0.94, SMSEA=0.06, and SRMR=0.05). It was recommended, among others, that the instrument should be used to measure secondary school students' academic locus of control.

Keywords: locus of control, academic achievement, factor analysis

Introduction

Students have beliefs about life general and education in particular. These beliefs are formed as result of many variables in the learners' environment. Some of the beliefs may be detrimental to effective leaning while some may enhance learning.Nonetheless, itis expected that school should inculcate right beliefs in students irrespective of students' pre-existing beliefs about life. It must be mentioned that the amount of belief a student has about things that occur in his environment determines how he will react to the outcomes. For example, students who have the belief that studying hard leads to good performance in examination may likely put more efforts in studying and in turn, perform better that those students who believe that fortune is all about being lucky. The concept that summarizes the belief about how a student have controls over what happen to him or her is the umbrella term, locus of control.

Locus of control is a term that denotes individuals' belief that they have control of what happens to them or not.Locus of control refers to people's general, cross situational beliefs about what determine whether or not they get reinforced in life (Rotter, 1966). Essentially, Rotter's definition of control includes anything that one has power or control over (Hasan & Khalid, 2014). Locus of control has also defined as an attribution of reasons that individualshave for the events in their lives(Angelora, 2011). Locus of control is an indicative of the degree to which an individual is convinced that he can determine whatever happens to him or control it himself (Beukman, 2005).

Locus of control is one of the psychological traits that is often discussed and widely misunderstood even by researchers. The idea of locus of control is based on social learning theory. Social learning theory postulates that personality represents an interaction of the individual with his environment. Based on the interaction of individual with his environment, Rotter's social learning theory is hinged, among others, on reinforcement value (Rotter, 2012). Reinforcement value entails the degree to which behaviours are desired to occur. For example, things we don't want to happen have small reinforcement value while things we want to happen have high reinforcement value. It could be said that individuals will exhibit behaviours that are associated with greatest reinforcement value.However, the challenge lies in determine reinforcement values students attach to different behaviour. It obvious that there could be two dipoles reinforcement value on the same behaviour. For instance, poor performance in an examination could be perceived differently by different students: some may accept being responsible for their failure while some may attribute their

failure to other factors.These two categories of students have resulted in two types of locus of control-internal locus of control and external locus of control.

Internal locus of control entails individual's acceptance that he or she is responsible for the occurrences in his or her life. Internal locus of control occurs when an individual perception is that his own behavior and attitudes will result in positive reward (Beukman, 2005). Contrarily, external locus of control is said to occur when individual's perception is that external factors, outside his control are responsible for behavoural rewards. These external factors may include bias, fate, destiny, injustice, and other environmental factors. There could be difference in the behaviours of students who have internal locus of control and those who have external locus of control. A person with internal control seems to take more responsibilities. He owns his actions and accepts his mistakes. He may show more enthusiastic in his devours.

A person with external locus of control may likely be less productive as such a person will have more excuses and may show less persistence in face ofobstacles. In fact, it has been asserted that 'If the individual is convinced that he has little control over the rewards or punishment he receives, he has little reason to adapt his behaviour in an effort to change the probability that the event will occur again (Rinn&Boazman, 2014).The relationship between locus of control and achievement both in schools and other organizations seems to have gained more attention of researchers in recent years.In an organization setting, the differences in performance of internally and externally controlled person have resulted in the following observations by (Rinn&Boazman, 2014)

1. 'Internals (as followers) prefer participative supervision and also demonstrate participative approaches as leaders.
2. They seem to display clearer response to reinforcing rewards and incentives (while, although they want them, externals are often unresponsive to incentives).
3. Internals show more initiative and are more effective when dealing with complex tasks and demands' (p. 102).

In schools, there is an increase in studies on influence of locus of control on students' academic achievement across different students' academic levels (Hasan & Khalid 2014; Rinn&Boazman, 2014). At the University level, it has been observed that there exists negative significant relationship between external locus of control and student academic achievement, whereas a significant positive relationship exists between internal locus of control and the students' academic achievement (Merkine, et al. 2019). Locus of control is also a significant factor in predicting junior secondary school students' achievement (Khir, 2015).With the increase in studies on locus of control, It is expected that the structure or dimensions of locus of control should have been established. Unfortunately, various instruments have been designed to measure locus of control, but the dimentsionality of the construct still remains unclear (Suarez-Alvarez, 2016).

Dimensionality deals with the number of factors that explain a given phenomenon. It has to do with the underlying structure of given construct. It answers the questions as to whether an instrument measures different aspect of the construct. A construct that has only one aspect is said to be unidimensional or one-dimensional. The Router'slocus of control scale was measured by means ofunidimensional, internalism-externalismscale, that is, as a single, continuous dimensionwith two opposing poles (Suarez-Alvarez, et al., 2016).However, the fact that most of constructs in social sciences and humanities are not unidimensional in nature have called for more investigation on the actual dimension of locus of control. The multidimensional nature of measurement in humanities and social sciences has led to the proposal for a 3-dimensional locus of control scale,comprising internal locus of control, external locus of control and chance factor locus of control(Lavanson, 1974). It has also been founded that locus of control has three dimensions (Santokhie&Lipps, 2020). It cannot be ignored that a four-dimensional locus of control scale has been developed (Curtis and Trice, 2013) and extensively being applied. More so, it has been maintained that locus of controlpossesses two dimensions (Suarez-Alvarez, et al. 2016).

The controversies regarding the number of dimensions and the quality of few existing locus of control scales call for more researches in these area. It seems that different approaches adopted by researchers in developing locus of control scales result in different dimension of the construct. It must be stated thatit is impossible to have asingle locus of control scale that could be used in different contexts, however, itis expected that within a particular context, the dimension of locus of control should be the same. Therefore, within the context ofsecondary education, students' locus of control scales about their academic outcome should have the similardimension.For a proper understanding of dimension of locus of control, it pertinent that large data be collected and,exploratory and confirmatory factor analysis be applied on the data obtained using an instrument comprising large number of items designed to measure locus of control.

Factor analysis is statistical procedure for examining the underlying structure of scales. The exploratory factor analysis is a data reduction approach that reduce large data set into smaller factors. The factors represent the commonality in the items variances. The confirmatory factor analysis seeks to validate a theoretical hypothesised factors that explain a phenomenon. Therefore, considering the relationship between locus of control and academic achievement; and the fact that the structure of locus of control scale is not yet clear, the need to have clear idea of the underlie structure of locus of control is imperative. Factor analysis is a very useful tool in instrument development, hence was adopted for use in this study.

Purpose of the study

The general purpose of the study was to develop and factorial validate scale that measures secondary school students' locus of control using secondary school students in Nsukka Education Zone. Specifically, the study sought to determine:

1. The number salient factors that underlie SSSALCS
2. The construct validity of SSSALCS
3. The reliability of the reliability of SSSALCS

Research Question

The following research questions guided the study:
1. How many salient factors underlie SSSALCS?
2. What is the construct validity of SSSALCS?
3. What are the reliabilities of the salient factors that underlie SSSALCS?

Methodology

Research and Sample Design

The research design adopted for this study is a descriptive research design. A descriptive research design aims at collecting data on, and describing, in a systematics manner, the characteristics of objects, persons, events or phenomenon (Nworgu, 2015). Descriptive researchdesign is considered appropriate for this study as the characteristics of SSSLACS is sought to be determined and described. The population for the study comprised all secondary school students in 59 public secondary schools in Nsukka Education Zone, Enugu State, Nigeria. The sample size for the study was 280 students comprising 133 boys and 347 girls. The sample size was considered adequate as it was greater than the minimum sample size of 200 recommended for structural equation modelling when no the data distribution in normal or free from missing data(Weston & Gore Jr. 2006).The 280 students were drawn from 59 public secondary schools in the zone. In the first place, 10 secondary school were randomly sample using simple random sampling by balloting. Secondly, having selected the 10 schools, 28 students were selected from each of the 10 using simple random sampling by balloting.

The Instrument development

The first step in the development of the locus of control scale was the writing of the scale items. In writing the items of the questionnaire, the author noted that a good questionnaire should, according to Nworgu (2015), possess the following characteristics: relevance, legibility, consistence, clarity and usability. The locus of control scaleis a structured questionnaire organised into two parts: students' personal information and the scale items. The students' personal information contains demographic information about the students such as gender. The scale comprised 60 items which are designed to measure secondary school students' locus of control. The SSSALCS is a Likert-type scale scored on 5-points. The 5-points ranges from strongly disagree (1) to strongly agree (5). A 5-point scale was chosen based on the recommendation that the best estimations of psychological parameters are obtained when a scale falls between 4 and 6 response categories (Lozano, et al., 2008). After writing the items of the instrument, the items were assembled and the instrument was given to experts for face validation. The face validation of the instrument was carried out by three experts: two in Educational Measurement and Evaluation Unit, Department of Science Education and one from Educational Psychology Unit, Department of Educational Foundations both from the University of Nigeria Nsukka. The experts were asked to assess whether the items of the instruments possess the attribute of locus of control given the operational definition of locus of control given to the experts. The experts were also asked to determine: the clarity, appropriateness and relevance of the items considering the intended respondents-secondary school students. During the process of face validation, 18 items were restructured in line with the suggestions by the experts.

Method of Data Collection and Analysis

After the face validation the researchers visited the 10 sampled schools and on-the-spot administration and retrieval of the instrument was carried. After the data collection, the data were screened for missing data and outliers. There were few cases of data missing at random and no evidence of outliers. The data were subjected to exploratory and confirmatory factor analysis in order to answer the research questions and the hypothesis. The exploratory factor analysis was carried on SPSS version 25 using Principal Component Analysis with Varimax rotation. Items with factor loadings values greater than or equal to .40 is the benchmark for inclusion of items in a factor, which is in line with the recommendation of some experts (Gana&Broc, 2019; Hair et al., 2002).

An item with a factor loading of .40 and above that loads in more than one factor is said to be factorial complex; the item will be deleted. More so, all items that have factor loadings less than .40 are regarded as factorial impure items and were deleted. The targeted items are factorial pure items with factor loading of at least .40 in one factor only.A Factors with at least 4 items were retained are considered in this study as salient factors whereas factors with less than 4 items were deleted and considered as non-salient factors. Research Question One was answered using eigenvalues, cumulative variances in the eigenvalues and scree plot. In order to answer Research Question Two, confirmatory factor analysis was carried out using Lavaan package (Rosseel, 2012) for structural equation modelling in R (R-Core Team, 2020) statistical software. The following indices: Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root-Mean Square Error (RMSEA) were used testing the validity of the SSSLCS. It been asserted that CFI and TLI values greater than or equal to .95 indicates good fit; and RMSEA of .05 or less is an indication of good fit (Kline, 2016). Research Question Three was answered using Cronbach Alpha.

Result

The result of this study is presented in line with the research questions that guided the study:

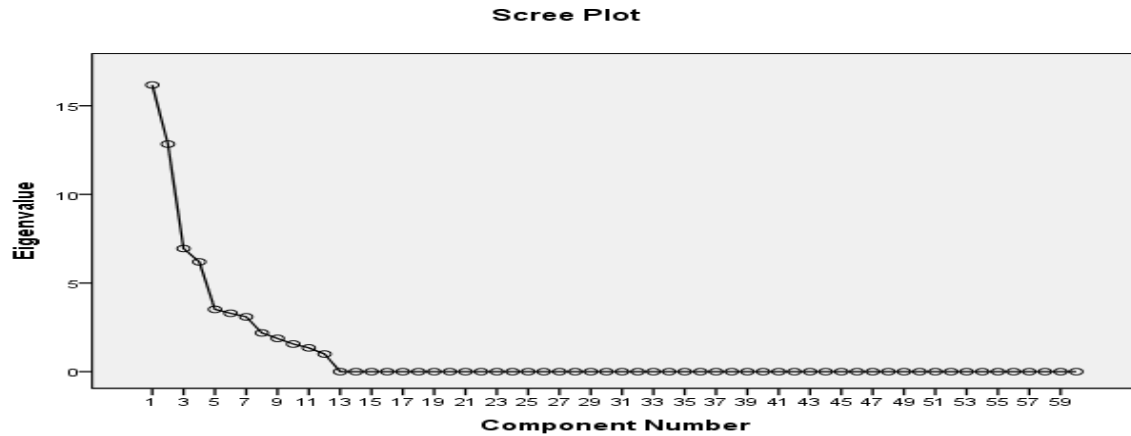**Research Question One**: How many salient factors underlie the locus of control scale?

Figure 1: **Scree Plot of the eigenvalues for correlation matrix of the 60 items**

The scree plot reveals that the last big drop occurs between 4th and 5th component. The scree plot also reveals that the biggest drop occurs between 11th and 13the component. Therefore, to identify the number of salient factors, it suffices to examine Table 1 which displays the total variance explained.

Table 1: Total Variance Explained by the Components

Component.	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var.	Cumulative %	Total	% of Var.	Cumulative %	Total	% of Var.	Cumulative %
1	16.17	26.95	26.95	16.17	26.95	26.95	7.19	11.98	11.98
2	12.84	21.39	48.35	12.84	21.39	48.35	5.55	9.24	21.22
3	6.95	11.57	59.92	6.95	11.57	59.92	5.47	9.11	30.33
4	6.19	10.32	70.25	6.19	10.32	70.25	5.43	9.05	39.38
5	3.52	5.86	76.10	3.52	5.86	76.10	5.34	8.90	48.27
6	3.29	5.49	81.59	3.29	5.49	81.59	5.24	8.74	57.01
7	3.09	5.15	86.75	3.09	5.15	86.75	5.11	8.52	65.53
8	2.18	3.64	90.39	2.18	3.64	90.39	5.00	8.34	73.86
9	1.88	3.13	93.51	1.88	3.13	93.51	4.97	8.28	82.15
10	1.56	2.60	96.11	1.56	2.60	96.11	4.96	8.26	90.40
11	1.34	2.23	98.34	1.34	2.23	98.34	4.76	7.94	98.34

Extraction Method: Principal Component Analysis.

Table 1 reveals the cumulative and total variance explained by the 11 factors that explain 98.34 percent variance in the SLCS. Out of the 60 items analyzed with exploratory factor analysis, 40 are factorial pure, 6 are factorial complex and 4 are factorial impure. The 40 factorial pure items are distributed in the 11 factors. Ten (10) items loaded on factor 1; 9 items loaded on factor 2; 8 items loaded on factor 3; 3 items each loaded on Factor 5 and Factor 6; 2 items each loaded on Factor 7, 8, 9, 10 and 11 respectively. The Table 1 shows that the cumulative percentage of Extraction Sums of Squared Loadings for the first 4 factors is 70.25 and total variance explained by each of the remaining factor ranges from 3.52 to 1.34. This implies that the first 4 factors are the salient factors in the scale. This is further confirmed by Table 2 which displays the factor loadings of the items.

Table 2: Salient Factors Loadings

S/N	Items	Personal Internal Locus of Control	F1	F2	F3	F4
1.	i2.	My success in school depends on my efforts, and not a matter of being lucky.	.72			
2.	i3.	My performance in last term was a true reflection of my knowledge.	.84			
3.	i7.	I know certainly, that I will make a good grade by hardworking.	.61			
4.	i13.	Sometimes I feel I deserve the punishments meted to me in school.	.79			
5.	i21.	I feel I am responsible for my position in my class.	.88			
6.	i29.	I believe my destiny is in my actions and inactions.	.59			
7.	i37.	I believe my performance in examination is a function of my efforts and persistence.	.86			
8.	i39.	If I fail in an examination, I don't blame anybody.	.75			
9.	i45.	My misfortunes are mainly as results of my mistakes.	.64			
10.	i57.	I hardly believe in luck or chance influencing my grades.	.83			
General Internal Locus of Control						
11.	i5.	I believe that what happens to students is as a result of their actions.		.76		
12.	i17.	Most often things turn out the way people plan them.		.92		
13.	i23.	I believe that those who have made it in life really worked for their success.		.57		
14.	i26.	I feel every dull student can become bright by hardworking and determination.		.58		
15.	i28.	I believe anyone can do well academically by studying hard.		.77		
16.	i53.	Making good grades is matter of adequate preparation and has nothing to do with luck or chance.		.71		
17.	i54.	Life is not fair to every student; some are lucky than others.		.45		
18.	i56.	I believe there is a relationship between hard work and success		.61		
Personal External Locus of Control						
19.	i1.	I am not always lucky to make good grades			.89	
20.	i4.	My last term result was negatively influenced by my teachers.			.67	
21.	i6.	Sometimes I feel that I do not have control over what happens to me.			.85	
22.	i12.	Sometimes I feel teachers punish students unnecessarily.			.59	
23.	i18.	I would have done better in my last term exams but many factors beyond my control stopped me.			.51	
24.	i22.	At times I perform below my expectation, but it is not always my fault			.49	
25.	i25.	I believe I don't have control over my academic performance.			.78	
26.	i35.	The success I have is largely a matter of chance.			.87	
27.	i40.	I often blame my teachers and my parents for my academic performances.			.68	
General External Locus of Control						
28.	i11.	If students don't do well in take home assignments, they always have excuses for that.				.54
39.	i20.	Sometimes I feel that those who perform excellently in academic work are just lucky.				.46
30.	i24.	I believe that one can be successful even without hardworking once it is destined by God.				.78
31.	i27.	I feel intelligence can only be inherited.				.72
32.	i30.	I believe success in exams is not for the students who studied but for the lucky ones.				.81
33.	i51.	I believe that, what will happen to students, will certainly happen, no matter the efforts of students.	I			.69

Table 2 shows the item loadings for the 4 salient Factors. On Factor 1 (Personal Internal Locus of Control), the following items 2, 3, 7, 13, 21, 29, 37, 39, 45 and 57. Factor 2 (General Internal Locus of Control) items 5, 17, 23, 26, 28, 53, 54 and 56. Factor 3 (Personal External Locus of Control), item1, 4, 6, 12, 18, 25, 35, and 40. Factor 4 (General External Locus of Control) item11, 20, 24, 27, 30 and 51.

Research Question 2: What is the construct validity of the locus of control scale?
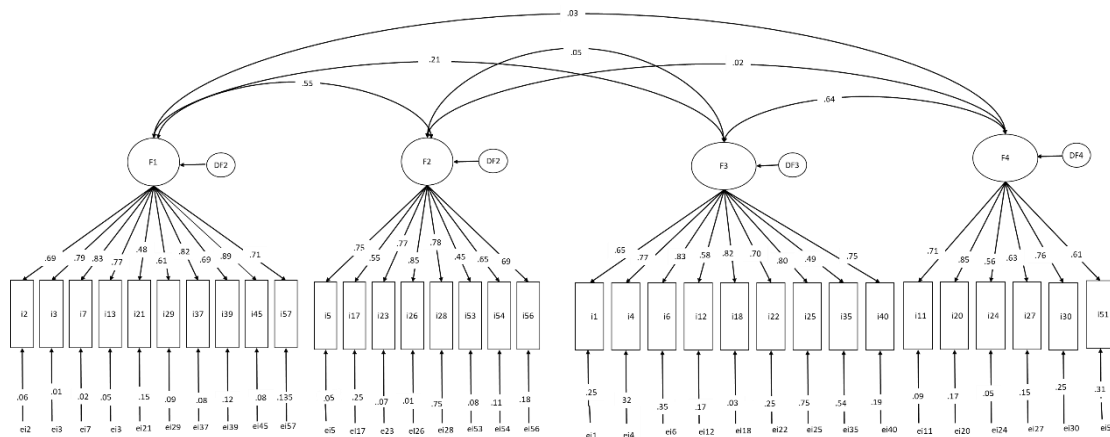

Figure 2: Path diagram of cfa of the SSSLCS

Based on the 4 salient factors that underlie the scale, the items of the salient factors were assembled accordingly and administer on the same sample. A hypothesised 4-factor correlated model was specified, estimated and evaluated as shown in Figure2. The cfareveals , □ /df.=1.88, CFI=.97, TLI=.94, SMSEA=.06, and SRMR=.05. It implies that there is a good fit between the hypothesied four factor model and the data.

Research Question Three: What are the reliabilities of the salient factors that underlie the SLCS?

Table 3 Reliability Estimates of the SLCS Factors

S/N	Cronbach Alpha Coefficients
Factor 1 (Personal Internal Locus of Control)	.91
Factor 2 (General Internal Locus of Control)	.88
Factor 3 (Personal External Locus of Control)	.79
Factor 4 (General External Locus of Control)	.84

Table 3 shows reliability estimates of the internal consistence for the 4-salient Factors that underlie the SLCS. The reliability coefficients ranges from .79 to .91. These results reveal that the SLCS is reliable as the underlie factors shown strong reliability estimates of .79 and above

Discussion

The study developed instrument for measuring secondary school students' academic locus of control (SSSALC). Research question one revealed that there are four (4) salient factors that underlie the SSSALC. The factors are classified as personal internal locus of control, general internal locus of control, personal external locus of control and general external locus of control. The findings of the study were in line with Curtis and Trice (2013) who found four factors within college students' academic locus of control scale. The findings of the study, however, were not in agreement with experts who found two dimensions (Rotter, 1966; Suarez-Alvarez, 2016) and three dimensions (Lavanson, 1974; Santokhie&Lipps, 2020) of locus of control. The discrepancies in the observed number of factors that underlie students' academic locus of control scale might be attributed to academic the structure of the items. For example, the popular Rotters' locus of control scale was structured to measure not only academic locus of control but lives generally. More so, confirmatory factor analysis confirmed that a four- factor correlated model fit the data collected using the SSSALC. The reliability of the estimates of the internal consistence of thefactors indicated that the instrument is reliable for measuring secondary school students' academic locus of control.

Conclusion

Based on the findings of the study, it is concluded that secondary school students' academic locus of control has four dimensions; personal internal locus of control, general internal locus of control, personal external locus of control, and general external locus of control. And that the SSSALC has high psychometric values.

Recommendation

1. Teachers, and guidance and counsellors should often measure students' locus of control using the developed SSALC and thus, provide the students with necessary supports.
2. With the developed SSALC, Researchers should also give adequate attention to secondary school students'academic locus of control as this could influence their perceptions performance in their future careers.
3. Government should sponsor a national research on assessment of secondary school students' locus of control in all secondary schools in Nigeria for urgent diagnostic and remediation of any identified cases of poor locus of control.

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