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Development And Psychometric Validation Of Home Environment Learning Scale For Secondary School Students

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Abstract: ***The home influences the child at the most earliest possible time of his life at a time when his mind is most receptive. It provides the first impression which may last through the whole life of the child.. Therefore, it becomes imperative to know the students Home Education Environment Learning Scale for students. The study is on development and psychometrics validation of Home Environment Learning Scale. The instrument has 14 items. The instrument was administered to a purposive sample of 1245 students from 35 secondary schools in Bayelsa State, Nigeria. The sample was randomly split in two halves. The sample was divided into two. 573 cases representing 46% was used for exploratory factor analysis while the second sample 672 cases representing 54% was used for confirmatory factor analysis. The Exploratory Factor Analysis (EFA) was conducted on the 14 items to explore the underlying structure of the MAI, Bartlett's Sphericity test was used to investigate whether the intercorrelation matrix contains sufficient common variance to make the factor analysis viable. The significant χ 2 value, χ 2 (91) 3042.550,p=0.00 and the high Kaiser–Meyer–Olkin value, 0.816, support the use of EFA The results of the Exploratory Factor Analysis resulted in three factor Solution that is parental supervision, parental assistance and learning materials. To validate the structure or factors obtained from the EFA, an confirmatory factor analysis was conducted using second sample of 672. The CFA results indicates model fit of the three-factor model derived from EFA is acceptable in CFA (χ2=2643.032; df =78; p=0.000; CFI=0.913; RMESA =0.075; SRMR = 0.056).The result of model fit were above the recommended cut of 0.90 for CFI, TLI and less than 0.08 for RMSEA and SRMR respectively. Furthermore, the study also indicates that items loading in the respective dimension were significant. Therefore, the Home Environment Learning Scale is valid and reliable.***

Keywords: Psychometrics, Validation, Learning, Home Environment, Scale

I. INTRODUCTION

The importance of learning in an individual cannot be over emphasized. Learning has a long lasting impact on one's life. For example the acquisition of knowledge and skills and all other things that is worthwhile, which are transmitted to a person through formal and informal education determines his or her potential in future. Basically, we understand that the home is the first school for a child where he or she is taught the basics norms and values by the parents before the child leaves for the formal education. Learning and reading begins in school but the first foundation of the child begins at home (Burtless, 1996).

A home is a place where pupils live with their parents or guardian and it is the place where they are groomed. It is a place where the pupils begin to learn the norms and values of the society in which they find themselves. The family is a social unit in any society and it is the source of early stimulation and experience in children (Collins, 2007). The home influences the child at the most earliest possible time of his life at a time when his mind is most receptive. It provides the first impression which may last through the whole life of the child. The child often sees the parents, siblings and things in their immediate environment to be most significant and they are capable of promoting or diminishing him in self-worth and academic performance (Ekanem, 2004). Aspects of home learning environment can also be divided into activities that include informal or incidental learning during everyday activities and formal parental teaching or instruction (LeFevre

et al. 2009; Se´ne´chal & LeFevre 2002; Skwarchuk, Sowinski, & LeFevre, 2014).

To assess home environment education level, the Parenting Style Inventory II (PSI-II), was developed by Darling and Toyokawa (1997). The 15-items Parenting Style Inventory consists of three subscales: Demandingness (degree to which parents have expectations and standards they expect their child to fulfill), Responsiveness (degree of emotional sensitivity and responsiveness), Autonomy granting or permissiveness (degree to which parents allow ad encourage their children to develop their own ideas, beliefs, and point of view). Participants responded to each item following the prompt 'How much do you agree or disagree with this sentence?" using a 5-point likert – type scale (1 ='strongly disagree' to 5 = 'strongly agree'). The coefficient alpha of responsiveness (a= 82), autonomy granting or permissiveness (a = .75) and demandingness (a = .72), respectively.

The parents socio-economic status of adolescents' scale was developed by Salami (2000). It was developed to measure the educational, occupational and social status of the adolescents'. The items in the scale requested for data of the participants also. These items included parents' occupational (10 marks), parents level of education (12 marks), parents residence (5 marks), parents possession of necessary and luxury items (29 marks) giving the total of fifty marks maximum score of 56. The test-retest reliability of the scale was .73. Niklas, Nguyen, Cloney, Tayler, and Adams (2016) developed and tested the psychometric properties of a short-form measure of home learning environment with a Rasch item-response-model using longitudinal data from over 1600 Australian families, Furthermore, the person reliability index of the model was higher than the reliability index of the other competing models (0.81 for the one-dimensional model, 0.87 and 0.80 for dimension 1 and 2 for the two-dimensional model, and between 0.76 and 0.78 for the three-dimensional models). The two items on formal learning frequency (items 8 and 9) had an excellent fit. The correlations between the two dimensions was 0.7, whereas the correlations between the dimensions of the three-dimensional model were much higher (literacy/numeracy = 0.90; literacy/creativity = 0.86; numeracy/creativity = 0.88), indicating that the three-dimensions did not differentiate well for the 12 study items.

A review of the literature above indicate that no scale of on measures of home learning specifically for secondary school in Nigeria context. The problem of this study is how to develop and validate a scale for assessment of home learning environment in Nigeria for secondary school students using both exploratory factor and confirmatory factor analysis.

II. RESEARCH METHOD

The study is a instrumentation research design which focuses on development and psychometrics validation of research instrument. The sample for the study is 1245 student that was selected 35 secondary school in Bayelsa State, Nigeria using purposive sampling techniques. The instrument was developed based on literature review. The instrument has three dimension. The first dimension is parental supervision, second dimension is learning materials and the third dimension is parental assistance. The instrument has 14 items with item1,2,3,4 and 5 measuring parental assistance, item 6, 7,8, 9 and 10 measuring learning materials available at home dimension while item 11, 12, 13 and 14 measuring parental assistance dimension. Items 2, 3, 5, 8 and 11 were negatively worded while item 1, 4, 6, 7, 9, 10, 12,13 and 14 were positively worded. The instrument was scored as SA – Strongly Agree (5points), A- Agree (4points), U—Undecided (3points), D –Disagree (2points), SD- Strongly Disagree (1pont),

The sample 1245 was divided into two. 573 cases representing 46% was used for exploratory factor analysis while the second sample 672 cases representing 54% was used for confirmatory factor analysis. EFA was performed using SPSS version 23 and confirmatory factor analysis was performed using R programming Language.

III. RESULTS

Preliminary analysis. In preparation of data for the analysis, data were screened for missing values, outliers, and normality distributions. There were some missing values. Missing values were evaluated with respect to both cases and variables. 568 cases (99.13%) had valid, non-missing values and 5 cases (0.87%) had missing values. Nine variable had no missing values. Then five variables with missing values. Little's MCAR test was used to assess the pattern of missing values. If the p-value for Little's MCAR test is not significant, then the data can be assumed to be MCAR. Little's MCAR test showed that the missing values can be assumed to be MCAR (χ^2= 54.109, df= 65, p= 0.832). 5 cases were deleted and the number of cases were reduced to 568.

Univariate and multivariate outliers were detected. To assess univariate outliers, all variables were converted to z scores. Tabachnick and Fidell (2012) recommend considering cases with Z scores higher than 3.29 (p <.001, two-tailed test) to be outliers. Two cases were above 3.28 recommended and deleted. The number of cases then reduced to 566. Multivariate outliers were identified by computing each case's Mahalanobis distance and a case is considered as a multivariate outlier if the probability associated with its D^2 is 0.001 or less (Tabachnick & Fidell, 2012). 19 multivariate outliers were identified and deleted. After deleting these cases, the remaining data contained of 547 cases.

Normalitiy distribution was assessed using skewness and kurtosis. Tabachnick and Fidell (2012) suggest that skewness and kurtosis values should be within the range of -2 to +2 when the variables are normally distributed. The values ranged between -.093 to 1.488 for skewness and between -.289 and 1.697 for kurtosis as shown in table. This indicated that the data is normality distributed.

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
v1	547	3.15	1.376	-.211	.104	-1.237	.209
v2	547	3.23	1.374	-.304	.104	-1.154	.209
v3	547	3.38	1.416	-.422	.104	-1.172	.209
v4	547	3.05	1.322	-.059	.104	-1.172	.209
v5	547	3.50	1.448	-.569	.104	-1.087	.209
v6	547	4.17	1.116	-1.449	.104	1.336	.209
v7	547	4.18	1.062	-1.494	.104	1.733	.209

v8	547	4.04	1.167	-1.309	.104	.912	.209
v9	547	4.07	1.126	-1.230	.104	.742	.209
v10	547	4.08	1.184	-1.353	.104	.970	.209
v11	547	3.73	1.273	-.799	.104	-.476	.209
v12	547	3.80	1.277	-.891	.104	-.304	.209
v13	547	3.68	1.324	-.656	.104	-.833	.209
v14	547	3.80	1.233	-.872	.104	-.222	.209

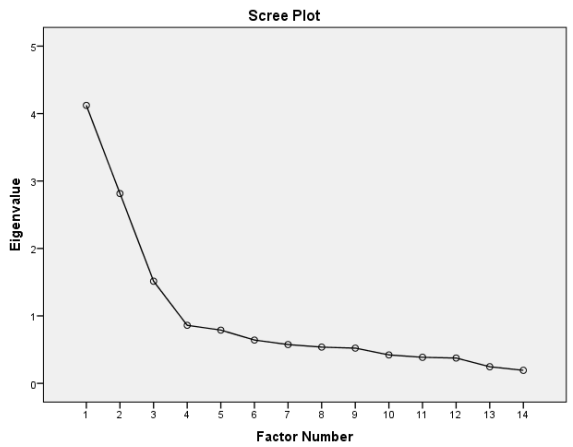
Table 1: Descriptive Statistics of items on the scale

Before exploratory factory analysis was conducted on the 14 items to explore the underlying structure of the MAI, Bartlett's Sphericity test was used to investigate whether the intercorrelation matrix contains sufficient common variance to make the factor analysis viable. The significant χ 2 value, χ 2 (91) 3042.550,p=0.00 and the high Kaiser–Meyer–Olkin value, 0.816, support the use of EFA (Field, 2012). Two criteria for determining the number of components were considered: Kaiser's criterion to retain eigenvalues greater than 1 (K1) and Cattell's scree test (Kline, 1998). The K1 rule retains all factors with eigenvalues greater than 1.0, whereas the scree test illustrates the plotted eigenvalues for drastic changes between adjacent pairs of plotted eigenvalues (Gorsuch, 2014). Both tests suggest three factor solution.

An exploratory factor analysis using principal maximum likelihood and varimax rotation with a forced 3-factor solution was then performed. Following Hair et al."s (2010) recommendation, items with factor loading of .40 and less were removed from further analysis.

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.122	29.441	29.441	3.716	26.542	26.542	3.206	22.900	22.900
2	2.815	20.105	49.546	2.239	15.996	42.538	2.077	14.835	37.735
3	1.515	10.818	60.364	.998	7.127	49.664	1.670	11.930	49.664
4	.861	6.147	66.511						
5	.789	5.637	72.148						
6	.642	4.586	76.734						
7	.575	4.110	80.844						
8	.537	3.836	84.679						
9	.523	3.732	88.412						
10	.422	3.012	91.424						
11	.386	2.758	94.182						
12	.375	2.682	96.864						
13	.246	1.757	98.621						
14	.193	1.379	100.000						

Table 2: Total Variance Explained



	Factor		
	1	2	3
1. I spend so many hours every week studying with my parents at home	.820		
2. My parents do not help me in doing home work	.866		
3. My parents encourage me at home with some rewards whenever I perform well in school.	.764		
4. My parents do not encourage me to watch and listen to news that are educative every day at home	.710		
6. My parent provide evening teacher that teaches me at home		.565	
7. My parents have library where I read at home		.572	
8. My parents have not provided study materials for me at home		.649	
9. My parents provide more opportunities for me to understand things about me		.639	
10. My parents give me extra home work related to my subjects in school.		.711	
11. My parents do not check my assignment/notebooks at home every day			.467
12. My parents' guide me on my educational activities			.529
13. My parents do check my academic result at the end of every term			.742
14. I am motivated to study hard by my parents when they check my academic work at home from time to time			.567

Item 5 my parents have set a standard that I must attain in school was deleted since it load more than one factor

Table 3: Rotated Factor loading of items

	Initial	Extraction
I spend so many hours every week studying with my parents at home	.629	.679
My parents do not help me in doing home work	.713	.776
My parents encourage me at home with some rewards whenever I perform well in school.	.600	.632
My parents do not encourage me to watch and listen to news that are educative every day at home	.518	.532
My parent provide evening teacher that teaches me at home	.317	.330
My parents have library where I read at home	.332	.351
My parents have not provide study materials for me at home	.346	.424
My parents provide more opportunities for me to understand things about me	.362	.453
My parents give me extra home work related to my subjects in school.	.406	.507
My parents do not check my assignment/notebooks at home every day	.316	.290
My parents' guide me on my educational activities	.260	.292
My parents do check my academic result at the end of every term	.426	.588
I am motivated to study hard by my parents when they check my academic work at home from time to time	.338	.388

Table 4: Communalities of items

IV. CONFIRMATORY FACTOR ANALYSIS

To validate the structure of the instrument obtained from EFA, data screening in preparation of data for the confirmatory analysis was conducted, data were screened for missing values, outliers, and normality distributions. There were some missing values. Missing values were evaluated with respect to both cases and variables. 667 cases (99.26%) had valid, non-missing values and 5 cases (0.74%) had missing values. Eight variable had no missing values. Three variables with missing values. Little's MCAR test was used to assess the pattern of missing values. If the p-value for Little's MCAR test is not significant, then the data can be assumed to be MCAR. Little's MCAR test showed that the missing values can be assumed to be MCAR (χ^2= 50.790, df= 60, p= 0.796). Therefore five cases were deleted and number of cases were reduced to 667.

Univariate and multivariate Outliers were detected. To assess univariate outliers, all variables were converted to z scores. Tabachnick and Fidell (2012) recommend considering cases with Z scores higher than 3.29 (p <.001, two-tailed test) to be outliers. Two cases were more than 3.29 recommended and were deleted, the sample was then reduced to 665. Multivariate outliers were identified by computing each case's Mahalanobis distance and a case is considered as a multivariate outlier if the probability associated with its D^2 is 0.001 or less (Tabachnick & Fidell, 2012). Twenty cases of multivariate outliers were identified and deleted. After deleting these cases, the remaining data contained of 643 cases.

Normalitiy distribution was assessed using skewness and kurtosis. Tabachnick and Fidell (2012) suggest that skewness and kurtosis values should be within the range of -2 to +2 when the variables are normally distributed. The values ranged between -.052 to 1.496 for skewness and between -.163 and 1.723 for kurtosis as shown in table. This indicated that the data is normality distributed, maxmum likelihood estimation was used in CFA

The term of the CFA model fit, the threshold values of RMSEA ⩽0.08, SRMR⩽0.10, CFI⩾0.9 and NNFI⩾0.9 are recommended (Hair et al., 2010; Bartlett, 1951). The CFA results indicates model fit of the three-factor model derived from EFA is acceptable in CFA (χ2=2643.032; df=78; p=0.000; CFI=0.913; RMESA =0.075; SRMR = 0.056). The average variance of parental assistance subscale= 0.59, learning material subscale=0.41, and parental supervision=0.38. Therefore construct reliability of the instrument was also achieved using the CFA approach in validating the structure obtained through EFA.

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
v1	643	3.16	1.370	-.200	.096	-1.241	.192
v2	643	3.29	1.364	-.353	.096	-1.109	.192
v3	643	3.41	1.405	-.441	.096	-1.151	.192
v4	643	3.06	1.291	-.052	.096	-1.095	.192
v6	643	4.17	1.112	-1.418	.096	1.271	.192
v7	643	4.18	1.071	-1.496	.096	1.723	.192
v8	643	3.99	1.196	-1.211	.096	.569	.192
v9	643	4.08	1.116	-1.239	.096	.802	.192
v10	643	4.04	1.204	-1.290	.096	.753	.192
v11	643	3.82	1.238	-.887	.096	-.267	.192
v12	643	3.85	1.253	-.947	.096	-.163	.192
v13	643	3.74	1.312	-.728	.096	-.713	.192
v14	643	3.81	1.224	-.878	.096	-.198	.192

Table 5: Descriptive Statistics of each items

Latent Factor	Indicator	Ava	loading
PA	V1		0.77
PA	V2	0.59	0.90
PA	V3		0.75
PA	V4		0.61
LM	V6		0.61
LM	V7		0.64
LM	V8	0.41	0.62
LM	V9		0.65
LM	V10		0.67
PS	V11		0.52
PS	V12		0.55
PS	V13		0.74
PS	V14	0.38	0.61

Table 6: Confirmatory Factor Loadings of the scale items

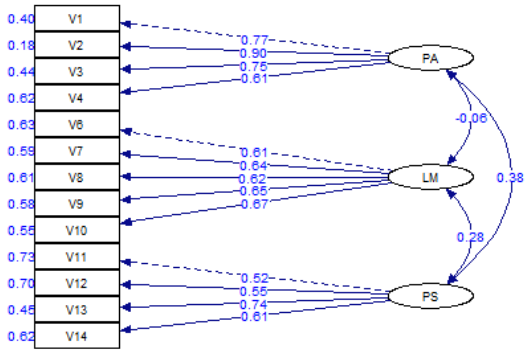


Figure 2: Path Diagram of CFA model

V. DISCUSSION AND CONCLUSION

The home influences the child at the most earliest possible time of his life at a time when his mind is most receptive. It provides the first impression which may last through the whole life of the child. Therefore, it becomes imperative to know the students Home Education Environment Learning Scale for students. The study is on development and psychometrics validation of Home Environment Learning Scale. The instrument has 14 items. The instrument was administered to a purposive sample of 1245 secondary students in Bayelsa State, Nigeria. The sample was randomly split in two halves. The sample 1245 was divided into two. 573 cases representing 46% was used for exploratory factor analysis while the second sample 672 cases representing 54% was used for confirmatory factor analysis. The Exploratory Factor Analysis (EFA) was conducted on the

14 items to explore the underlying structure of the Home Environment Learning Scale, Bartlett's Sphericity test was used to investigate whether the intercorrelation matrix contains sufficient common variance to make the factor analysis viable. The significant χ 2 value, χ 2 (91) 3042.550,p=0.00 and the high Kaiser–Meyer–Olkin value, 0.816, support the use of EFA. The above finding is supported by recommendation of KMO above 0.7 (Field, 2012). The results of the Exploratory Factor Analysis resulted in three factor Solution that is parental supervision, parental assistance and learning materials. To validate the structure or factors obtained from the EFA, an confirmatory factor analysis was conducted using second sample of 672. The CFA results indicates model fit of the three-factor model derived from EFA is acceptable in CFA (χ2=2643.032; df =78; p=0.000; CFI=0.913; RMESA =0.075; SRMR = 0.056).The result of model fit were above the recommended cut of 0.90 for CFI, TLI and less than 0.08 for RMSEA and SRMR respectively. The above study is line with (Hair et al., 2010; Bartlett, 1951) study that recommended the threshold values of RMSEA $\leqslant$0.08, SRMR$\leqslant$0.10, CFI$\geqslant$0.9 and NNFI$\geqslant$0.9 as good model fit for confirmatory factor analysis. Furthermore, the study also indicates that items loading in the respective dimension were significant.

Cronbach Alpha reliability coefficient of the final form of the attitude scale for physical education and sports teachers concerning measurement and evaluation was calculated as 0.85. Therefore, the geography interest inventory is valid and reliable and can be used by the school counselors, the geography teachers and the school management to measure student interest level in geography so to help them develop interest in the subject and possibly increase enrollment.

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