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Reliability and validity of the self-constructed effective learning scale

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Abstract

Effective Learning is being stated as, "learning how to learn," actively involves the students in metacognitive learning processes of planning, monitoring and reflecting. Dennison and Kirk (1990) Effective Learning model explains that it takes place through four elements, i.e., Active Learning, Collaborative Learning, Learner Responsibility, and Learning About Learning of teaching-learning process. The present study was envisaged to develop a valid and reliable scale to assess the Effective Learning of students. The items were pooled in from various sources and were subjected to statistical procedures of face validity, content validity, factor analysis, reliability, and internal consistency. After subjecting to these processes, the final version of the Effective Learning Scale (ELS) consisted of 52 items. The questionnaire was then administered to 400 students to test reliability and validity. The results indicated that the tool has emerged as an excellent reliable and valid scale.

Keywords: Effective Learning, students, validity, reliability

1.1 Introduction

Learning is an active process in which the learner relates the new experience to existing meaning, and may accommodate and assimilate new ideas. The process is influenced by the use to which learning is to be put: how the learning informs action in future situations is vital. Learners' conceptions of learning reflect their educational experiences – the style of teaching, the disciplines followed, and the assessment systems in which their learning has occurred.

Being interested, motivated and engaged in learning is essential for children once they start school. Some learning approaches work better for a few students than others.

Lesson planning should reflect a variety of ways to offer an effective learning experience by all students. If the teacher knows that a student builds understanding best when she can watch a demonstration and then dialog about the content and its implications, she should be provided that experience. While each student has different approaches to learning, learning preferences do overlap in groups of students. The result is activities that are accessible to small and large student groups (McCarthy, 2014) [7].

Teachers can start using learning profiles when they know the various ways that each of the students makes sense of content. The more teachers understand the students, the more efficient can be ensured their learning successes. When teachers have an in-depth understanding of how the students learn, there is a major impact on diagnosing student needs and planning effective supports. The careful use of learning profiles keeps the light on and the door open for them to learn (McCarthy, 2014) [7]. Therefore, learning will be successful if an effective teaching-learning process is applied. William F Dennison and Roger E. Kirk (1990) in their Effective learning Model explained effective learning takes place through four elements of the teaching-learning process.

Active Learning: Active engagement with materials, persons, and ideas are needed, with active reflection, inquiry, and sensemaking. It is not sufficient to be engaged in an activity: without reflection, the learning potential is lost. Pupils welcome this: they rate activities such as research, group work, practical work and class discussions as twice as effective at promoting their learning (Hughes, 1997) [4].

Collaborative Learning: When learners together create a joint product and understanding, they develop higher-order skills. Co-operative cultures and group investigation methods give better academic results (Hogan, 1999) [3]. Learners develop interpersonal and management skills (Slavin, 1995) [12], improved communication skills and positive multi-ethnic relations.

Learner Responsibility: Learners who see themselves as key players in their learning are not only more self-directed, they are also more collaborative: when this is not so, dependent roles emerge, and engagement reduces. When learners plan how to proceed, they gain over high-quality teacher-planned occasions in terms of academic scores, retention of knowledge, and reports of enjoyment, motivation, and effort (Hughes, 1993) [5].

Learning about Learning: Learners are encouraged to notice aspects of their learning as they engage in tasks. This is not merely taught: classroom practices which promote learning about learning include: making learning an object of attention, conversation, reflection, and learning.

In view of the above discussion, research was undertaken to construct and validate a scale to assess Effective Learning among elementary school children.

1.2 Method

1.1.1 Sample

The study sample consisted of 400 children of 10-13 years

Studying in VI standard of various schools located in Bangalore city. The sample for the present study was selected through cluster sampling technique.

1.1.2 Procedure
The following steps have been carried in the development and validation of the Effective Learning Scale (ELS) for elementary school children.

1.2.2.1 Step 1: Item Generation
Generating items for the scale is the first step in tool development. Pooling in suitable items for the scale will help in achieving the objectives set for the scale. The investigator is concerned with a variety of parameters that regulate the setting of each item and the scale as a whole. For example, suitable scale instructions, an appropriate number of items, adequate display format, appropriate item redaction (all items should be simple, clear, specific, ensure the variability of response, remain unbiased, etc.), among other parameters (DeVellis 2003; Pasquali 2010) [9].

The initial pool of items was generated from an extensive review of literature related to learning among the children, online assessments, books and magazines related to Effective Learning. The statements were formulated to understand Effective Learning among the respondents completely. After reviewing, the investigator identified, adapted and compiled a total of 112 statements. (Refer table 1)

Table 1: Items selected from various sources for face validity

Sources	Number of Items	Percentage
Previous Literature		
Thesis	09	8.03
Peer Reviewed Papers	20	17.85
Books		
Children Books	15	13.39
Magazines	10	8.94
Internet Source		
Online learning scales	40	35.71
Online Library	10	8.94
Online Journal	08	7.14
Total	112	100

a) Face Validity

The researcher and the research guide skimmed the surface in order to form an opinion whether “on its face” it looks like a good translation of the construct. The statements which were suitable were picked with overall 89 statements were retained.

b) Content Validity

Content validity addresses the issue of whether all facets of the construct of interest are being measured (Robertson, 2017) [11]. Content validity indicates whether the content reflects a complete range of the attributes under study and is usually undertaken by seven or more experts (Polit & Hungler 1999; DeVon *et al.* 2007) [10].

The pool of statements finalized in face validity was subjected to experts in the disciplines of Human Development, Psychology, Education and School teachers (09 experts) to scrutinize the items on its relevance and rate them on a scale of 10, 10 being highly relevant and 1 being least relevant.

The result obtained from the content analysis was quantified. The items which obtained more than 8 rating were identified. Thus, a total of 52 statements were retained. (Refer table 2).

Table 2: Content validity by nine subject experts for developing MII

Description	Number of Items	Percentage
Number of items screened at face validity	112	100.0
Number of items evaluated by experts	89	79.46
Number of items retained	52	49.42
Number of items considered for the pilot study	52	49.42

1.2.2.2 Step 2: Scale Development
a) Pilot Study

A pilot study is conducted to examine the reliability of the proposed tool for the research study. When estimating the sample size for the pilot trial, Connelly (2008) [1], discusses that extant literature suggests that a pilot study sample should be 10% of the sample projected for the larger parent study. Isaac and Michael (1995) [6] suggested 10 – 30 participants; Hill (1998) suggested 10 to 30 participants for pilots in survey research; Treece and Treece (1982) [14] suggested 10% of the project sample size. For the present study, a sample of 40 elementary children studying in the sixth standard in Bangalore city was selected for conducting the pilot study. The data obtained was subjected to statistical analysis to check reliability and internal consistency.

b) Internal Consistency

Internal consistency is typically measured using Cronbach's Alpha (α). Cronbach's Alpha ranges from 0 to 1, with higher values indicating greater internal consistency (and ultimately reliability) (Taylor, 2013) [13]. The internal consistency of the MII scale was assessed through Cronbach's alpha coefficient. The scale obtained Cronbach`s Alpha of 0.919 indicating very good Internal consistency.

c) Reliability

Reliability refers to the consistency, stability, and repeatability of results, i.e., the result of a researcher is considered reliable if consistent results have been obtained in identical situations but different circumstances (Twycross and Shields, 2004) [15].

For the present study, the Spearman-Brown Spilt –half and Guttman Spilt –half co-efficient methods were used to assess the reliability of the instrument for the present study. The ELS obtained 0.961 on Spearman-Brown and 0.926 Guttman Spilt –half co-efficient indicating high reliability of the scale.

1.2.2.3 Step 3: Scale Evaluation
The ELS, after assessing the reliability and internal consistency based on Pilot study results, was administered to the larger sample. Again, the scale was evaluated through factor analysis, reliability and internal consistency based on the results obtained from large scale study.

a) **Factor Analysis**

Factor Analysis is an exploratory technique applied to a set of observed variables that seeks to find underlying factors (subsets of variables) from which the observed variables were generated. Factor analysis is carried out on the correlation matrix of the observed variables (NCSS Statistical Software).

The exploratory factor analysis was conducted for 52 items using SPSS 18.0. A Principal Component Analysis of 52 Likert scale statements from the Effective Learning Scale was conducted on data gathered from 400 participants. Bartlett's test was administered, and the results are as follows:

An examination of Kaiser-Meyer-Olkin (KMO) suggested (Ref table 3) that the sample was factorable (KMO = 0.670). Bartlett's test of sphericity for ELS suggested significant at 0.000 level of significance (Ref table 3). Hence Factor Analysis is considered as an appropriate technique for further analysis of the data.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.670
Bartlett's Test of Sphericity	Approx. Chi-Square	8358.23
	Degrees of Freedom	3160
	Significance	0.000

Communalities

Indicate the amount of variance in each variable that is accounted for. A communality is an extent to which an item correlates with all other items. Higher communalities are better if communalities for a particular variable are low (between 0.0-0.4), then that variable may struggle to load significantly on any factor. The communalities ine table 4 are all high, which indicates that the extracted components represent the variables well.

Table 4: Communalities

Item No.	Initial	Extraction	Item No.	Initial	Extraction
Q1	1.000	0.859	Q27	1.000	0.931
Q2	1.000	0.894	Q28	1.000	0.834
Q3	1.000	0.826	Q29	1.000	0.898
Q4	1.000	0.890	Q30	1.000	0.924
Q5	1.000	0.788	Q31	1.000	0.817
Q6	1.000	0.924	Q32	1.000	0.739
Q7	1.000	0.766	Q33	1.000	0.874
Q8	1.000	0.840	Q34	1.000	0.788
Q9	1.000	0.830	Q35	1.000	0.729
Q10	1.000	0.753	Q36	1.000	0.882
Q11	1.000	0.841	Q37	1.000	0.794
Q12	1.000	0.896	Q38	1.000	0.893
Q13	1.000	0.659	Q39	1.000	0.856
Q14	1.000	0.899	Q40	1.000	0.782
Q15	1.000	0.859	Q41	1.000	0.772
Q16	1.000	0.829	Q42	1.000	0.834
Q17	1.000	0.885	Q43	1.000	0.788
Q18	1.000	0.919	Q44	1.000	0.882
Q19	1.000	0.890	Q45	1.000	0.915
Q20	1.000	0.811	Q46	1.000	0.885
Q21	1.000	0.857	Q47	1.000	0.734
Q22	1.000	0.908	Q48	1.000	0.873
Q23	1.000	0.890	Q49	1.000	0.834
Q24	1.000	0.830	Q50	1.000	0.808
Q25	1.000	0.843	Q51	1.000	0.856
Q26	1.000	0.873	Q52	1.000	0.886

Eigen value

Reflects the number of extracted factors whose sum should be equal to number of items which are subjected to factor analysis. The following shows all the factors extractable from the analysis along with their eigenvalues.

The Eigenvalue table 5 has been divided into two sub-sections, i.e., Initial Eigen Values and Extracted Sums of Squared Loadings. For analysis and interpretation purpose we are only concerned with Extracted Sums of Squared Loadings. Here one should note that the first factor accounts for 20.183% of the variance and the sixteenth-factor accounts for 84.361%. All the remaining factors are not significant.

Table 5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.495	20.183	20.183	10.495	20.183	20.183
2	3.926	7.550	27.733	3.926	7.550	27.733
3	3.571	6.867	34.600	3.571	6.867	34.600
4	3.291	6.329	40.929	3.291	6.329	40.929
5	3.063	5.889	46.818	3.063	5.889	46.818
6	2.769	5.325	52.143	2.769	5.325	52.143

7	2.503	4.814	56.957	2.503	4.814	56.957
8	2.377	4.570	61.527	2.377	4.570	61.527
9	2.028	3.900	65.427	2.028	3.900	65.427
10	1.882	3.619	69.046	1.882	3.619	69.046
11	1.717	3.302	72.349	1.717	3.302	72.349
12	1.502	2.889	75.238	1.502	2.889	75.238
13	1.411	2.713	77.951	1.411	2.713	77.951
14	1.175	2.260	80.211	1.175	2.260	80.211
15	1.093	2.102	82.313	1.093	2.102	82.313
16	1.065	2.048	84.361	1.065	2.048	84.361
17	.982	1.889	86.250			
18	.809	1.555	87.805			
19	.711	1.368	89.173			
20	.692	1.331	90.504			
21	.637	1.225	91.729			
22	.459	.883	92.612			
23	.398	.765	93.377			
24	.390	.750	94.126			
25	.383	.737	94.863			
26	.350	.674	95.536			
27	.329	.633	96.169			
28	.267	.514	96.683			
29	.220	.424	97.107			
30	.196	.377	97.484			
31	.183	.352	97.837			
32	.183	.351	98.188			
33	.155	.298	98.486			
34	.123	.236	98.723			
35	.111	.213	98.935			
36	.091	.175	99.110			
37	.084	.162	99.273			
38	.078	.151	99.423			
39	.067	.130	99.553			
40	.050	.095	99.648			
41	.044	.085	99.734			
42	.042	.080	99.814			
43	.028	.054	99.868			
44	.024	.046	99.914			
45	.022	.042	99.956			
46	.010	.019	99.976			
47	.006	.012	99.987			
48	.004	.007	99.994			
49	.002	.003	99.997			
50	.001	.002	100.000			
51	.000	.000	100.000			
52	.000	.000	100.000			

Extraction Method: Principal Component Analysis.

The total variance of the ELS gives 84.361 percent of the cumulative variable

b) Internal Consistency and Reliability

The Effective Learning Scale (ELS) developed to assess was distributed to the 400 samples, aged between 10-13 years to test the reliability of the tool.

For the present study reliability of the Effective Learning Scale (ELS) is calculated by the following methods (Refer table 6):

Table 6: Internal Consistency and Reliability

	No. of Items	Cronbach's Alpha	Spearman-Brown Coefficient	Guttman Split-Half Coefficient
Part I	26	0.8270	0.9220	0.9210
Part II	26	0.8410	0.9220	
Total items	52			

1.3 Conclusion

The above results reveal that the Effective Learning Scale (ELS) has high reliability and validity. This indicates that the ELS tool has emerged as a reliable and valid tool for assessing Effective Learning of elementary school children.

1.4 Acknowledgment

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