A Validity and Reliability Study of Grasha-Riechmann Student Learning Style Scale

Yaşar Baykul, Musa Gürsel, Hacı Sulak, Erhan Ertekin, Ersen Yazıcı,
Osman Dülger, Yasin Aslan and Kağan Büyükkarcı

Abstract—The reliability of the tools developed to learn the learning styles is essential to find out students' learning styles trustworthily. For this purpose, the psychometric features of Grasha-Riechman Student Learning Style Inventory developed by Grasha was studied to contribute to this field. The study was carried out on 6th, 7th, and 8th graders of 10 primary education schools in Konya. The inventory was applied twice with an interval of one month, and according to the data of this application, the reliability coefficient numbers of the 6 sub-dimensions pointed in the theory of the inventory was found to be medium. Besides, it was found that the inventory does not have a structure with 6 factors for both Mathematics and English courses as represented in the theory.

Keywords—Learning styles, Grasha-Riechmann, reliability, validity.

I. INTRODUCTION

THE experts studying on learning style concept have different views on this notion. There are both different and similar view points on this concept. When taken as a whole, such dimensions as cognitive, perceptive-psychological, affective, sociological, physical, and environmental can be mentioned [8]. Different definitions of learning styles were made from various perspectives. Keefe (1979) defined learning style as the cognitive, emotional, and psychological features that are the indicators of how learners perceive the learning environment, how s/he interacts with it, and how s/he reacts to this environment (Cited in: [3]).

The concept of learning style was first presented by Rita Dunn in 1960 [2]. Learning style and cognitive style are sometimes used interchangeably. However, cognitive style has been taken place firstly in the literature. Cognitive style is defined as the personal feature of the individual in using his mind, perceiving and using information. Learning style is similar to cognitive style, but is a more specific form of cognitive style.

Cognitive style studies began with Gardner and his friends' theory. In these researches, they examined the differences in individual's using and configuring information, and they developed cognitive control concept that affects memory, concept development, attentiveness, perception, and thinking. This notion affected developments of cognitive styles. The following studies in this field have begun to search cognitive style as a process rather than as a construct, and learning style theory is based on individuals' not only perceiving but also processing their perception in different forms [10].

As explained above, various models and scales based on these models were developed on learning styles. However, one of the main problems about learning styles is about the scales in this field [5]. Besides, it is important that researchers and teachers use the right scale for their students considering their age, and the dimension which they are aiming to determine. This is necessary for researches to produce reliable results, and to improve student success. That is why, information about age groups and the style dimension they evaluate, reliability, and validity of the scales were presented in Table 1.

This study dealt with validity and reliability of Student Learning Style Inventory developed by Grasha and Riechman in 1996. Therefore, the features of this inventory were summed up below.

Grasha (1996) defines learning style as child's preferences in thinking and interaction with other children in different classroom environments and experiences (Cited in [6]).

Grasha and Riechmann (1974) separated students into six groups: the ones who learn on their own (independent), the ones who are dependent to their teacher in learning (dependent), the ones who cooperate with others (collaborative), the one who compete with others (competitive), the ones who take part in activities (contributive), and the ones who are shy and uninterested in learning (avoidant).

Grasha's (1996) studies illustrated that independent students liked studying alone and that their learning abilities are enough. These students consider learning the subject independently important. They build up their knowledge on

Yaşar Baykul is with the Department of Mathematics Education, University of Yeditepe, İstanbul, TURKEY. (e-mail: baykulyasar@hotmail.com).

Musa Gürsel, Hacı Sulak, Erhan Ertekin, Osman Dülger are with the University of Selcuk, 42090, Konya, TURKEY. (e-mail: mgursel@selcuk.edu.tr; hsulak@ selcuk.edu.tr; eertekin@ selcuk.edu.tr; odulger@ selcuk.edu.tr).

Ersen Yazıcı is with the Department of Elelmentary Mathematics Education, University of Selcuk, 42090, Konya, TURKEY. (corresponding author to e-mail: ersenyazici@selcuk.edu.tr)

Yasin Aslan is with the Foreign Language Research Center, University of Selcuk, 42090, Konya, TURKEY. (e-mail: yaslan@selcuk.edu.tr).

Kağan Büyükkarcı is with the University of Cukurova, ADANA. (e-mail: kbuyukkarci@selcuk.edu.tr).

TABLE I
FEATURES OF LEARNING STYLE SCALES

Scale	Writer	Age	Style Dimensions	Validity	Reliability
CITE Learning Style Scale	Babich, Burdine, Albright, &Rando (1980)	Students	Auditory, Visual, language, numeral, physical, study condition, stand alone, with others	Medium	-
Grasha-Riechmann Learning Styles Inventory	Grasha-Riechmann 1975	HS &College	What kind of an interaction the students are in with the teachers and their friends	Good	Medium
Learning Styles Inventory	Dunn, Dunn &Price 1982a	3–12 age	Emotional, sociological, psychological, logical	Good	Good
Learning Styles Inventory	Kolb (1976)	Young Adolescences	Reflective, Observation/ Concrete Experience Abstract Conceptualization /Active Experience	Medium	Medium
Learning Styles Profile	Keefe &Monk 1986	Grade 6–12	Psychological / Environmental, cognitive, emotional, Information processing	Good	Low
Perceptual Learning Styles Scale	Reid 1984	Grade 3-12	Auditory, Visual, tactile, kinesthetic, group, individual	Medium	Low

their own. They may have problems in getting help from others; according to Grasha (1996), dependent students are seldom inquisitive, and they only learn what is needed. They like the structures their teacher develop and see teacher as the authority. These students may overcome their anxiety, and they wait clear instructions from teachers. Moreover, they have problems in learning alone, and they cannot handle uncertain situations and learn on their own.

Collaborative students like sharing their ideas and studying with their teachers and classmates. These students expand their knowledge in group and team work, and they are more successful when they are in a group work. The disadvantage of these students is that they are too dependent to other students and they are not good at studying alone (Grasha, 1996; cited in [7]); competitive students focus on learning as "I should be better than others". They compete for the award. They like to attract attraction, and they want to be remembered by their success in the class. These students have problems with other students and with cooperative learning environments; the students having the contributive style are defined as good individuals. They like going to classroom and taking part in activities. Characteristically, they are more

willing to do more than expected, and they give priority to the needs of other students (Grasha, 1996; cited in [7]); the avoidant students are not so enthusiastic about learning and taking part in classroom activities. Generally, they do not join their teachers and other students. they are indifferent to what is happening in the classroom (Grasha, 1996; cited in [7]).

A. Grasha-Riechmann's Learning Styles Scale (GRSLSS)

This scale was developed by Grasha and Riechmann. In the original form of the scale which was developed in 1974, the objective was to determine three learning styles; namely, dependent, independent and cooperative styles. Later on, Grasha (1990, 1996) further developed the scale-whose characteristics are summarized above- to include 6 styles each of which is composed of 10 items and came up with the current form of the scale (Cited in [7]).

Reference [8] found the test-retest reliability coefficients between 0,64 and 0.89. In a study by Bourhis & Stubbs (1991), the cronbach alpha internal consistency values were 0,5 for dependent sub-dimension, 0,68 for competitive sub-dimension, 0,55 for independent sub-dimension, 0,81 for timidity sub-dimension, 0,77 for cooperative sub-dimension,

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and 0,77 for sociality sub-dimension (Cited in [4]). In another study by Reference [6], the cronbach alpha internal consistency values were 0,5 for dependent sub-dimension, 0.74 for competitive sub-dimension, 0.65 for dependent sub-dimension, 0.69 timidity sub-dimension, 0.78 for cooperative sub-dimension, and 0.62 for sociality sub-dimension. In a study by Reference [9] in our country, the aforementioned values were found to be 0,72 for independent sub-dimension, 0,58 for timidity sub-dimension, 0,74 for cooperative sub-dimension, 0,69 for dependent sub-dimension, and 0,74 for sociality sub-dimension.

Scales develop abroad are translated or adapted and being used in the fields of education, psychological counseling and guidance in our country without conducting sufficient research on their reliability and validity and regarding the validity and reliability determined in the country of origin sufficient. When it is considered that these types of scales are closely tied to the culture and educational systems, it cannot be said that the psychometric features of a scale developed in a country will always be the same or similar in another country. Therefore, the means of measurement to be used is to be tested for validity and reliability and then be used if it is sufficient. Another point to be considered is that although some means of measurement are developed for a certain subject field or age group in mind, they are used for other subjects or age groups without considering whether it will show the same results for those subjects or age groups. With this in mind, this research studies the reliability and validity of Grasha-Riechmann's Learning Style Scale.

II. METHOD

A. Means of Data Collection

As the study is on the reliability and validity of Grasha-Riechmann's Learning Style Scale, it was used as a means of data collection. The scale was first translated into Turkish. The Turkish translation was retranslated into English by an expert at English Language of Teaching Department Faculty of Education, Selçuk University. Then the English translation was compared with the original scale and necessary changes were made and a match between the original scale and the Turkish translation was achieved. The Turkish forms were used after they were examined by Turkish Language experts.

B. Data Collection

The data was collected from students of randomly chosen 6th to 8th grades from 10 randomly chosen Primary Education schools from various socio-economic districts in the center of Konya. It must be noted that choosing schools from various socio-economic fields, choosing schools and classes randomly is not a statistically sampling method but only the inclusion of differences in the sampling.

For the collection of the data GRSLSS was applied to the same groups of students for four times; twice being for English course and twice being for Mathematics course. In the first two applications in the same week, the students were

TABLE II
RELIABILITY COEFFICIENTS OBTAINED FROM THE 1ST AND 2ND
APPLICATIONS OF THE GRSLSS'S SUBSCALES IN ENGLISH AND
MATHEMATICS COURSES

| Scale | ENGLISH | | MATHEMATICS | |
	1st Application (n=323)	2nd Application (n=113)	1st Application (n=334)	2nd Application (n=102)
Independent	0,50	0,59	0,48	0,41
Avoidant	0,71	0,73	0,71	0,67
Collaborative	0,71	0,62	0,70	0,70
Dependent	0,37	0,40	0,38	0,23
Competitive	0,76	0,78	0,75	0,73
Participant	0,67	0,56	0,53	0,48

asked to answer the questions considering English course and Mathematics course. In these two applications, which students will answer the questions for English course first and then for Mathematics course or vice versa was randomly appointed. This was also repeated for the third and fourth applications, which were carried out almost a month later in the same week. The first two of these applications were accepted as the first and the last two were accepted as the second application. Thus, we had double data clusters for English and Mathematic courses obtained almost a month apart.

The scale was applied twice for English and Mathematics courses. In the first application, totally 384 students participated; 178 being from 6th grades, 110 being from 7th grades and 96 being from 8th grades. Among these students who gave different answers to the same control question in the scale were omitted from the survey. As a result, the analyses included 323 students for English course, 153 being from 6th grades, 98 being from 7th grades and 72 being from 8th grades and 334 students were included to the analyses for Math course, 160 being from 6th grades, 92 being from 7th grades, 82 being from 8th grades.

The second application was performed almost one month after the first application. For English course 140 students participated, 69 being from 6th grades and 71 from 7th grades. When the students who gave different answers to the same question are omitted, there remained 113 students, 61 being from 6th grades, and 52 being from 7th grades. For Math course 121 students took part in the application; 60 being from 6th grades and 61 being from 7th grades. When the students who gave different answers to the same question omitted -just as in other applications-, there remained 102 students; 51 being from 6th grades and 51 being from 7th grades.

C. Data Analysis

In this study, GRSLSS was examined in terms of reliability, consistency and determinacy. Determinacy means measurement device's giving similar results when applied to the same student group twice or more within a reasonable period of time and based on the assumption that the measured traits (learning styles) of individuals will not change in the period between the two applications and that repliers do not answer the questions haphazardly but reflect their real

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emotions and ideas.

Cronbach α correlation number was used in the determination of the consistency of the items of the scale with the whole scale and with the learning styles they are related to. This coefficient was used as a criterion for both reliability and validity. Because a high correlation indicates both the consistency of the item with the learning style (sub-scale) it is in and with the variable measured with that scale, and thus that it measured the same construct [1].

On the other hand, factor analysis was used in determining the validity of the scale. In both applications, we wanted to find out whether the scale has as many factorial constructions as the number learning style, which items represent which learning styles (structures), and whether these items are the same as the ones indicated in the construction of the scale. For these determinations, principal components factor analysis was applied. For each application, these calculations were carried out separately and we sought to find out whether these factorial structures showed difference between these two applications.

III. FINDINGS AND IMPLICATIONS

A. Reliability of GRSLSS for English and Mathematics courses

Calculated Cronbach's α coefficients of the subscales after the application of the scale twice a month apart in English and Mathematics courses were found as in Table 2:

According to table 2, the maximum difference between the 1st and 2nd applications in English courses have been found 0.11 for the participant dimension, 0.09 for the independent and collaborative dimensions, and 0.03 for the other dimensions. These differences were found 0.15 for the dependent dimension and 0.07 for the other dimensions in mathematics courses. These findings can be interpreted as the GRSLSS's reliability is high in the competitive dimension, and average or less than average in the other dimensions. When the values in the table are observed, it can be concluded that the differences were lower in more dimensions in mathematics courses. This situation can be interpreted as the GRSLSS is more stable in mathematics.

On the other hand, consistency of the items with the subscale they are in was calculated as part of the reliability calculations of the scale. Item-subscale correlations were calculated for this purpose. Correlation coefficients of the items calculated by including them in can be seen in Table 3 (Appendix-A).

Differences between the values of the 1st and 2nd applications of the highest and lowest correlations according to the subscales that the items are included in, in English courses, were 0.36 and 0.48 in the independent dimension, 0.74 and 0.82 in the avoidant dimension, 0.19 and 0.28 in the collaborative dimension, 0.27 and 0.21 in the dependent dimension, 0.30 and 0.41 in the competitive dimension, and 0.26 and 0.19 in the participant dimension. The same values pertaining to the mathematics courses were 0.37 and 0.50 in

TABLE IV
EIGEN VALUES PERTAINING TO THE 1ST AND 2ND
APPLICATIONS OF THE GRSLSS IN ENGLISH AND
MATHEMATICS COURSES

Item No	ENGLISH		MATHEMATICS	
	1st Application	2nd Application	1st Application	2nd Application
1	9,506	9,335	7,862	7,500
2	4,035	4,075	3,942	3,901
3	2,512	3,199	2,724	3,504
4	2,149	2,993	2,195	2,833
5	1,797	2,623	1,796	2,637
6	1,644	2,078	1,731	2,444
7	1,591	1,987	1,687	2,186
8	1,469	1,893	1,517	2,125
9	1,407	1,791	1,382	1,919
10	1,362	1,753	1,362	1,835
11	1,277	1,693	1,345	1,662
12	1,243	1,521	1,311	1,593
13	1,222	1,424	1,256	1,500
14	1,172	1,368	1,212	1,460
15	1,142	1,237	1,175	1,333
16	1,095	1,200	1,142	1,295
17	1,082	1,101	1,081	1,208
18	1,053	1,071	1,068	1,138
19	1,006	1,031	0,987	1,091
20	1,002	0,998	0,980	1,046

the independent dimension , 0.71and 0.94 in the avoidant dimension, 0.11 and 0.40 in the collaborative dimension, 0.30 and 0.35 in the dependent dimension, 0.34 and 0.60 in the competitive dimension, 0.20 and 0.30 in the participant dimension.

Parallel to the values in Table 3 (Appendix-A) and the differences highlighted above, item-subscale correlations of the 1st and 2nd applications of the GRSLSS can be said to be, in general terms, at the interval of 0.30-0.70, and only the values in the avoidant dimensions stayed out of this interval. For the English course application, the differences between the correlations of the 1st and 2nd applications were 0.16 in the independent dimension (Item 49), 0.26 in the avoidant dimension (Item 8), 0.24 in the collaborative dimension (Item 33), 0.11 in the dependent dimension (Item 52), 0.22 in the competitive dimension (Item 53), 0.15 in the participant dimension (Item 42); highest differences in the applications for mathematics courses were 0.13 in the independent dimension (Items 31 and 49), 0.16 in the avoidant dimension (Item 43), 0.21 in the collaborative dimension (Item 21), 0.26 in the dependent dimension (Item 46), 0.30 in the competitive dimension (Item 23), and 0.12 in the participant dimension (Item 6).

Values in Table 3 (Appendix-A) and the explanations above indicate that, in the GRSLSS, differences higher than 0.10 were obtained in the 1st and 2nd applications in terms of the correlations of 15 items for English course and 24 items for the mathematics course with their subscales. Most of the correlation coefficients are relatively at the average or lower level, even there are negative correlation coefficients. Relatively high coefficients are very rare. This situation means that there are significant differences between the two applications of the GRSLSS. As it is mentioned in the methodology section, taking into consideration that the papers

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of the students who answered the verification questions differently in the two applications were left out, it is likely to claim that the cited differences result from the survey. Analysis on the items suggested that this situation might be resulting from the differences between the usage of the expressions such as class, lesson, course etc. used in the questions, in Turkey and the country where the scale was developed.

B. Validity of GRSLSS for English and Mathematics

In order to calculate the validity of GRSLSS for English and Mathematics courses, separate factor analysis was conducted for the 1st and 2nd applications. Eigen values higher than 1, pertaining to the factor analysis obtained from the 1st and 2nd applications of the scale to the English and Mathematics course, were found as in table 4.

When Table 4 is monitored, it is observed that a 20 factor structure emerges from the 1st and 2nd applications of GRSLSS in English and Mathematics courses. Items included in the sub dimensions of the scale and their factor loads are summarized in Table 5 (Appendix-B).

According to Table 5 (Appendix-B), in the 1st and 2nd applications, both for English and Mathematics courses, items 19 and 25 took place in the independent dimension, 2, 26, 32, and 38 took place in the avoidant dimension; 5, 11, and 35 took place in the competitive dimension as it was indicated in the original form of the scale. Items 1, 7, 31 and 37 in the independent dimension, 8, 14, 20, 50 and 56 in the avoidant dimension, 3, 9, 15, 27, 33, 51 and 57 in the collaborative dimension, 4, 10, 16, 22, 34, 40, 52 and 58 in the dependent dimension, 17, 29, 47, 53 and 59 in the competitive dimension, and 12, 24, 30, 36, 42 and 48 in the participant dimension stayed out of the dimensions indicated in theory, for either of English or Mathematics course, in either of the applications. Besides, items 13, 43, 49 and 55 in the independent dimension, 44 in the avoidant dimension, 21, 39 and 45 in the collaborative dimension, 28 and 46 in the dependent dimension, 23 and 41 in the competitive dimension, 6, 18, 54 and 60 in the participant dimension stayed out of the relevant dimension for neither of the courses and in neither of the applications. Items that did not take place in the relevant dimension, for either of the courses or in either of the applications, either took place in another dimension of the scale or were distributed to dimensions which were not found in the original form of the scale.

Explanations above indicate that items included in the subscales of GRSLSS are different from the ones declared in theory. According to the factor structure obtained from the research, some items took place in a subscale different from the theoretically declared one while some others did not take place in any of those subscales. For instance, item 21 as 'Students should be encouraged to share more of their ideas with each other' took place in different dimensions of the scale in the analysis. An estimated reason for this is the difference in students' understanding of the expression. Similarly, item 8 that took place in the avoidant dimension is

expressed as 'Classroom activities are usually boring'. The word 'boring' in this statement does not mean 'avoidant' in our language. More of such examples can be found in the scale.

IV. DISCUSSION, CONCLUSION AND SUGGESTIONS

In view of the findings above, GRSLSS's low validity coefficients with one of its sub dimensions and generally at medium level with other dimensions can be interpreted as the validities of the items in this scale, in terms of their validities with the subscales they are included in, are not high enough for mathematics and English courses. Significantly high differences between the α reliability coefficients pertaining to the subscales signal that subscales are not reliable at the same degree.

The medium and low level of correlations of the items, as well as negative correlations encountered, with the subscales they are included in suggest that these items are generally not consistent with their subscales in terms of theory. This is condition is among the reasons why the α coefficients pertaining to the subscales are not high enough.

Findings do not indicate that GRSLSS has 6 factors. When the dissonance in a few items is ignored, apparently maximum three factors work. This is the case both for English and Mathematics courses. Besides, medium lower levels of item-subscale correlations support the factor analysis results about the scale structure. Therefore, structural validity of the scale can be claimed to be low, and this result is parallel with Reference [8] results.

Many items stayed out of the dimensions found in the theoretical structure of the scale, and some of them appear in other dimensions of the scale. Among the reasons for this situation is the school, instruction and student characteristics in the culture where the scale was developed are different from those of in Turkey; deeper research can be conducted to explore the causes.

In conclusion, reliability of the GRSLSS's subscales for English and mathematics courses is generally at medium level. This result is consistent with the studies found in the literature, although there may be changes for the different dimensions.

The scale displays similar structures for both of these courses and the structure indicated in the scale could not be obtained for neither of the courses; only three factors can be obtained. It is suggested not to use the scale, without validity and reliability explorations of the scale, for the current research to be conducted to determine learning styles of 6th and 8th grade students in Turkey; if necessary, it is recommended to use after adapting the scale to the conditions of the country.

REFERENCES

[1] Baykul, Y. (2000). *Eğitimde ve psikolojide ölçme: Klasik test teorisi ve uygulaması.* Ankara: ÖSYM Yayınları.
[2] Boydak, A. (2001). *Öğrenme stilleri.* İstanbul: Beyaz Yayınları

World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:4, No:3, 2010

[3] Cheng, C-H. (2001). The preferred learning and teaching styles at a selected junior college in Taiwan. Unpublished doctoral dissertation, University of South Dakota.

[4] Hamidah, J.S., Sarina, M.N.&Jusoff, K. (2009). The social ınteraction learning styles of science and social science students. *Asian Social Science, Vol:5*, No:7.

[5] Lemine, D. (2005). Establishing the psychometric properties of one learning style ınstrument. Unpublished Doctoral Dissertation, Kansas State University, Manhattan, Kansas.

[6] Nicodemus, C.F. (2003). An investigation of learning styles of distance learners and fece-to-face learners in a graduate program in rehabilitation counseling. Published doctoral dissertation, University of Northern Colorado.

[7] Short, G.F.L. (2001). Learning, Teaching, and Supervisory Styles in field education: The working alliance. Unpublished Doctoral Dissertation, University of South Carolina.

[8] Snyder, R. (1997). An assessment of the reliability and validity of scores obtained by six popular learning styles instruments. Unpublished doctoral dissertations, Utah State University. Logan, UTAH.

[9] Tatar, E., Tüysüz, C.&İlhan, N. (2008). Kimya öğretmen adaylarının öğrenme stillerinin akademik başarıyla ilişkisi. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 5(10)*.

[10] Zikmund, A.B. (1988). The effect of grade level gender and learning style on responses to conservation type rhythmic and melodic patterns. Unpublished Phd. Thesis, University of Nebraska.

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APPENDIX-A

TABLE III
ITEM-SUBSCALE CORRELATIONS OF GRSLSS IN ENGLISH AND MATHEMATICS COURSES

Item	Learning Style	English 1st App	English 2nd App	Mathematics 1st App	Mathematics 2nd App
Item 1	Independent	0,51	0,49	0,43	0,46
Item 2	Avoidant	0,60	0,54	0,62	0,57
Item 3	Collaborative	0,56	0,37	0,48	0,66
Item 4	Dependent	0,33	0,43	0,24	0,46
Item 5	Competitive	0,69	0,72	0,73	0,69
Item 6	Participant	0,57	0,47	0,41	0,29
Item 7	Independent	0,44	0,45	0,42	0,31
Item 8	Avoidant	0,57	0,31	0,50	0,39
Item 9	Collaborative	0,58	0,47	0,52	0,48
Item 10	Dependent	0,39	0,48	0,44	0,40
Item 11	Competitive	0,70	0,77	0,69	0,67
Item 12	Participant	0,60	0,52	0,55	0,59
Item 13	Independent	0,24	0,16	0,27	0,28
Item 14	Avoidant	0,46	0,60	0,46	0,48
Item 15	Collaborative	0,63	0,63	0,58	0,66
Item 16	Dependent	0,44	0,41	0,54	0,42
Item 17	Competitive	0,66	0,61	0,65	0,63
Item 18	Participant	0,40	0,36	0,35	0,38
Item 19	Independent	0,60	0,64	0,57	0,64
Item 20	Avoidant	0,56	0,68	0,63	0,58
Item 21	Collaborative	0,52	0,64	0,47	0,26
Item 22	Dependent	0,36	0,39	0,34	0,29
Item 23	Competitive	0,49	0,38	0,39	0,09
Item 24	Participant	0,42	0,33	0,35	0,42
Item 25	Independent	0,57	0,55	0,56	0,57
Item 26	Avoidant	0,64	0,67	0,67	0,74
Item 27	Collaborative	0,44	0,41	0,51	0,61
Item 28	Dependent	0,26	0,31	0,32	0,30
Item 29	Competitive	0,50	0,53	0,53	0,37
Item 30	Participant	0,46	0,46	0,43	0,53
Item 31	Independent	0,40	0,41	0,28	0,15
Item 32	Avoidant	0,60	0,64	0,58	0,64
Item 33	Collaborative	0,60	0,36	0,58	0,56
Item 34	Dependent	0,40	0,43	0,43	0,27
Item 35	Competitive	0,66	0,58	0,62	0,69
Item 36	Participant	0,61	0,49	0,49	0,53
Item 37	Independent	0,45	0,49	0,39	0,36
Item 38	Avoidant	0,57	0,63	0,60	0,57
Item 39	Collaborative	0,44	0,51	0,53	0,40
Item 40	Dependent	0,39	0,40	0,38	0,56
Item 41	Competitive	0,40	0,36	0,42	0,19
Item 42	Participant	0,64	0,49	0,51	0,44
Item 43	Independent	0,32	0,34	0,20	0,14
Item 44	Avoidant	-0,1	-0,14	-0,04	-0,20
Item 45	Collaborative	0,46	0,41	0,50	0,37
Item 46	Dependent	0,53	0,51	0,48	0,22
Item 47	Competitive	0,62	0,66	0,51	0,59
Item 48	Participant	0,52	0,49	0,47	0,43
Item 49	Independent	0,38	0,54	0,50	0,37
Item 50	Avoidant	0,50	0,50	0,46	0,37
Item 51	Collaborative	0,51	0,53	0,52	0,64
Item 52	Dependent	0,41	0,30	0,44	0,42
Item 53	Competitive	0,44	0,66	0,47	0,62
Item 54	Participant	0,58	0,49	0,48	0,38
Item 55	Independent	0,45	0,54	0,45	0,49
Item 56	Avoidant	0,63	0,62	0,62	0,60
Item 57	Collaborative	0,62	0,54	0,55	0,63
Item 58	Dependent	0,45	0,42	0,31	0,21
Item 59	Competitive	0,44	0,48	0,52	0,53
Item 60	Participant	0,38	0,45	0,40	0,38

APPENDIX-B

TABLE V

FACTOR LOADS PERTAINING TO THE 1st AND 2nd APPLICATIONS OF GRSLSS TO ENGLISH AND MATHEMATICS COURSES

Learning Style	Course	Item	English 1st App	English 2nd App	Math 1st App	Math 2nd App
Independent		1	0,54	0,63		0,41
		7		0,63		
		13		0,56		
		19	0,80	0,71	0,72	0,73
		25	0,77	0,72	0,73	0,80
		31		0,49		
		37		0,50		
		43				
		49				
		55				
Avoidant		2	0,57	0,47	0,62	0,70
		8	0,45	0,70	0,47	0,66
		14		0,56	0,66	0,58
		20	0,38	0,70	0,72	
		26	0,60	0,61	0,66	0,65
		32	0,59	0,48	0,57	0,67
		38	0,62	0,69	0,58	0,52
		44				
		50	0,53	0,42		
		56	0,43	0,61	0,60	
Collaborative		3	0,66			0,69
		9				0,69
		15	0,66	0,58		
		21	0,60			
		27			0,53	
		33	0,38		0,51	0,38
		39				
		45				
		51	0,53			
		57	0,61			
Dependent		4	0,53			0,62
		10				0,62
		16			0,58	
		22			0,58	0,65
		28			0,53	
		34			0,74	
		40			0,68	
		46				
		52		0,53		
		58		0,54		0,63
Competitive		5	0,78	0,78	0,75	0,74
		11	0,78	0,82	0,75	0,39
		17	0,73	0,75		
		23				0,49
		29			0,39	
		35	0,69	0,49	0,63	0,49
		41			0,68	
		47	0,37		0,48	
		53		0,48		
		59		0,48		0,63
Participant		6	0,79		0,64	0,84
		12	0,75	0,74		
		18	0,68			
		24				0,67
		30			0,39	0,53
		36			0,76	
		42	0,48	0,68	0,76	0,53
		48	0,48	0,53	0,68	
		54		0,76		
		60		0,76		