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# Metric Characteristics Of The Scale For Measuring Learning Styles In The Student Population

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**Abstract.** The purpose of this research was to verify the construct validity of the learning styles questionnaire in the student population. The learning styles questionnaire is based on the principles of Honey and Mumford's theory of the universal content and structure of learning styles. The research was carried out on a sample of 437, of which 145 are school children and 292 are students of social and natural sciences, aged 15–23 years. The learning styles questionnaire (Honey & Mumford, 1986) was used to measure four specific styles (pragmatists, reflectors, activists, and theorizers). Applying exploratory factor analysis, three interpretable factors were extracted, and the structure of values in two-dimensional space was checked using the Multidimensional Scaling (MDS) method. The resulting structure doesn't correspond to the expected structure according to Honey & Mumford's theory, i.e., the items were grouped into three higher-order values: theorizing style, reflective, and pragmatic-activating style. Inner consistency of the scale is  $\alpha=0,88$ . Moderate to high correlations were obtained between items. Analysis of variance and post hoc analysis did not verify differences in the context of learning styles between dominant learning styles in secondary and higher education, as well as insignificant gender differences in the context of learning styles. The theorist's style and the reflector's style remain the dominant learning options even during studies. The findings confirm the validity of the questionnaire for the assessment of learning styles and show its applicability to the population of students and those of secondary schools for the purpose of assessing learning styles.

**Keywords:** learning styles, reliability, students

## 1 Introduction

Learning is the process of acquiring new knowledge, behaviors, skills, values, attitudes, and preferences (Gross, 2010). Some learning is triggered by a single event, and some knowledge and skills are accumulated based on repeated experiences (Schacter, Gilbert & Wegner, 2011). A person's preferred learning method is determined by their attitudes and behaviors, which lead to the definition of learning style (Honey & Mumford, 1992). Learning style is a mix of cognitive, affective, and psychological domains that indicate how students engage and react to a learning environment. Individual differences are examined in the study of learning styles: people act, think, and see the world in different ways, and they create ideas and acquire knowledge in different ways (Jung, 1921; Myers & Briggs, 1962).

Learning styles refer to the concept that individuals differ in how they study best. Learning style assessments ask people to rate what kind of information presentation they prefer, e.g., words vs. pictures, or what kind of mental activity they find more engaging, e.g., analyzing vs. listening, although assessment instruments are extremely diverse (Pashler et al., 2008). Kolb's (1976) model of experiential learning is one that has attracted much interest and application. ELM consists of an assumed four-stage learning cycle. According to the theory, different individuals may prefer some parts of the learning cycle over others. At the beginning, students receive information from concrete experience to the new experience, continuing with the observation phase where data is extracted from the perspective. Third is abstract conceptualization, where generalizations are created to integrate observations into sound theories or principles, thus creating guidelines for action in new and complex situations. Individual differences in learning styles are explained by this process: Kolb's learning style is explained on the basis of two dimensions: they are the way a person understands and processes information. This perceived information is then classified as concrete experience or abstract conceptualization, and the processed information as active experimentation or reflective observation.

Based on Kolb's theory is the Learning Style Questionnaire (LSQ), created by Honey and Mumford (1982), followed by a revised edition in 1986. The LSQ has been applied in a variety of areas, including training and development management. It was created to report on the preferred learning styles of female management trainees and then transfer them to students in higher education. This questionnaire is self-administered and consists of 80 items that are scored 1 or 0. The statements are divided into four subgroups of 20 randomly ordered items, each of which assesses a particular learning style: activist, reflector, theoretician, and pragmatist. These subgroups are broadly equivalent to those suggested by Kolb's (1976) experiential learning model (ELM): active experimentation (activist), reflective observation (reflector), abstract conceptualization (theorist), and concrete experience (pragmatist). Each subgroup or learning style can receive a maximum possible score of 20 points (Allinson & Hayes, 1988). This instrument may be desirable for educational researchers because of its normative nature (Dunlap & Cornwell, 1994). According to the division of styles, activists: prefer to be involved in new experiences without prejudices; they are enthusiastic about new ideas; they are happy to be dominated by immediate experiences; and tend to act first, then look at the implications or consequences. Activists learn best when involved in new experiences, problems, and opportunities, when there is teamwork and difficult tasks; on the other hand, they do not prefer to listen to long lectures or even when they have to follow precise instructions. Reflectors: see the situation from different perspectives, collect data, review, analyze, and think before reaching any conclusion. They observe and listen to the views of others before presenting their own. The types who belong to this style prefer to observe individuals during work, review what has happened, and think about what they have learned from it; they do not have deadlines or short time frames to complete tasks. On the other hand, such types learn less when taking on the role of leader in front of others, are worried about deadlines, and do things without time to prepare. Theorists like to analyze, synthesize, adapt, and integrate observations into complex and logically sound theories. They value rationality and objectivity and are prone to assumptions, principles, theories, models, and basic systematic thinking. They think about problems step by step and tend to be perfectionists. Theorists learn best when they are placed in complex situations where they have to use their skills and knowledge, when they are in situations that have a clear purpose when they are offered interesting ideas, and when they have the opportunity to investigate ideas and ask questions. Theorists learn less when there are situations where the emphasis is on emotion and feeling, information is weak, and they have to do things without knowing the principles. Pragmatists: they want to try things and use concepts that can be applied in their

work; they are impatient to have long discussions; they are practical and down to earth. They like to move quickly and act quickly on new ideas that appeal to them. Pragmatists learn best when there is a connection between the topic and the work and when they are given the opportunity to try out techniques that have advantages. Pragmatists learn less when they receive no visible or immediate benefit, when they are not instructed in how things are done, and when the learning is only theory.

Learning styles are variable in our case, and before being treated empirically, it is necessary to undergo the process of methodological conception. The variable changes its form before the final structure; first, it passes to the theoretical conception, then to a more simplified form such as operationalization, which is described as a logical process of selecting the most reliable and valuable indicators. From this, we say the main characteristics are: validity, which refers to the issue of whether we have really observed and measured what we wanted to observe and measure, and reliability, which refers to the accuracy of the measurement process. Errors in the measurement process result in low reliability of the measurement process. Due to the low validity of the variable, there is a possibility that we will interpret and misunderstand the results (Osmani, 2014, fq., 128-154). Reliability refers to the consistency of a measurement technique and is concerned with the stability of data from a measurement across different characteristics or conditions. To be a reliable test, the correlation coefficient should be high. 80. The concept of validity refers to what the test or measurement strategy measures and how well it does so. Conceptually, validity seeks to answer the following question: Does the instrument or measurement approach measure what it is supposed to measure? (Marczyk, DeMatteo & Festinger, 2010).

There is limited evidence regarding the psychometric properties of the LSQ. The study by Duff & Duffy (2002), with 224 undergraduate students enrolled in business courses and 164 undergraduate students in health studies, found that exploratory factor analysis failed to support the existence of the two bipolar dimensions proposed by Kolb and the four learning styles by Honey and Mumford, and internal consistency reliability was not achieved at a satisfactory level. Research by Yousef (2012), with the participation of 1,615 students divided into two universities, examined the reliability and validity of the data. Through Cronbach's alpha, cross-correlation, and confirmatory factor analysis (CFA), the data were analyzed, and it was found that the styles questionnaire of learning (LSQ) had moderate internal consistency, inter-correlations revealed positive (weak to modest) correlations between the four learning styles, implying a lack of support for the two bipolar dimensions proposed by Kolb, and factor analysis failed to support the four learning styles described by Honey and Mumford.. On the other hand, some studies have verified the reliability and validity of the LSQ; thus, the study by Haque and Afrin (2018) among university students in Bangladesh with a sample of 238 students drawn from three universities concluded that the internal consistency and reliability of the test-retest were satisfactory and significant correlations were found between the subscales. Meanwhile, Klein et al. (2007) evaluated the psychometric properties of the LSQ using Cronbach's alpha, test-retest, correlational analysis, and factor analysis among 66 undergraduate medical students at Monash University (Hong Kong) and found that the 40-item version of the LSQ has reliability and poor validity, also research with 381 second-year students in accounting, engineering, and communication programs at the University of Hong Kong, Fung et al. (1993) examined the relatively low reliability of the four learning styles scales of a shortened version of the LSQ. Furthermore, factor analysis of the items did not reveal any coherent factor structure consistent with the underlying constructs. Mulaik (1987) has emphasized that the exploratory techniques that have been used in many studies can only make suggestions; therefore, CFA (confirmatory factor analysis) is necessary. For this reason, research is limited regarding the psychometric properties of the results produced by the LSQ.

## **2 Research Methodology**

### **2.1 The research problem**

The problem of this study is the question of whether the questionnaire for the assessment of learning styles confirms validity and, at the same time, whether it is applicable to the population of students and those in secondary schools.

## 2.2 The purpose and tasks of the research

The purpose of the research is to verify the construct validity of the questionnaire on learning styles in the student population. In order to realize the purpose of the research, several tasks were compiled, as follows:

- a. To determine the reliability and validity of the questionnaire in the selected sample
- b. To see if there are differences in the context of learning styles between the dominant learning styles in secondary and higher education
- c. To determine the dominant learning style during studies

## 2.3 Populations and samples

The sample consisted of 437 subjects, 145 are school children and 292 are students of social and natural sciences. The study was conducted in September 2023. The students are aged 15–23.

## 2.4 Instruments

The Learning Styles Questionnaire (LSQ) by Honey & Mumford (1986) was designed to measure learning preferences in individuals. The questionnaire is available in 40 or 80 items and is designed to prompt individuals and groups to think about how they prefer to receive information and learn from their experiences. In our case, we used a questionnaire with 40 statements with 10 items for each learning style: activist, reflector, theoretician, and pragmatist, which are evaluated with 1 (if you agree, check) or 0 (if it does not agree, x).

## 3 Results

To measure the internal consistency of the Learning Styles Questionnaire ( $n = 40$ ), Cronbach's alpha coefficient was calculated. The reliability assessment of the Learning Styles Questionnaire and the internal consistency of the eight subscales were also assessed by calculating Cronbach's alpha for the subscales. The obtained values are included in the following table.

**Table 1.** Analysis of the internal consistency of the learning styles questionnaire in the Albanian-speaking student population ( $N = 437$ )

	No. of items	Alpha coefficient
Scale in general	<b>40</b>	.85
The first factor	17	.83
The second factor	11	.79
The third factor	12	.81

The value of Cronbach's Alpha is 0.85 for the lower subscale because the value was expected to decrease with the reduction of items from the overall scale. Cronbach's alpha reliability of the 46-item learning styles questionnaire was 0.83. The value is considered high enough for each subtest. The value of Cronbach's alpha suggests that the items were homogeneously stable as theoretically expected when creating the Learning Styles Scale.

**Table 2.** Exploratory factor analysis of the learning styles questionnaire in the Albanian student population (N = 437)

Initial characteristic roots	The sums of the squared densities of the retained components					
	Components	$\lambda$	Variance (%)	Cumulative (%)	$\lambda$	Variance (%)
1	4,295	32,821	32,821	5,295	32,821	32,821
2	2,604	21,276	54,097	3,604	21,276	54,097
3	1,892	18,828	72,923	2,892	18,828	72,923
4	1,125	7,029	79,952			
.	.	.	.			
40	,255	0,591	100,000			

Before continuing the factor analysis, its prerequisites were tested. The Kaiser-Meyer-Olkin coefficient on sample fit was quite high (KMO = 0.801), and Bartlett's test of sphericity was found to be significant ( $\chi^2 = 1592.09$ ;  $p < .01$ ). The mentioned results justify the application of factorial analysis (Fulgosi, 1984).

An exploratory factor analysis using the principal components method was applied, which yielded 3 principal components that together explain almost 55% of the total variance, of which the first has a significantly larger characteristic root. The first component represents a general factor that can be interpreted as reflector-theorizer variance (e.g., complementarity between theorizing and reflective styles). The other two components represent those latent factors that should be in the background of the two remaining styles, the activist style and the pragmatist style; that is, they represent two styles that can be considered opponents in the bipolar dimension of a higher order. The second and third components are essential factors that saturate the two learning styles of the bipolar dimension.

**Table 3.** Presentation of individual learning styles questionnaire items on the first, second, and third factors obtained from exploratory factor analysis (N = 437)

Item No.	F1	F2	F3	Item No.	F1	F2	F3
<b>1</b>	.667	.068	.141	<b>21</b>	.066	.337	.214
<b>2</b>	.665	.088	.163	<b>22</b>	.032	.315	.123
<b>3</b>	.678	.036	.173	<b>23</b>	.174	.453	.208
<b>4</b>	.749	.006	.206	<b>24</b>	.283	.452	.173
<b>5</b>	.643	-.095	.031	<b>25</b>	.167	.450	.270
<b>6</b>	.466	.111	.148	<b>26</b>	.120	.450	.074
<b>7</b>	.544	.229	.003	<b>27</b>	.115	.316	.061
<b>8</b>	.412	-.003	.069	<b>28</b>	.159	.390	.064
<b>9</b>	.520	-.065	.243	<b>29</b>	.078	.257	.453
<b>10</b>	.321	.007	.053	<b>30</b>	.052	.107	.398
<b>11</b>	.576	-.003	.294	<b>31</b>	.110	-.051	.410
<b>12</b>	.421	.118	.23	<b>32</b>	.173	-.079	.515
<b>13</b>	.408	.025	.200	<b>33</b>	.064	.022	.591
<b>14</b>	.323	.176	.050	<b>34</b>	.132	.082	.450
<b>15</b>	.481	.176	.099	<b>35</b>	.050	.027	.578
<b>16</b>	.498	.157	.073	<b>36</b>	-.042	.243	.674
<b>17</b>	.383	.141	.240	<b>37</b>	-.157	.191	.524
<b>18</b>	.065	.488	.201	<b>38</b>	-.045	-.012	.439
<b>19</b>	.149	.360	.112	<b>39</b>	-.075	.099	.470
<b>20</b>	.105	.387	.272	<b>40</b>	-.168	.178	.332

*Legend: Saturations of primary items with factors 1, 2 and 3 are greater than 0.30.*

The method used during factor extraction was Varimax rotation. The criteria for the selection of the items have been to keep the factor loading of 0.30 or higher, while the load value between <0.30 has been removed from the scale (Field, 2009). Table 3 shows the individual items of the questionnaire on individual learning styles and their saturation with the first, second, and third factors obtained from the exploratory factor analysis. The first factor refers to the relector-theorizing style, such as the participants' preference to generally give higher or lower answers, and almost all items are positively saturated with this factor (saturation above 0.30). In the second factor, items from 18 to 28 are singled out as items with higher positive saturation, and we have called this factor the activating style. Items 3, 7, 11, and 15 are positively saturated with the third component.

The scale in general, respectively the 40 items of the scale were once again subjected to item-total correlation. The z-total correlation range for the 40 items was 0.321 to 0.631 and was significant ( $p < .01$ ). The results are presented in table 4.

**Table 4.** Item-total score correlation for the 40 items of the scale for the assessment of learning styles (N=437)

Item No	Correlation with the total score	Item No	Correlation with the total score
1	.346**	21	.404**
2	.377**	22	.362**
3	.341**	23	.414**
4	.378**	24	.398**
5	.394**	25	.398**
6	.337**	26	.331**
7	.412**	27	.431**
8	.384**	28	.354**
9	.331**	29	.353**
10	.338**	30	.329**
11	.426**	31	.341**
12	.393**	32	.384**
13	.368**	33	.462**
14	.375**	34	.488**
15	.399**	35	.398**
16	.369**	36	.397**
17	.534**	37	.358**
18	.374**	38	.390**
19	.546**	39	.631**
20	.402**	40	.492**

#### **Intercorrelations between subscales and total score**

To determine the intercorrelations between the three factors, the total score on the learning styles assessment scale was calculated. Correlational analysis proved that there were significant positive correlations between the three learning styles. Thus, it was found that two subscales, that is, the subscales for the activist style and the pragmatist style, had low but statistically significant correlations. The correlations of the three factors are presented in table 5.

**Table 5.** Correlations between learning styles, questionnaire factors, and correlations with the overall scale (N=437)

	Reflector-Theorist	Activist	Pragmatist	Total score
Reflector-Theorist	1	,040	,217**	,817**
Activist	,040	<b>1</b>	,291**	,789**
Pragmatist	,217**	,291**	<b>1</b>	,717**
Total score	,817**	,789**	,717**	<b>1</b>

*Legend: Correlations between corresponding higher-order values are printed in bold; \*\*p <.01; \*p <.05*

Table 5 shows that the intercorrelations between factors, extracted through factor analysis, are significantly correlated. The extent of correlations between the subscales shows that they are relatively low in correlation, while high correlations exist with the total score of the Learning Styles Assessment Scale. These correlation values confirm that the three subscales characterize theoretically distinct dimensions. The reflective-theorizing factor correlates with the pragmatist factor ( $r = .217$ ;  $p < .01$ ) but not with the activating factor ( $r = .040$ ;  $p > .05$ ). The activation factor correlates significantly with the pragmatic factor ( $r = .291$ ;  $p < .01$ ).

A highly positive and significant correlation was found between the subscales and the total of the Learning Styles Assessment Scale. The total score correlates with the reflective-theorizing factor ( $r = .817$ ;  $p < .01$ ), with the activating factor ( $r = .789$ ;  $p < .01$ ), and with the pragmatic factor ( $r = .717$ ;  $p < .01$ ). Therefore, it is concluded that all three subscales contributed to the overall result, which recommends that the 40-item Learning Styles Assessment Scale measure students' learning styles, which include three dimensions of learning: reflector-theorist, activist, and pragmatist.

## 4 Discussion

The factor structure of the questionnaire on learning styles for the Albanian-speaking student population is not completely equivalent to the findings of the authors of the Honey and Mumford Questionnaire. Factor analysis extracted three factors. The result from the factor loadings of the 40 items of the Learning Styles Scale on three different factors is that we obtain a three-factor scale keeping in mind all the assumptions discussed previously. Each factor was observed based on the theoretical importance of the items and the content of the items.

Correlative analysis between the factors of the questionnaire on learning styles shows the corresponding relationship between the activating factor and the pragmatist style, as well as between the reflective-theorizing style but not between the latter and the activating style. The low intercorrelations prove that the factors among themselves are qualified as separate factors with internal consistency and thematic content different from each other.

Even in spite of the reduction of factors from 4 (in the Honey & Mumford 1986 study) to 3 (in the present study), the obtained findings still confirm the validity of the questionnaire for the assessment of learning styles and show its applicability in the population of students and those of secondary schools for the purpose of assessing learning styles. The fusion of two separate styles, theorizing and reflective (Honey & Mumford 1986), into a single style that we have named "reflective-theorizing" only strengthens the degree of applicability and validity of Honey and Mumford's four-factor theory (1986). In the conducted study, it turns out that items with their own variance and latent roots are merged into a single style, within which the items that were extracted as two separate styles in Honey and Mumford's factor analysis are merged.

Based on the fact that LSQ had its origins in Kolb's theory and discussed the existence of four learning styles and the limited evidence regarding psychometric characteristics, the study in question proved the existence of three factors, showing satisfactory reliability and validity in the sample that was applied. Our findings in terms of validity and reliability are consistent with the study by Haque and Afrin (2018); however, they are not consistent with the study by Duff & Duffy (2002), where their findings do



not support the model and reliability was not achieved at the level of satisfactory through applied analyses.

This study used only two samples to test the instrument's reliability and validity, yet it has various implications for researchers, educators, and those interested in broader fields. This research represents the first opportunity to assess the reliability and validity of the LSQ in educational settings in our cultural context. The findings contribute to the study of learning styles and testing instruments. The use of reliable and valid instruments is key to extracting results on which recommendations can be made and clear conclusions can be reached. In our case, the use of such an instrument to determine the learning styles of students in educational institutions would improve the quality and, at the same time, strengthen the students' abilities for higher achievements.

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