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Developing Valid and Reliable Map Literacy Scale

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Abstract

The purpose of the present study is to develop a valid and reliable map literacy scale that is able to determine map literacy of individuals, especially that of high school and university students. The study sample was composed of 518 students studying at various faculties at Cumhuriyet University and high schools in Sivas and its counties. With this aim in mind, an initial item pool for piloting was prepared in line with the literature, and expert opinion was sought on the item pool. After the piloting exercise, the draft scale was administered to the study sample. Exploratory factor analysis (EFA) was carried out to investigate the factor structure of the scale; confirmatory factor analysis (CFA) was carried out to test construct validity of the scale along with other validity analyses. As a result of the exploratory factor analysis, it was seen that the scale was composed of 4 factors. These factors are as follows: reading and interpreting maps, using maps, carrying out procedures in maps, and sketching maps.

Keywords: Maps, map skills, map reading and interpretation, map use, sketching maps

Introduction

We frequently make use of maps in such activities as: locating valuable underground and ground sources and their distribution, preparing development plans intended for processing these valuable resources, ensuring national defense and security, resolving border problems, determining routes (highways, railways and oil or natural gas pipelines etc.) and land use (Koç and Bulut, 2014).

Coding information in maps, and decoding this information and interpreting it, are highly beneficial not only in the field of geography, but also in our daily lives. Building

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upon the studies by Catling (1988: 168) and Wiegand (1993: 19), Weeden (1997: 173) classified the use of maps into four main functions.

- Location, enabling the user to find a place (e.g. in an atlas or on a street map)
- Route-displaying, allowing the user to get from A to B (e.g. a road atlas, underground map or street map)
- Storing and displaying information, allowing the user to isolate and sort information from a wide range of different items (e.g. ordnance survey maps), or to consider patterns of, and relationships between, selected information (e.g. distribution maps)
- Problem-solving, helping the user to solve problems by interpreting or inferring from the information provided (e.g. why a road does not take the most direct route or where to locate a factory). Skilled map users learn to "see" the landscape from the information on the map.

Maps and plans are extremely useful ways of storing and communicating information about places, and the people who live and work in them. There is a language of maps and pupils can be helped to understand and use it just as they can be helped with any other language development (Beddis, 1983: 5).

Maps can be used in a powerful way of thinking about the earth (Krygier & Wood, 2005: 3). They are important tools that are used to describe the distribution of physical and human phenomena, events and objects, and to account for the relations of these to their environments. An individual has to have minimum map literacy to understand various distributions of events, phenomena and objects and interpret them.

"What does map literacy mean? How can we identify map literacy levels? It is difficult to answer these questions"(Clarke, 2003: 713).

Though the notion of literacy is mainly related to reading and writing skills, the scope of this notion was broadened after the industrial revolution. Since the industrial revolution, this concept has been used to mean being well educated or having a huge amount of knowledge in a field of study (McBride, 2011:23).

Buckley, Muehrcke & Muehrcke (2011) classify map use into three categories. These categories include reading, analysing and interpreting maps. Olson (1976) suggested three levels of map literacy that gradually become more difficult.

Level 1: Includes a comparison of the symbols' properties one by one.

Level 2: Includes acquiring knowledge of the properties of symbol groups in a map as a whole.

Level 3: Encompasses the use of maps as a tool in decision making or constructing knowledge by interpreting information based on symbols.

Carswell (1971:40-45) divides map literacy skills into various categories: directions, judging distances, comprehending geographic characteristics and recognizing patterns.

"Map literacy refers to using maps in our daily lives and understanding them. It is composed of five steps: knowledge, comprehension, application, analysis, synthesis and evaluation" (Clarke, 2003: 717). Weeden (1997: 169) lists map skills as using maps, drawing them, reading and interpreting them.

Golledge, Marsh and Battersby (2008: 91–92) call map skills as spatial thinking skills and divide these skills into five categories: (1) primitive level (identity, location, magnitude, space-time); (2) simple level (arrangements, distribution, line, shape, boundary, distance, reference frame, sequence); (3) difficult level (adjacency, angle, classification, coordinate, grid pattern, polygon); (4) complicated level (buffer, connectivity, gradient, profile, representation, scale) and (5) complex level (area association, interpolations, map projection, subjective space, virtual reality).

The terms "map skills" and "map literacy" are frequently used in academic circles. There are many studies on these issues (Buckley, Muehrcke & Muehrcke, 2011; Clarke, 2003; Gerber & Wilson, 1989; Gilmartin and Patton 1984; Golledge, Marsh, and Battersby, 2008; Kızılçaoğlu, 2007; Koç, 2008; Liben & Downs, 1989; MacEachren, 2004; McClure, 1992; Richard B. Schultz , Joseph J. Kerski & Todd C. Patterson, 2008; Taş, 2006; Weeden, 1997; White, 1995; Wiegand, 2006; Wood, 1992). However, there is limited literature on map literacy skill development (e.g., Jongman and Bednarz, 2012).

The Purpose of study

"In our society, individuals have difficulties reading maps or using them properly. That is, primary, secondary and high school students fail to locate provincial areas, prominent transportation routes, geographical formations and distribution of natural and human elements, and they are not able to make inferences about the geographical characteristics of a place by using various distribution maps. Moreover, even adults are not able to give clear and comprehensible directions" (Koç, 2008: 16). Therefore, it is essential that we should identify map literacy levels of individuals at various educational levels including those in higher education.

The purpose of the present study is to develop a tool to identify high school and higher education students' map literacy levels and to validate this tool. Buckley, Muehrcke & Muehrcke (2011); Olson, (1976); Carswell, (1971); Clarke, (2003); McClure, (1992); Weeden (1997) classified map skills and identified the levels of these skills. However, no validation studies were carried out in these studies with reference to classification and the identification of the levels.

In this study, map skills are classified, and based on this classification; the resulting tool is called as "map literacy scale." What distinguishes this study from others is that the researchers have carried out validation studies, so that they develop a tool that can be used in future. Fully validated scales are highly significant in terms of assessment. This is because there is need for reliable and valid scales to assess and interpret the map literacy skills of individuals and societies. By using such scales, it is possible to identify what map skills a person has, what skills he/she partially has or what others he/she does not have. There are very few scales that can be used to assess map literacy. We think that the present study will address this gap in the literature.

Map skills can be developed through education. This skill used changes from one situation to another based on the dynamics of the environment in which the person lives or the perceptual capacity of this person. Researchers think that this scale will contribute to the studies focusing on map literacy of high school and higher education students all over the world and to the efforts to increase their map literacy levels.

Methodology

Study Sample

The study sample was composed of 518 students studying at various faculties at Cumhuriyet University and high schools in Sivas and its counties. The participants were selected from high school and higher education students through random group sampling.

Based on the theory of probability, random sampling techniques often produce "good" samples. A good sample fully represents the universe where it comes from. That is, except for its size, a representative sample resembles, with its every characteristic, to the universe it belongs to. Although the representative sample rarely represents the universe perfectly, random sampling always represents the universe better than non-random sampling does (Johnson & Christensen, 2014:217). In this study, both high school students and university students were accepted as adults and these two groups were included in the study sample. While choosing the sample, equal number of students from all faculties at Cumhuriyet University were taken into the the sample without reference to the faculty they belong to. Table 1 presents detailed information about the sample.

Table 1.
Detailed information about the sample

Level	**Department**	**Grade**	**Gender**			**Percentage within the Whole Sample (%)**
			Male	*Female*	*Total*	
High School	High School	9.	24	24	48	9,22
		10.	24	24	48	9,22
		11.	24	24	48	9,22
		12.	24	23	48	9,20
University	Faculty of Medicine		20	29	49	9,46
University	Faculty of Dentistry		30	18	48	9,27
University	Faculty of Education		26	20	46	8,88
University	Faculty of Science		24	19	43	8,30
University	Veterinary Faculty		27	20	47	9,07
University	Faculty of Engineering		29	17	46	8,88
University	Faculty of Economics		24	24	48	9,27
Total			280	238	518	100,00

Instrument

Developing a Map Literacy Scale (MLS)

An item pool was constructed as the first step of developing the Map Literacy Scale (MLS). To create the item pool for the MLS, various studies in the related literature (Buckley, Muehrcke & Muehrcke, 2011; Clarke, 2003; Gerber & Wilson, 1989; Kızılçaoğlu, 2007; Krygier & Wood, 2005; Koç, 2008; Liben & Downs, 1989; MacEachren, 2004; McClure, 1992; Taş, 2006; Weeden, 1997; White, 1995; Wiegand, 2006; Wood, 1992) were examined. The pilot scale was composed of four subscales that included: reading and interpreting maps, using maps, carrying out procedures in maps, and sketching a map. There was a total of 48 items in the pilot scale. The subscale of reading maps had 15 items; the subscale of using maps was composed of 17 items; carrying out procedures in maps was composed of 9 items, and the subscale of sketching maps consisted of 7 items. All the piloting items were constructed to seek the participants' opinions about undesirable situations rather than testing factual knowledge.

The piloting item pool was revised by six lecturers holding a PhD degree in geography education. These people had carried out research studies on map literacy. Then, five geography teachers were asked to evaluate the items. The items were revised in line with the feedback provided by these teachers. All the items formulated were examined in terms of language, meaning and discourse by two Turkish educators holding a PhD. The items were revised after they were examined in terms of spelling, punctuation, meaning and expression.

After the completion of all these steps, the item pool was assessed by two experts with a PhD degree in testing and evaluation. These experts were experienced in item writing, item revision and survey development. Throughout this process, in line with expert opinions, all the items were assessed in terms of expression, appropriateness for the purpose of the study, and content validity.

The items in the item pool were randomly ordered, and for initial piloting, the scale was administered to 199 students, 148 of them being students at Sivas Selçuk Anatolian High School and 61 of them being students at the Communication Faculty, Cumhuriyet University. These students were not included in the actual study sample.

The researchers tried to test whether the items in the item pool were comprehensible for the students before they were administered to the actual study group. The feedback obtained through the initial piloting indicated that there were no items that were incomprehensible or misleading. Thus, after the initial piloting it was concluded that the pilot scale could be administered to the study sample.

Data Collection

The data in this study were collected in February and March, 2013. The scale was administered to the participants after they were informed about the purpose of the study. They were informed that the data to be collected were going to be analyzed as a whole, rather than individually; that this study was not an examination and it is not intended for identifying a case or an event related with the school, and that the questions didn't have right or wrong answers. Furthermore, the researchers clearly stated that the data to be collected would be kept private and would not be shared with anyone, so the participants were asked to respond sincerely.

Analysis of data

The data were analyzed using SPSS 17.0 and Lisrel 8.51. To test the construct validity of the scale, exploratory and confirmatory factor analyses were carried out. Item-test correlations, test re-test correlation and the Cronbach alpha internal reliability coefficient were calculated. In addition, a t-test was carried out to see if the items discriminated between the upper and lower 27% of the groups.

Findings

The distribution of the scores from the scale was examined before exploratory factor analysis; coefficient of skewness and kurtosis coefficient were calculate to be -,032 and ,233, respectively. These statistical data indicated that the scores were normally distributed (Brownlow, 2004).

Before the exploratory factor analysis, item-test correlations of the pilot scale with 48 items were calculated and three items with item-test correlations below .40 were deleted.

As the last step before the exploratory factor analysis, a Kaiser-Meyer-Olkin (KMO) test was conducted to see whether the sample size was appropriate for forming factors. The analysis revealed that the KMO value of the scale was 0.905. This indicated that the sample size was "perfectly adequate" to carry out factor analysis (Brownlow, 2004; Pett, Lackey & Sullivan, 2003). Moreover, the result of a Bartlett Sphercity test revealed that the Chi-square value was statistically significant. ($X^2(276)=3010.610$; $p<.01$). Considering these findings, the researchers concluded that the data could form factors (Lackey & Sullivan, 2003; Child, 2006; Pett, Hutcheson & Sofroniou, 1999). In this study, to test the construct validity of the MLS, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were carried out. After the scale was piloted, the correlations between the scores for each item and the whole scale were calculated.

Exploratory Factor Analysis

In order to identify the factor structure of the MLS, principal components analysis using the Varimax rotation technique was carried out (Brownlow, 2004; Walkey & Welch, 2010).

In the exploratory factor analysis, the lower boundary for the factor loading was determined to be 0.40; the items with a value lower than this were eliminated, and another factor analysis was carried out on the remaining items. This exploratory factor analysis revealed that there were 4 factors with an eigenvalue over 1.

When the factor loadings of the items in the scale were examined, it was found that four items (5, 8, 31 and 34) had high factor loadings for more than one factor, and the difference between the factor loadings was lower than 0.10. Therefore, these were considered as overlapping items and were excluded from the scale. 19th and 35th items were also deleted since there were similar items in the scale and response rate for these items was low.

In line with all these practices, some items were excluded from the scale since 3 of them had item-test correlations below 0.40, and 4 of them were considered as overlapping items. In addition, 2 items were deleted due to contextual reasons, and 15 of them were excluded from the scale since they had factor loadings below 0.40. The scale which initially had 48 items was composed of 24 items at the end of the process.

It was found that the first factor explained the covariance at 18.926%; the second factor explained it at 17.854%; the third factor explained it at 10.984% and the fourth one explained it at 10.294%. The contribution of the four factors to the total variance was 58.058%. This rate is enough for multi-factor designs (Brownlow, 2004; Hutcheson & Sofroniou, 1999; Fabrigar & Wegener, 2011). Table 2 presents the factor design obtained as a result of the analysis and the factor loadings of the items.

Table 2.

Factor Structure of the MLS according to exploratory factor analysis

Reading and Interpreting Maps		Using Maps		Carrying out Procedures in Maps (Trading)		Sketching Maps (Draw)	
Item	Factor Loading	Item	Factor Loading	Item	Factor Loading	Item	Factor Loading
15	.762	23	.777	1	.804	11	.807
13	.729	25	.740	2	.794	10	.792
16	.688	22	.725	4	.643	9	.659
18	.674	28	.695	3	.559		
12	.673	20	.686				
17	.628	27	.647				
6	.538	24	.611				
14	523	26	.541				
7	.464						
The Variance Explained %	18. 926	% 17. 854		% 10.984		% 10.294	

Table 2 shows that the factor loadings range between 0.762 and 0.464 for the 9 items in the subscale of reading and interpreting maps, between 0.777 and 0.541 for the 8 items in the subscale of using maps, between 0.804 and 0.559 for the 4 items in the subscale of carrying out procedures in maps, and between 0.807 and 0.659 for the 3 items in the subscale of sketching maps.

Item- Test Correlations

Table 3 Presents item-test correlation values that explain the validity coefficient of each item.

Table 3.

Item-Test Correlation Coefficients of the MLS

Factors	Items																							
	15	13	16	18	12	17	6	14	7	23	25	22	28	20	27	24	26	1	2	4	3	11	10	9
Reading and Interpreting Maps	73	66	67	65	62	64	55	65	56															
Using Maps										67	63	65	58	57	52	56	51							
Carrying out Procedures in Maps																		73	75	58	60			
Sketching Maps																						64	72	61
Total	**65**	**59**	**65**	**62**	**61**	**62**	**54**	**63**	**56**	**58**	**48**	**52**	**50**	**46**	**50**	**50**	**51**	**59**	**59**	**54**	**63**	**46**	**53**	**65**

Table 3 demonstrates that the correlation coefficients of the items in the scale range between 0.51 and 0.75. These values show that most of the items had moderate levels of item-test correlation and some of them had a strong item-test correlation (Brownlow, 2004; Hutcheson & Sofroniou, 1999).

Table 4.

The Correlations between Factor Scores of the MLS

Factors	Correlation			
	Reading and Interpreting Maps	**Using Maps**	**Carrying out Procedures in Maps**	Sketching Maps
Reading and Interpreting Maps	1			
Using Maps	.548 (**)	1		
Carrying out Procedures in Maps	.688 (**)	.421 (**)	1	
Sketching Maps	.556 (**)	.433 (**)	.504 (**)	1
Total	.900 (**)	.797 (**)	.777 (**)	.703 (**)

When Table 4 is examined, it is seen that there is a moderate correlation between the subscales of reading and interpreting maps, using maps, carrying out procedures with maps, and sketching maps, and a strong correlation between the subscales and total scale.

Discriminatory Properties of the Items

To test the discriminatory power of the items in the scale, a t-test was carried out. The participants' scores were ordered from the highest to the lowest, and thus the upper and lower 27% of the groups were identified. The mean scores of the groups were compared using an independent samples t-test. Table 5 presents the result of this test.

Table 5.
Item Analysis of the MLS

Item	**Group**	**N**	**X**	**Ss**	**t**	**p**
Item 15	Upper	148	2,3581	,97597	-19,481	.000
	Lower	148	4,3176	,73805		
Item 13	Upper	148	2,5878	1,21178	-16,829	.000
	Lower	148	4,5068	,67508		
Item 16	Upper	148	2,1622	,93353	-19,879	.000
	Lower	148	4,1622	,79157		
Item 18	Upper	148	2,4054	1,01578	-17,000	.000
	Lower	148	4,2365	,82776		
Item 12	Upper	148	2,2500	1,07460	-17,847	.000
	Lower	148	4,2095	,79328		
Item 17	Upper	148	2,4122	1,06859	-16,571	.000
	Lower	148	4,2500	,82375		
Item 6	Upper	148	2,5811	1,25092	-14,298	.000
	Lower	148	4,3581	,84925		
Item 14	Upper	148	2,1419	,94768	-17,167	.000
	Lower	148	3,9932	,90724		
Item 7	Upper	148	2,5608	1,35640	-14,018	.000
	Lower	148	4,3986	,83901		
Item 23	Upper	148	2,0878	1,00967	-17,446	.000
	Lower	148	4,0338	,90663		
Item 25	Upper	148	1,7568	,85413	-13,090	.000
	Lower	148	3,3176	1,17246		
Item 22	Upper	148	2,4189	1,21786	-14,270	.000
	Lower	148	4,2162	,92978		
Item 28	Upper	148	1,9932	1,11573	-13,660	.000
	Lower	148	3,8041	1,16443		
Item 20	Upper	148	2,3986	1,26028	-11,954	.000
	Lower	148	3,9730	,98937		
Item 27	Upper	148	1,8716	,92052	-13,367	.000
	Lower	148	3,4865	1,14575		
Item 24	Upper	148	2,1419	1,12492	-14,733	.000
	Lower	148	3,9324	,95947		
Item 26	Upper	148	2,2095	1,10197	-15,152	.000
	Lower	148	4,0878	1,02969		
Item 1	Upper	148	2,5405	1,18021	-16,933	.000
	Lower	148	4,4527	,70310		
Item 2	Upper	148	2,2500	1,07460	-17,060	.000
	Lower	148	4,1959	,87799		
Item 4	Upper	148	2,6351	1,33579	-14,150	.000
	Lower	148	4,4527	,81093		
Item 3	Upper	148	1,8311	,87589	-19,339	.000

	Lower	148	3,8919	,95572		
Item 11	Upper	148	1,6757	1,15597	-11,529	.000
	Lower	148	3,3243	1,30001		
Item 10	Upper	148	1,5946	,86377	-14,389	.000
	Lower	148	3,4189	1,27783		
Item 9	Upper	148	1,7432	,94128	-18,698	.000
	Lower	148	3,9054	1,04548		

Table 5 shows that there is statistically significant difference between the upper and lower groups ($p<.01$). This statistically significant difference indicates that the items in the scale have enough discriminatory power (Brownlow, 2004).

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was carried out to test the validity of the four-factor structure that emerged as a result of the exploratory factor analysis. The results of confirmatory factor analysis are presented in Table 6 and Figure 1.

Table 6.
The Results of the CFA of the MLS

Fitness Criteria	Values
X^2	537,91 (P = 0.0)
Sd (Degrees of Freedom)	246
X^2/sd	2,33
P-Value for Test of Close Fit (RMSEA < 0.05)	0.00
NNFI (Non-Normed Fit Index)	0.95
CFI (Comparative Fit Index)	0.96
RMSEA (Root Mean Square Error of Approximation)	0.078
SRMR (Standardized Root Mean Square Residual)	0.067
GFI (Goodness of Fit Index)	0.83
AGFI (Adjusted Goodness of Fit Index)	0.79
CFI (Comparative Fit Index)	0.96

The results of confirmatory factor analysis are given in Figure 1 and Table 1. In confirmatory factor analysis, it was clear that the MLS's proportion of degree of freedom to X^2 was slightly over two (2,33); this implies good fitness; RMSEA's being 0.078 implies acceptable fitness; GFI was 0.83 but it was not smaller than −2 and bigger than +2; this signals good fitness; AGFI was .79 and this implies acceptable fitness; the SRMR was 0.067 and this shows good fitness; NNFI was .95, so this signals perfect fitness, and CFI was 0.96, and this implies good fitness (Bartholomew, Knott & Moustaki, 2011; Brown, 2006; Thompson, 2004) When the "t" values were examined, it was seen that there were no red arrow warnings. Therefore, the items were significant at 0.05 levels.

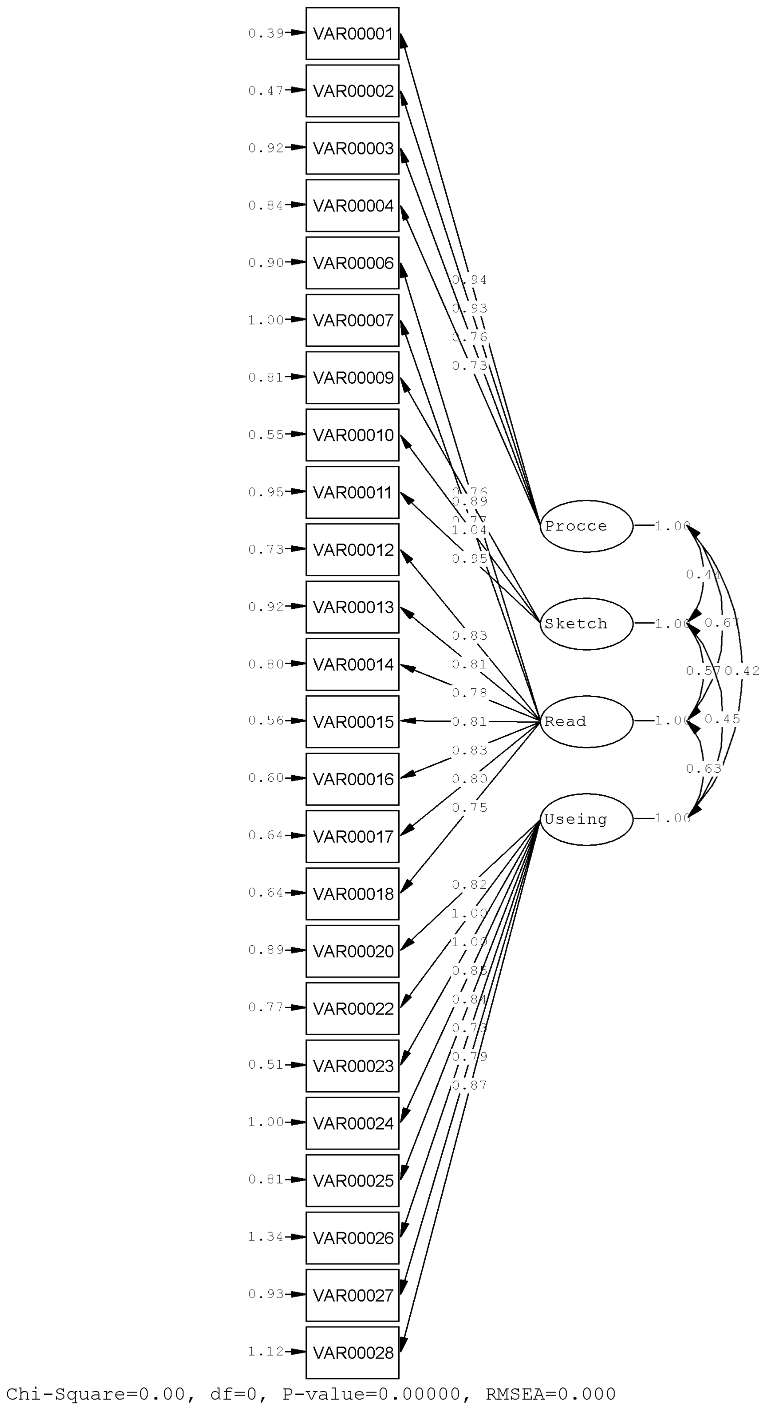

Figure 1.
Confirmatory Factor Analysis of the MLS (Path Diagram)

Findings about Internal Reliability

To find out the reliability of the MLS, the Cronbach alpha, Spearman-Brown, and Guttman split-half reliability coefficients were calculated. The overall Cronbach alpha reliability coefficient of the scale was calculated to be 0.926. The Spearman-Brown coefficient was found to be 0.905, and the Guttman Split-Half reliability coefficient was calculated to be 0.906. The Cronbach Alpha reliability coefficients of the subscales are presented in Table 7.

Table 7.

The Cronbach Alpha Reliability Coefficients of the Subscales

Factors	Cronbach Alpha Reliability Coefficient
Reading and Interpreting Maps	0.885
Using Maps	0.850
Carrying out Procedures in Maps	0.834
Sketching Maps	0.807

The Cronbach alpha reliability coefficients of the subscales range between 0.807 and 0.885. These values indicate that the subscales are reliable enough (Brownlow, 2004).

Optimal reliability coefficients (Cronbach Coefficient alpha) were computed for each scale (Table 8). These results show that all scales had at least satisfactory internal consistency. Indices ranged from .71 for Sketching Maps to .81 for Reading and Interpreting Maps (Byrne, 1998; Cronbach, Schönemann, & McKie,. 1965; Kamata, Turhan, & Darandari, 2003). Correlation Matrix was computed for each scale (see Table 9).

Table 8.

Optimal reliability coefficients (Cronbach Coefficient alpha) and Path Loading

Scale	Coefficient α	Path Loading (λ)
Reading and Interpreting Maps	.81	90
Using Maps	.79	84
Carrying out Procedures in Maps	.74	81
Sketching Maps	.71	79

Table 9.

Correlation Matrix

	Correlation Matrix of Independent Variables			
Scale	Reading and Interpreting Maps	Using Maps	Carrying out Procedures in Maps	Sketching Maps
Reading and Interpreting Maps	**1**			
Using Maps	0.67 (0.04) 14.89	**1**		
Carrying out Procedures in Maps	0.44 (0.06) 6.89	0.57 (0.05) 10.39	**1**	
Sketching Maps	0.42 (0.06) 6.93	0.63 (0.05) 13.65	0.45 (0.06) 7.33	**1**

Conclusion and Discussion

This study aims to develop a scale intended for identifying map literacy levels of individuals, especially high school and university students. With this aim in mind, an initial item pool for piloting was prepared in line with the literature, and expert opinion was sought on the item pool. The experts were asked to rate the items using a three-point Likert scale by using the labels "Appropriate", "Partially Appropriate" and "Not Appropriate". In line with the feedback provided by these experts, the item pool prepared was used as the pilot form.

After the piloting, the draft scale was administered to the study sample. Exploratory factor analysis (EFA) was carried out to investigate the factor structure of the scale; confirmatory factor analysis (CFA) was carried out to test construct validity of the scale along with other validity analyses.

As a result of the exploratory factor analysis, it was seen that the scale was composed of 4 factors. These factors are as follows: reading and interpreting maps, using maps, carrying out procedures in maps, and sketching maps. The factor loadings of the items range between .804 and .464.

To give appropriate names to the four dimensions of the scale (reading and interpreting maps, using maps, carrying out procedures with maps and drafting maps), the researchers cooperated with people with expertise on maps. The items in the scale were examined in a detailed way while assigning titles to the subscales. The researchers and experts discussed where to place each item. As a result of the discussions, the following conclusions were reached.

1. The items that focused on interpreting the physical and human properties of a place on earth, evaluating the characteristics of a place and identifying the location of that place, fall into the heading of reading and interpreting maps.

2. The items that involve mathematical procedures such as calculating distance, area and slope ratio, and finding differences in local time were included under the heading of carrying out procedures with maps. Items related with transferring data onto a plane are placed under the heading of sketching maps.

3. Items concerning how to use maps in daily life were included in the heading of using maps.

According to the result of the confirmatory factor analysis carried out to test the validity of the scale with 24 items and four factors, the proportion of X^2 to degree of freedom was slightly over two (2,33). This result indicates that the scale was consistent with real data. Table 6 shows that the fitness values are within acceptable limits, so it can be concluded that the MLS with 4 factors is a valid model. Furthermore, the Cronbach alpha reliability coefficient of the scale (0.926), and the correlation coefficients between the subscales and test-retest reliability coefficient indicated that the scale was reliable.

The researchers think that each of the items in the scale will provide individuals with a chance to evaluate themselves in terms of map skills and habits of using maps and will determine their level of proficiency. Those who respond to this scale will be able to learn what advanced map skills they have and what map skills they have to develop. We think that geography educators will have insight into the map literacy skills of the whole society or a certain part of it. With the help of this insight, they can offer solutions to problems related with map literacy.

As noted earlier in the introduction, there are a limited number of tools that can be used to assess map literacy skills. Jongman and Bednarz (2012) is one of these studies in the literature. The scale that these researchers developed is composed of eight multiple-choice items. When this scale is examined, it is seen that it is intended for assessing individuals' knowledge and skills.

As noted earlier, this suggested scale is composed of four subscales. It includes five-point Likert items that are intended to survey individuals' map knowledge and their map literacy. These items are categorized into the subscales of ability to process information in maps, reading maps, drawing draft maps and interpreting maps (See Appendix A). What makes the present study different from other studies is that it encompasses items that are intended to identify individuals' perceptions of and attitudes towards maps and how they usually use maps. These items are included in the subscale of using maps (See Appendix A).

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Appendix A

The items in this section aim to discover how proficient you are about the procedures carried out using maps. This is not an examination. There is no right or wrong answers to the questions. You are simply asked to read the items carefully and identify the option that describes you best by putting an "X" sign next to it. Chose only one option for each sentence.		**Never**	**Rarely**	**Sometimes**	**Generally**	**Always**
Subscale of Carrying out Procedures in Maps	**1**. I can calculate the distance between two locations in meters or kilometers by using maps.					
	2. I can calculate the actual area of a place using a map.					
	3. I can calculate the slope in a certain intersection of a road by using a topography map.					
	4. I can find the local time difference between two locations with the help of maps.					
Subscale of Reading and Interpreting Maps	**6.** I can create sketches that show the way from my house to school, from the game park to my house, and from my house to the shopping centre.					
	7. I can show the places in which I live, and was born, on small-scale and large-scale maps which have no writing on them.					
	12. I can make use of appropriate symbols (dots, areas and lines) while showing natural and human elements such as cafés, schools, petrol stations, roads, rivers and football pitches on outline maps.					
	13. I can easily understand the information presented with the help of the legend, the section that explains what shapes and symbols mean in a map.					
	14. I can analyze the changes in lands and evaluate the factors that trigger these changes by using maps of residential areas drawn at different time periods.					
	15. I can assess the geographical characteristics of a place by using different map types (weather maps, topography maps, geology maps, underground resource maps and maps for land use).					

	16. I can make sense of the relationship between geographical formations and land by using topography maps.					
	17. By using highway and railway networks, I can identify the factors that prove influential in the distribution of transportation networks and make deductions about the relationship between transportation networks and economic activities.					
	18. I can assess the factors that play a significant role in the distribution of natural disasters such as earthquakes, floods, landslides, and avalanches by using appropriate maps.					
Subscale of Sketching Maps	**9**. I can draw topography maps using contour lines.					
	10. I can draw isobaric charts using isobars.					
	11. I can draw precipitation maps using isohyets.					
The Subscale of Map Use	**20.** I make use of road maps during journeys.					
	22. When I look for a place that I don't know, I look at maps first.					
	23. I am accustomed to using maps when trying to find my direction.					
	24. When I hear the names of unfamiliar elements such as countries, islands, lakes, seas and dams, I immediately refer to my atlas to find out where they are.					
	25. I actively make use of maps in solving problems that disturb my daily activities (e.g., to find a solution to traffic jam or identify alternative routes if there is roadwork ahead).					
	26. I'm accustomed to using some map-related applications in my car, and on my computer and mobile phone.					
	27. I read about maps.					
	28. I make use of physical maps to learn about the holiday resort where I am planning to have a holiday, to see whether it is rugged, high or on the coastline.					