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AN ADAPTATION STUDY OF CRITICAL THINKING DISPOSITION SCALE

ELEŞTİREL DÜŞÜNME EĞİLİMİ ÖLÇEĞİNİN TÜRKÇE'YE UYARLANMASI

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Abstract

The purpose of this research was to adapted the scale for Critical Thinking Disposition (EMI) which was developed by Ricketss and Rudd (2005) into Turkish. 1264 first grade high school students in Ankara participated in the study in academic year of 2011-2012. EMI is a five-point Likert scale consisting of 26 subject items. The correlations between the two languages which were obtained from the group's scores of the English and Turkish forms were evaluated, thus determining the language equivalency of the scale. Exploratory and confirmatory factor analyses were conducted in order to obtain evidences regarding the structural validity of the scale. The internal consistency coefficients of each sub-dimension of the scale were calculated to determine the reliability analysis of EMI. When the Cronbach's-alpha coefficients of EMI and its sub-dimensions were investigated, the coefficient values were determined as high. The internal consistency coefficients have similar values to those of the original form, which was indicated in the guidebook of the scale. The results therefore indicate that this scale is highly reliable. The test-retest reliability of the scale was also investigated. For this aim, two trials were conducted, and the scores were analyzed using the Pearson product-moment correlation coefficient method. A positive and highly significant correlation was found between the scores, thereby indicating that the test-retest reliability is sufficient.

Key Words: Critical Thinking, Critical Thinking Skill and Disposition, Validity and Reliability

Özet

Bu araştırmada Ricketss and Rudd (2005) tarafından geliştirilen Eleştirel Düşünme Bu araştırmada Ricketss and Rudd (2005) tarafından geliştirilen Eleştirel Düşünme Eğilimi Ölçeği'nin Türkçe'ye adaptasyon çalışması gerçekleştirilmiştir. Ankara'da eğitim gören 1294 lise birinci sınıf öğrencisi araştırmanın örneklemini oluşturmaktadır. Eleştirel Düşünme Eğilimi Ölçeği 26

maddeden oluşan beşli Likert tipi ölçektir. Ölçek maddeleri bir grup tarafından İngilizce'den Türkçeye çevrilmiş, daha sonra geri çevirisi yapılarak ölçek maddelerinin anlam bakımından aynı bilgiyi verip vermediği araştırılmıştır. Ölçeğin dilsel eşdeğerliği çalışmaları İngilizce ve Türkçe'ye hakim bir grup üzerinde gerçekleştirilmiştir. Bu gruba hem orijinal (İngilizce) hem de Türkçe form uygulanmış alınan puanlar arasındaki korelasyon ve alınan puanlar arasından manidar fark olup olmadığı incelenmiştir. Alt ölçekler için elde edilen korelasyon katsayıları ve manidarlık testleri sonuçlarına dayalı olarak, Eleştirel Düşünme Eğilimi Ölçeği'nin orijinaline uygun bir biçimde çevrildiği ve dilsel eşdeğerliliğinin sağlandığı sonucuna ulaşılmıştır. Doğrulamalı ve açıklayıcı faktör analizleri ile ölçeğin yapı geçerliğine ilişkin kanıtlar elde edilmiştir. Ölçeğin iç tutarlılık anlamındaki güvenilirlik kanıtları için ise Cronbach alfa hesaplanmıştır. Ölçeğin alt boyutlarına ilişkin Cronbach alfa değerlerinin yüksek olduğu saptanmıştır. Ölçeğin test tekrar güvenilirliği için ise iki hafta arayla uygulanan test sonuçları arasındaki korelasyon hesaplanmıştır. Bu korelasyon değerinin yüksek olduğu saptanmıştır. Ölçekten elde edilen bulgular birlikte ele alındığında bu ölçeğin Türkçe'ye uyarlanma çalışmalarının geçerli ve güvenilir sonuçlar verdiği ve bu ölçeğin eleştirel düşünme eğiliminin araştırıldığı çalışmalarda kullanılabileceği söylenebilir.

Anahtar Kelimeler: Eleştirel Düşünme Eğilimi, Eleştirel Düşünme Becerisi, Geçerlik ve Güvenirlik

1. INTRODUCTION

Critical thinking is an aim of modern educational curricula. The Turkish education system emphasizes critical thinking within the National Education Basic Law. The second general purpose of the Turkish education system is to make critical thinking skills directly effective in the development of curricula.

Paul and Elder (2004) indicated that critical thinking was a thinking model about the subject, concept or problem that the thinkers cleverly changed the basic structures of thoughts and developed the qualities of that thought by applying standards of thought to them. According to Inch and Warnick (1994: 11), critical thinking is used "to indicate problems, questions or situations; to integrate all available information; to reach hypotheses and results, and to affirm one's idea.

Ramasay (2011) indicated that an appropriate disposition is necessary in order to be a critical thinker. Ennis (1987) defined the critical thinking disposition as "to do something in certain circumstances". Facione and Facione (1992) stated that the critical thinking disposition comprised seven sophisticated components: searching for the truth, broadmindedness, analyticalness, systematicity, self-confidence, curiosity and maturity.

Ennis and Norris (1990) emphasized that students' cognitive skills were important in developing a disposition to critical thinking. They also thought that critical thinking should include dimensions of both skill and disposition. According to the conceptual model developed by Ricketts and Rudd (2004), critical thinking skills

were composed of critical thinking disposition and such facilitating factors as age and gender (Figure 1).

Behavior/Critical Thinking Skills = Critical Thinking Dispositions + Facilitating Factors

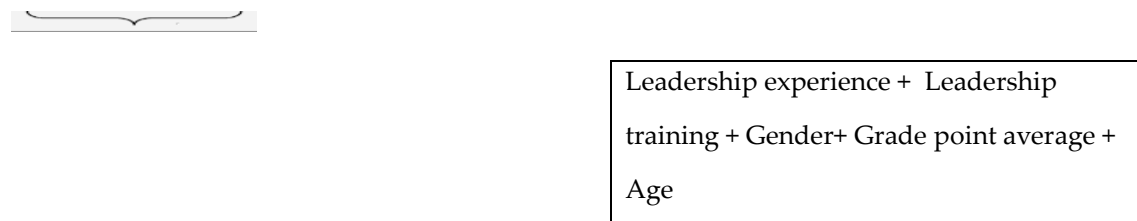


Figure 1: Conceptual model of critical thinking skills (Behavior) (Ricketts and Rudd, 2004)

Critical thinking skills require the use of cognitive strategies preeminently. A disposition towards critical thinking provides the motivation and desire to utilize these cognitive skills.

Critical thinking is accepted as a key factor in developing appropriate student-skills within the curricula of such countries as the USA, UK and Austria (American Association of Colleges and Universities, 2005; Australian Council for Educational Research, 2002; Higher Education Quality Council, 1996). Education reforms, which have been currently put into practice in China and Japan in addition to western countries, support the development of critical thinking for students to join a liberal community. Scientists and educators reached a consensus on the importance of being a critical thinker in the evolution of students. However, they stated that teaching and evaluation of critical thinking were difficult processes.

Various scientific studies measured critical thinking disposition. Many of these studies used the California Critical Thinking Disposition Instrument (CCTDI). Ricketts and Rudd (2004) developed EMI scale, and examined the relationship between critical thinking disposition and the skills of leaders. They found a negative correlation between critical thinking skills and critical thinking disposition. Stedman and Andenoro (2006) used EMI to measure critical thinking disposition, and found a positive correlation between critical thinking and emotional intelligence. Lee (2009) used the EMI scale, and concluded that metacognitive tasks had a significant effect on self-regulation among students; and that critical thinking skills and critical thinking disposition were not effective in achieving self-regulation.

Çıkrıkçı (1993) adapted the Watson-Glaser Critical Thinking Appraisal Test Form YM (long form) to measure critical thinking in Turkey; the scale was determined as difficult and moderate-difficult for the 1st-3rd grade high school students. The Watson-Glaser Power of Critical Reasoning Test Form S was adapted to Turkish culture by Evcen (2002); the study reported that WG-EAGT Form S was valid and reliable for grades 1-3 high school pupils and grade-1 university students. Kökdemir

(2003) conducted an adaptation study of the California Critical Thinking Disposition Instrument (CCTDI). It was concluded that college students who had been receiving lessons such as introduction to psychology and critical thinking had a higher level of critical thinking compared with those who had not attended such lessons.

Other studies in the literature were followed by the adoption studies of Cornell Critical Thinking Test Level X to Turkish culture. There is no survey to measure the critical thinking inclinations of the students in 1st grade of high schools in Turkey. The Critical Thinking Survey used in the present study constitutes the subject of foreign researches, but could not be examined in Turkey due to the absence of its adoption studies to Turkish Language. Based on this thought, this study aims to gain a new survey that can measure the critical thinking inclinations of the students in 1st grade of high school to Turkish culture. The present research comprises an adaptation study of EMI (developed by Ricketts and Rudd, 2005) to Turkish culture in order to provide a new scale that can measure critical thinking disposition. With this general aim, the study examined the following questions.

1. Is there a significant difference between the practice scores of original EMI and its Turkish forms?
2. Is there a significant relationship between the practice scores of original EMI and its Turkish forms?
3. What is the factor structure of the Turkish form of EMI according to exploratory factor analysis?
4. Are the factor structure of the Turkish form of EMI and the three-factor structure of the original tool verified?
5. Is there a significant relationship between the subscales of EMI and total test score?
6. Is there a significant relationship between the scores of EMI and CCTDI, which was previously reported to be valid and reliable?
7. What is the internal consistency coefficient of the Turkish form of EMI?
8. What is the test-retest reliability of the Turkish form of EMI?

2. METHODOLOGY

Model

An adaptation study of the Critical Thinking Disposition (EMI) scale was conducted by investigating the critical thinking levels of 1st-grade secondary school students. Survey method was used in study.

Population and Sample

The study sample comprised 1264 students who attended the first grade of high school in Ankara province during the education period 2011–2012. The participants were selected according to data for the education period 2011–2012, which was obtained from the Statistical Unit of Ministry of Education in the eight central districts (Altındağ, Çankaya, Etimesgut, Gölbaşı, Keçiören, Mamak, Sincan and Yenimahalle) that comprised the study population. According to the this data, the

study sample was selected from 125 secondary schools comprising 39049 1st-grade high school students via the methods of random cluster sampling and stratified sampling in terms of socio-economic degree (SED). The gender of the students and distributions according to SED are shown in Table 1.

Table 1: The sexes of the students and distributions according to SED

Districts (SED)	Woman	Men	Total	%
Altındağ (Low)	196	209	405	32.04
Yenimahalle (Medial)	216	228	444	35.12
Çankaya (High)	203	212	415	32.84
Total	615	649	1264	100

Table 1 showed that the students, 48.70% of whom were female and 51.30% of whom were male, had low level of SED at 32.04% rate, medium level of SED at 35.12% rate and high level of SED at 32.84% rate.

Data Collecting Tool

The original “Critical Thinking Disposition Assessment (EMI)” scale was developed by Ricketts and Rudd in 2005. This scale contains 26 items, which are assessed via a five-point Likert score. The scale includes three subscales: Engagement, Cognitive Maturity and Innovativeness. Individuals with high engagement inclination accept that well-thinking is always necessary, justify their thinking skills and seek an opportunity to use their thinking skills for problem-solving and decision-making. Individuals with high cognitive maturity are aware that many problems are more complex than their superficial appearance. Individuals with high innovativeness disposition are described as “hungry for learning”.

The process of test adaptation and implementation

Permission to use the scale was taken from Ricketts, one of the developers of the scale. Three English Teaching graduates translated the original form of the scale (English) into Turkish. Researchers compared and evaluated these three different translations in terms of language and meaning. They then formed the scale from which the implementation will be done. A Turkish linguist was consulted to check the form in terms of language and meaning. Two steps were followed to decide whether the language versions of the original and Turkish forms of the scale were equivalent. First, three acknowledged experts from graduated English Language and Literature Department of Education, who had not seen the original scale, re-translated the scale from Turkish to English; this re-translated English form was sent to the original author (Ricketts), who confirmed that it could be used in that form. The second step was the use of a bilingual group pattern. Within this method, a group of students who had good knowledge of both languages were presented with the Turkish and English versions of the scale. The opinions of the experts were taken in terms of translation, re-translation and linguistic equivalences when trialing the scale. A translated form of the scale was prepared for preliminary trials. Several changes were made to the items of

the scale in accordance with the results of the preliminary study, and then the final form of the scale was produced. Questions about the demographic characteristics of the respondents were added to the final version of the form. Permission was obtained from the provincial directorate for national education of Ankara in order to apply the EMI in high schools within the districts of Altındağ, Çankaya and Yenimahalle.

Data Analysis

The study data was analyzed via SPSS (version 15.0) and LISREL (version 8.7), and significance level was set at .05. The linguistic equivalence was tested of the original and Turkish versions of the scale; t-test and Pearson product-moment correlation coefficient were calculated for dependent groups.

Exploratory and Confirmatory Factor Analysis was used to test the structure validity of the scale as part of the sub-goals of the study. Pearson product-moment correlation coefficient was used to determine criterion validity and test-retest reliability. Cronbach alpha coefficient was calculated to test the internal consistency.

3. FINDINGS

This section summarizes and interprets the research findings within the context of the study objectives.

Studies of Linguistic Equivalence

The linguistic equivalence of the original and Turkish versions of the tool was examined via t-test and Pearson product-moment correlation coefficient for dependent groups.

1. Is there a meaningful difference between the practice scores of original EMI and its Turkish forms?

The original and translated forms of the EMI were given to 139 senior students at Ataturk Anatolian High School. The interval between tests was four weeks. The difference between the average subscale scores of the original and translated forms was calculated via t-test for dependent groups (see Table 2).

Table 2: The difference between the average subscale scores of the original and translated forms

Factor	Practise	N	X	S	df	t	p
1	Original Form	139	45.48	4.64	138	1.52	.12
	Turkish Form	139	44.98	5.02			
2	Original Form	139	32.23	3.85	138	-.14	.88
	Turkish Form	139	32.27	3.52			
3	Original Form	139	28.87	3.17	138	1.48	.11
	Turkish Form	139	28.58	3.32			
Total	Original Form	139	106.58	10.14	138	1.21	.22
	Turkish Form	139	105.84	10.64			

As is seen in Table 2, there was no significant difference between the average scores of the original and translated forms of EMI, which suggests linguistic equivalence between the two versions of the scale.

2. Is there a meaningful relationship between the practice scores of original EMI and its Turkish forms?

Subscale scores for the original and Turkish forms of the scale, and the Pearson product-moment correlation coefficient calculated for total scores are shown in Table 3.

Table 3: Pearson product-moment correlation coefficients between sub-scale scores of original and Turkish scales in linguistic equivalence study (N=139)

Turkish English	Engagement	Cognitive Maturity	Innovativeness	Total
Engagement	.68**	--	--	--
Cognitive Maturity	--	.54**	--	--
Innovativeness	--	--	.76**	--
Total	--	--	--	.76**

**p< .01

As seen in Table 3, the correlation coefficients of the original and translation forms were 54 and 76, respectively. The correlation coefficient between the total scores of the scale is 76. Correlation coefficients are high and positive. This shows consistency between the tests, thereby indicating linguistic equivalence (r= .76, p< .01).

According to the correlation coefficients of subscales and the results of the significance tests, it was concluded that the translated EMI achieved linguistic equivalence with the original version.

Validity studies

Structure validity and criterion-based validity were used to test the validity of the scale.

3. What is the factor structure of Turkish form of EMI following exploratory factor analysis?

The data group was examined to determine whether it met the assumptions of the factor analysis and it was concluded that it had a normal distribution before applying exploratory factor analysis on the scores of the EMI sample group. Item-total correlation (r) were calculated to determine the distinctiveness of each item of the EMI (see Table 4).

Table 4: Item-total correlations (R)

Item	r	Item	r	Item	r	Item	r
1	.39	8	.45	15	.60	22	.51
2	.53	9	.49	16	.29	23	.43
3	.46	10	.55	17	.47	24	.49
4	.62	11	.18	18	.54	25	.42
5	.47	12	.47	19	.49	26	.34
6	.53	13	.39	20	.39		
7	.47	14	.51	21	.47		

As seen in Table 4, values of items distinctiveness ranged between .29 and .62 except for the 11th item, which had a low distinctiveness index of .18, and was therefore removed from the scale and then analyses on the scale were conducted.

Exploratory factor analysis was conducted within the scale. The number of factors was limited to 3, according to the speculative frame of the scale. The value of Kaiser-Meyer Olkin (KMO) was calculated as .88 and Bartlett Test was significant. Principal component factor analysis indicated a relationship between the sub-factors of the scale. Therefore, the Promax spinning method, which is one of the taper-spinning methods, was preferred. The factor structure that was obtained after the analyses of the items, factor loading values and common factor variances are shown in Table 5.

Table 5: EMI's factor structure (Taper-Spinning methods-Promax)

Factor and Items		Variance Explained	Factor Loading
Factor 1: Engagement		29.03	
7	I enjoy finding answers to challenging questions.		.85
5	I am able to relate to a wide variety of issues.		.84
2	I look for opportunities to solve problems.		.59
18	I ask good questions when trying to clarify a solution.		.58
8	I am a good problem solver.		.56
9	I am confident that I can reach a reasonable conclusion.		.53
19	I present issues in a clear and precise manner.		.46
14	I am able to apply my knowledge to a wide variety of issues.		.44
17	I am able to explain things clearly.		.42
3	I am interested in many issues.		.40
22	I keep on working on things until I get them right.		.34
Factor 2: Innovativeness		9.53	
4	I enjoy learning about many topics.		.95
15	I enjoy learning even when I am not in school.		.89
6	I ask lots of questions in a learning environment.		.83
10	I strive to be well informed.		

		.70
21	I search for the truth even when it makes me uncomfortable.	.64
23	I will go out of my way to find the right answers to a problem.	.64
12	I enjoy solving problems.	.48
Factor 3: Cognitive Maturity		5.75
20	I consider how my own biases affect my opinions.	53
16	I can get along with people who do not share my opinions.	53
13	I try to consider the facts and not let my biases affect my decisions..	52
1	I listen carefully to the opinions of others even when they disagree with me.	49
26	I believe that most problems have more than one solution.	45
24	I try to find multiple solutions to problems.	43
25	I ask many questions when making a decision.	35
Total		44.31

The analysis showed that Engagement (first factor) expressed 29.03% of the total variance, Innovativeness (second factor) accounted for 9.53% and Cognitive Maturity (third factor) 5.75%. The three described factors of the scale in combination explained 44.31% of the total variance.

4. Are the factor structure of Turkish form of EMI and three-factor structure of the original tool verified?

First/lower order Confirmatory Factor Analysis (CFA) was conducted for the three-factor structure of the EMI that was obtained as a result of the exploratory factor analysis, in order to investigate the significance of the factor structure at .05 level. The relationships between implicit variables (factor) and observed variables are shown in Table 6. The valuations of t and λ of the error variances of the observed variables are also shown in Table 6.

Table 6: Standardized t and Lambda-x values of EMI scale substances

FACTOR	ITEMS	t	λ
ENGAGEMENT	EMI 2	-	.72
	EMI 3	15.94	.48
	EMI 5	18.17	.55
	EMI 7	18.26	.55
	EMI 8	17.41	.53
	EMI 9	18.87	.57
	EMI 14	18.59	.56
	EMI 17	18.15	.55
	EMI 18	23.79	.73
	EMI 19	19.87	.60
COGNITIVE MATURITY	EMI 22	16.95	.51
	EMI 1	-	.43
	EMI 13	10.94	.47
	EMI 16	9.12	.35
	EMI 20	11.14	.49
	EMI 24	12.46	.62
	EMI 25	11.57	.52
INNOVATIVENESS	EMI 26	11.05	.48
	EMI 4	-	.96
	EMI 6	39.19	.79
	EMI 10	28.49	.66
	EMI 12	20.32	.62
	EMI 15	48.77	.87
	EMI 21	22.99	.87
EMI 23	23.43	.58	

Fit indexes obtained from EMI sample group and values calculated accordingly are given on Table 7.

Table 7: Fit indexes of EMI's measurement model

χ^2	Sd	p	RMSEA	AGFI	SRMR	CFI	NNFI
2851.35	272	.00	.08	.82	.06	.91	.90

As seen in Table 7, fit indexes were calculated via CFA to investigate whether the factor structure of the EMI in the original scale was valid for Turkish culture, and whether it was compatible with the data. Fit indexes were calculated as $\chi^2 = 2851.35$ (sd = 272, p = 0.00), $\chi^2/sd = 10.78$, RMSEA = .08, AGFI = .82, SRMR = .06, CFI = .91 and NNFI = .90. The proportion of chi-square to degree of freedom was higher than 5. As a result, it was decided to make modifications between the items 18-2, 7-5 and 8-3. according to the results of the confirmatory factor analysis.

Following the modifications, the relationships between implicit variables (factor) and observed variables, and the values of t and lambda-x for the error variances of the observed variables are shown in Table 8.

Table 8: Following the modifications, standardized t and Lambda-x values of EMI scale substances

FACTOR	ITEMS	t	λ
ENGAGEMENT	EMI 2	-	.62
	EMI 3	14.34	.48
	EMI 5	15.13	.51
	EMI 7	15.13	.51
	EMI 8	15.52	.53
	EMI 9	17.08	.59
	EMI 14	16.65	.58
	EMI 17	16.42	.57
	EMI 18	33.30	.63
	EMI 19	17.42	.61
COGNITIVE MATURITY	EMI 22	15.85	.54
	EMI 1	-	.44
	EMI 13	11.17	.48
	EMI 16	9.28	.36
	EMI 20	11.24	.49
	EMI 24	12.57	.62
	EMI 25	11.62	.52
INNOVATIVENESS	EMI 26	11.09	.47
	EMI 4	-	.95
	EMI 6	39.07	.79
	EMI 10	28.68	.66
	EMI 12	20.33	.62
	EMI 15	48.77	.87
	EMI 21	23.01	.87
	EMI 23	23.43	.58

After the modification of EMI, fit indexes were calculated for the sample group, as shown in Table 9.

Table 9: After the modification of EMI, fit indexes of EMI's measurement model

χ^2	sd	p	RMSEA	AGFI	SRMR	CFI	NNFI
1240.16	269	.00	.05	.91	.04	.97	.96

The CFA results following the modification are as follows: $\chi^2 = 1240.16$ (sd = 269, p = .00), $\chi^2/\text{sd} = 4.61$, RMSEA = .05, SRMR = .04, AGFI = .91, CFI = .97 and NNFI = .96. Comparing the goodness of fit indexes, it was seen that the modifications considerably enhanced the values.

When all of the obtained values and prospective critical values were compared, it was seen that the obtained values showed good or excellent fit to the model data.

This indicates that the original structure of the scale was confirmed through the study data.

5. Is there a meaningful relationship between the subscales of EMI and total test score?

A correlation matrix regarding total score and subscales of the scale, the mean values and standard deviation were calculated, (see Table 10).

Table 10: A correlation matrix regarding total score and subscales of the scale, the mean values and standard deviation (N=1264)

	Engagement	Cognitive Maturity	Innovativeness	X	S
Engagement	-	-	-	43.39	6.21
Cognitive Maturity	.57**	-	-	27.36	3.99
Innovativeness	.47**	.43**	-	28.22	4.80
Total	.87**	.78**	.77**	102.57	12.52

**p< .01

As seen in Table 10, all of the scales within the EMI show meaningful relationships ($p < .01$) with each other and the total score. The relationships of the sub-dimensions of the scales with each other and the total score range between .43 and .87. This is taken as evidence of the validity of the scale.

6. Is there a meaningful relationship between the EMI and CCTDI scores which was previously determined as valid and reliable?

The California Critical Thinking Disposition Instrument (CCTDI) was used in the criterion validity method, which was conducted to determine the validity of the research. The California Critical Thinking Disposition Instrument resulted from the Delphi Project that the American Philosophy Society conducted in 1990. The scale was developed by Facione and Facione (1992), and includes 76 questions and 7 sub-scales. First, 269 1st-grade high school students were exposed to CCTDI, and the Turkish form of the EMI was applied two weeks later. The sample group was selected randomly from three different neighborhoods classified as having low, medial and high socio-economic characteristics. Table 11 shows the Pearson product-moment correlation coefficient, calculated from the California Critical Thinking Disposition Instrument and EMI scores.

Table 11: The pearson product-moment correlation coefficient between CCTDI and EMI scores (N=269)

Variable	CCTDI	EMI
CCTDI	--	.42**
EMI	.42**	--

**p< .00

As seen in Table 11, positive, moderate and significant relationships were determined between CCTDI and EMI ($p < .01$). This result is evidence of the validity of the criteria of EMI.

Reliability Studies

The reliability of the scale was tested via Cronbach-alpha internal consistency coefficient and test-retest reliability.

7. What is the internal consistency coefficient of the Turkish form of EMI?

Cronbach-alpha internal consistency coefficient was calculated, and the internal consistency coefficients for each sub-dimension of the scale and total were compared with those obtained from the original form. The results are shown in Table 12.

Table 12: Cronbach-Alpha internal consistency coefficient from the practice scores of original EMI and its Turkish forms

Sub-dimensions	Original Form			Turkish Form		
	N	Number of item (k)	α	N	Number of item (k)	α
Engagement	1095	11	.90	1264	11	.84
Cognitive Maturity	1095	8	.87	1264	7	.71
Innovativeness	1095	7	.79	1264	7	.87
Total	1095	26	.93	1264	25	.88

When the internal consistency coefficients of the sub-dimensions of the original EMI were investigated, the internal consistency coefficient of the “Engagement” sub-dimension was calculated as .90 (n =1095 individuals), compared with .84 for the Turkish form (n =1264). The internal consistency coefficient of the “Cognitive Maturity” sub-dimension was .87 in the original form, compared with .71 in the Turkish scale. Nunnally and Bernstein (1994) reported values within the range .70– .80 were sufficient for usage. The internal consistency coefficient of the “Innovativeness” sub-dimension was .87 in the Turkish form and .79 in the original form. This finding shows that the sub-scales have a consistent structure. Cronbach’s-alpha internal consistency coefficient related to the all items of EMI was calculated as .93 in the original form and .88 in the Turkish form.

8. What is the test-retest reliability of the Turkish form of EMI?

The stability factor that was obtained from the two different trials is shown in Table 13. These trials were conducted at two-week intervals, and included 223 1st-grade high school students.

Table 13: EMI's test-retest reliability coefficients

Factor	Trial	X	Ss	r
Engagement	1. Trial	43.29	5.88	.76(*)
	2. Trial	43.49	5.48	
Cognitive Maturity	1. Trial	30.78	4.37	.70(*)
	2. Trial	30.85	4.39	
Innovativeness	1. Trial	26.69	4.09	.71(*)
	2. Trial	26.75	3.96	
Total	1. Trial	100.77	12.60	.78(*)
	2. Trial	101.10	12.11	

*p< .01

As seen in Table 13, test-retest reliability coefficients of the scale were calculated as .76 for Engagement, .70 for Cognitive Maturity and .71 for Innovativeness. The test-retest correlation coefficient for the total score was .78. A reliability level of .70 is taken to indicate that all of the sub-scales and the overall scale are sufficiently reliable.

4. CONCLUSION and DISCUSSION

A study was conducted of the adaptation of the EMI to Turkish. Linguistic equivalence studies of the original (English) and target (Turkish) language forms were conducted to test the suitability of the scale. Scores were compared between the original and target language forms of the scale, and it was found that there was no meaningful difference. Principal component factor analysis indicated a relationship between the sub-factors of the scale. On this basis, it was concluded that the measurement tool was translated concordantly with the original version.

Exploratory Factor Analysis was conducted via the Principal Component Analysis method, using data obtained from 1st-grade high school students in order to indicate the scale structure of EMI. It was concluded that the scale had a three-factor structure similar to the original form, and that the items within each factor were collected within their own factors (Ricketts and Rudd, 2005). It was also concluded that the items showed high loading values. This supports the results obtained from the study of Lee (2009). This finding supports the studies by Friedel et al. (2008) and Stedman and Anderono (2007). Information on the principal components of the scale, which was determined via exploratory factor analysis, the structure of the scale and the critical thinking disposition of the scale were determined via Confirmatory Factor Analysis. It was concluded that the three-factor structure of EMI as a model had a high fit index. On this basis, it was concluded that EMI was a suitable measurement tool for 1st-grade high school students.

Correlation analysis was conducted, in which the relationships of the sub-scales of EMI and total scores were compared with each other. Tavşanlı (2002) reported that the sub-dimensions that showed low relationship with the total score should be

removed from the scale. It was concluded from the correlation analysis that the sub-scales were related to the total score at a significance level of .01.

The internal consistency coefficients of each sub-dimension of the scale were calculated to determine the reliability analysis of EMI. When the Cronbach's-alpha coefficients of EMI and its sub-dimensions were investigated, the coefficient values were determined as high. The internal consistency coefficients have similar values to those of the original form, which was indicated in the guidebook of the scale (Irani, Rudd, Gallo, Ricketts, Friedel, & Rhoades, 2007). The results therefore indicate that this scale is highly reliable. The test-retest reliability of the scale was also investigated. For this aim, two trials were conducted, and the scores were analyzed using the Pearson product-moment correlation coefficient method. A positive and highly significant correlation was found between the scores, thereby indicating that the test-retest reliability is sufficient.

On the basis of the research results, further studies can be conducted of the validity and reliability of EMI for application to all primary, secondary and high school grades and higher education. Future studies can be compared with the findings of the present study. Future studies may identify reasons for the lack of distinctiveness of the 11th item discussed in the present study.

REFERENCES

- American Association Of Colleges And Universities (2005). Liberal education outcomes: A preliminary report on student achievement in college. Washington, DC: AAC&U.
- Australian Council For Educational Research (2002). Graduate skills assessment. Australia: Commonwealth of Australia.
- ÇIKRIKÇI-Demirtaşlı, N. (1993). Watson-Glaser Critical Thinking Appraisal Test (Form YM) on the pre-trial application of high school students. *Ankara University Faculty of Educational Journals*, 25 (2), 559-569.
- ENNİS, R. H. (1987). A taxonomy of critical thinking dispositions and abilities. J. Boykoff-Baron ve R. J. Sternberg (Eds.), *Teaching thinking skills: Theory and practice* (pp. 9-26). New York, NY: W. H. Freeman.
- ENNİS, R. H. & Norris, S. P. (1990). Critical thinking assessment: Statues, issues, needs. S. Legg ve J. Algina (Eds.), *Cognitive assessment of language and math outcomes*. Norwood, NJ: Ablex.
- EVCEN, D. (2002). Adaptation of Watson-Glaser Critical Thinking Appraisal Test (form S) to Turkish. Unpublished Thesis. Graduate School of Education Science, Ankara University, Ankara.
- FACIONE, N. C. & Facione, P. A. (1992). *The California Critical Thinking Disposition Inventory test manual*. Millbrae, CA: California Academic Press.
- FRIEDEL, C. R., Irani, T. A., Rhoades, E. B., Fuhrman, N. E. & Gallo, M. (2008). It's in

- the genes: Exploring relationships between critical thinking and problem solving in undergraduate agriscience students' solutions to problems in mendelian genetics. *Journal of agricultural education*, 49 (4), 25-37.
- Higher Education Quality Council, Quality Enhancement Group (1996). What are graduates? Clarifying the attributes of gradueness. London: HEQC.
- INCH, B. & Warnick, E. S. (1994). *Critical thinking and communication: The use of reason in argument*. New York, NY: Macmillan.
- IRANI, T., Rudd, R., Gallo, M., Ricketts, J., Friedel, C. & Rhoades, E. (2007). *Critical thinking instrumentation manual*. Retrieved from http://step.ufl.edu/resources/critical_thinking/ctmanual.pdf.
- KÖKDEMİR, D. (2003). *Decision Making and Problem Solving under Uncertainty*. Unpublished Ph. D. Thesis, Social Science. Graduate School of Social Science, Ankara University, Ankara.
- LEE, S. (2009). *Examining the relationships between metacognition, self regulation and critical thinking in online socratic seminars for high school social studies students*. Unpublished Ph. D. Thesis, Social Science, The University of Texas, Austin.
- NUNNALLY, J. C. & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). NY: McGraw-Hill, Inc.
- PAUL, R. & Elder, L. (2004). *The miniature guide to critical thinking, concepts and tools*. Dillon Beach, CA: The Foundation for Critical Thinking.
- RAMASAMY, S. (2011). *An analysis of informal reasoning fallacy and critical thinking dispositions among malaysian under graduates*. Retrieved from http://eric.ed.gov/ERICWebPortal/search/recordDetails.jsp?ERICExtSearch_SearchValue_0=ED525513&searchtype=keyword&ERICExtSearch_SearchType_0=no&_pageLabel=RecordDetails&accno=ED525513&_nfls=false&source=ae
- RICKETTS, J. & Rudds, R. (2004). *The relationship between critical thinking dispositions and critical thinking skills of selected you thleaders in the national organization*. *Journal of Southern Agricultural Education Research*, 54 (1).
- RICKETTS, J. C. & Rudd, R. D. (2005). *Critical thinking of selected you thleaders: The efficacy of critical thinking dispositions, leadership and academic performance*. *Journal of Agricultural Education*, 46 (1), 33-44.
- STEDMAN, N. L. P. & Andenoro, A. C. (2006). *Linking emotional intelligence to critical thinking: Balancing our curriculum within leadership education*. *Proceedings of the Association of Leadership Educators*, Big Sky, MT.
- STEDMAN, N. L. P. & Andenoro, A. C. (2007). *Identification of Relationships between Emotional Intelligence Skill & Critical Thinking Disposition in Undergraduate Leadership Students*. *Journal of Lidership Education*, 6 (1), 190-235.
- TAVŞANCIL, E. (2002). *Measurement of Attitude and Data Analysis with SPSS*. Ankara: Nobel Academic Press.