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The Adaptation of the Sources of Mathematics Self-Efficacy Scale for Turkish Context *

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Abstract

The aim of the study is to adapt the Sources of Middle School Mathematics Self-Efficacy Scale developed by, Usher and Pajares (2009) for Turkish context. After the Turkish version was formed through required procedures, it was administered with 750 middle school students of 6th, 7th and 8th grades. The ages of the students ranged between 12 and 15. The 48% of the students were female (n=408) and 52%of the students were male (n=342). 32% of the students were attending (n=242) sixth grade, 34'% of them (n=257) seventh and 34% (n=251) eighth grade. Construct validity of the scale was investigated via Exploratory and Confirmatory Factor Analysis. Criterion validity of the scale was also done to see if it serves its purpose well. Reliability of the scale was tested by computing Cronbach Alpha, corrected total item correlation coefficient, and t-tests comparing the total item scores of top 27% and bottom 27% participants. The results indicated that the Turkish version of the SMSMSEC consists of four factors. Cronbach alpha values of the factors ranged between 0.80 and 0.94. Corrected total item correlation coefficients ranged between 0.77 and -0.25. Criterion validity results indicated the scale serves its purpose well. The t-test results indicated that there were significant difference between the total scores of top 27% and bottom 27% of the participants for all items.

Keywords

Sources of Self-efficacy
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Introduction

Self-efficacy is used in recent studies on learning and motivation more often than other concepts such as self-identity and self-respect (Şahin, 2013). The reason for this can be that self-efficacy can explain the students' performances more compared to other concepts available in the literature (Bong and Clark, 1999; Bong and Skaalvik, 2003; Ferla, Valcke and Cai, 2009). Self-efficacy refers to a person's belief related to his or her capacity to perform a task well (Bandura, 1997). Self-efficacy is about being aware of what a person can accomplish rather than being aware of what they want to accomplish (Senemoğlu, 2007). Research on self-efficacy has indicated that self efficcay has an impact on indivual's choice of activity, motives, persistence, learning and achivements (Bandura, 1997; Schunk and Pajares, 2005; Schunk and Zimmerman, 1998). People tend to choose the activities they

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think they will succeed and tend to avoid the ones they think they will fail (Bandura, 1997). On the other hand, they set big goals for themselves in areas where they have high self-efficacy (Bandura, 1997). People with high self-efficay also exhibit high level of effort while they are working on task and they exhibit high level of persistence when they meet obstacles (Bandura, 1997). There are studies (Schunk and Pajares, 2005; Zimmerman and Kitsantas, 1999; Collins, 1982, as cited in Schunk and Pajares, 2009, s. 39) which indicate that students who believe they can achieve are more likely to complete a task than the ones who do not believe they can achieve even if both group of students have similar or same level of ability. In other words, in situations where people have same abilities in the outset of a task, people with high self-efficacy tend to learn more and be more successful. Studies have shown that self-efficacy plays a major role both in academic success at any level and in all types of successful behaviors (Schunk, 2011).

Bandura (1997) states that a person's self-efficacy comes from four sources. These sources are personal experiences, vicarious experiences, social persuasions, emotional and physiological states. Personal experiences have a permanent impact on self-efficacy of a person. As a result of this, personal experiences are the most prominent source of a person's self-efficacy (Bandura, 1997). After the completion of a task, a person evaluates his performance. If his evaluation is positive, his confidence boosts regarding his capacity and beliefs of completing similar tasks in the future. If the evaluation is negative, his confidence wanes regarding similar future tasks. For example, if a student who always gets AA on tests got BB on a particular test despite studying hard, he would feel disappointed. This particular student may start to doubt himself. On the other hand, when a student who always gets CC on a particular course's tests got BB, this student tends to develop confidence in his success on that particular course. In short, people's personal experiences affect their self-efficacy either positively or negatively (Bandura, 1997).

Another source of self-efficacy is vicarious experiences, which people gain by observing others performing particular tasks. Students constantly observe significant people such as their parents, teachers, siblings and peers and these observations affect their self-efficacy. For example, if a student's classmate who gets AA on a test, his own self-efficacy increases because he believes that he could also get a similar mark on the exam. Vicarious experiences may also have negative impact on a person's self-efficacy. If the student observes that his peers have failed in a task, he tends to believe that he would fail in that particular task too. This situation applies especially when the person has limited relevant experience or lacks any judgment regarding his capacity to perform the task (Bandura, 1997).

The third source of self-efficacy is social persuasions. People's self-efficacy may increase or decrease as a result of encouragement and discouragement of their parents, teachers and friends. For example, teachers' encouragement may increase students' self-efficacy for academic goals and achievement. Students need encouragement of their teachers and families especially when they believe their capacity to complete a task is not good enough. However, over- encouragement for a person in tasks beyond his capacity may lead to future mistakes and lessening of self-efficacy (Bandura, 1997).

The final source of self-efficacy is emotional and physiological states. People tend to reach a judgment about their capacity based on their physical responses in stressful situations. People who possess similar capacities and skills may exhibit different physical responses in stressful situations. These physical responses in stressful situations alter a person's self-efficacy. People who can control these responses get stressed less and their self- efficacy remains unchanged (Bandura, 1997).

Studies on self-efficacy in the literature mostly focus on high school and university students (Usher, 2009). Studies on self-efficacy in the Turkish context have investigated self-efficacy of teachers and students at faculties of education or prospective teachers (Akbaş and Çelikkaleli, 2006; Azar, 2010; Çalışkan, Selçuk and Özcan, 2010; Coşkun, 2010; Çapri and Çelikkaleli, 2008; Çetin, 2008; Durdukoca, 2010; Ekici, 2006; İpek and Acuner, 2011; Morgil, Seçken and Yücel, 2004; Maden, 2010; Terzi and Mirasyedioğlu, 2009; Yaman, Koray and Altunçekiç, 2004; Yılmaz and Çimen, 2008; Yılmaz, Yılmaz

and Türk, 2010). There are very few studies (Arslan, 2012; Arslan, 2013; Çetin, 2009) investigating self-efficacy of students at middle school. One of the reasons is due to a lack of suitable assessment instrument to evaluate middle school students' self-efficacy. For example, the literature review revealed that there are two instruments for assessing middle school students' self-efficacy in mathematics (Işıksal and Aşkar, 2003; Karadeniz, Büyüköztürk, Akgün, Çakmak and Demirel, 2008). One of these instruments (Işıksal and Aşkar, 2003), aims to assess self-efficacy of students in specific areas of mathematics (e.g. symmetry and equations). The other one aims to assess students' self-efficacy for self-regulated mathematic skills (Karadeniz et al., 2008). The literature review also revealed that there is no Turkish self-efficacy scale which aims to measure mathematic self-efficacy sources based on the sources of self-efficacy pointed out by Bandura (1997). Therefore, this study aims to adapt the Sources of Middle School Mathematics Self-Efficacy Scale developed by Usher and Pajares (2009) for the Turkish context.

Many studies have indicated that self-efficacy plays an important role in students' academic success (Schunk and Zimmerman, 1998; Usher and Pajares, 2006; Schunk, 2011). Additionally, self-efficacy is an inherent component of every type of successful behavior (Schunk, 2011). Adopted measurement instrument will help to identify the sources of middle school mathematics self-efficacy scale. Thus, the relations of selfefficacy sources with the cognitive, affective and motivational variables related to mathematics can be examined in a variety of research. In the light of this research both theoretical and practical knowledge will be offered. It is hoped that this study may close a gap in the literature regarding a lack of Turkish version of Sources of Middle School Mathematics Self-Efficacy Scale.

Method

Participants

The participants of the study are 750 middle school students. 48% of the participant are female (n=342) , 52% of the participants are male (n=408). 32% of the participants are 6th grade (n=242); 34%of them are 7th grade (n=257) and 34% of them are 8th grade students (n=251). The participants' ages range between 12-15 years. Data from 266 students was used for Exploratory Factor Analysis; data from 254 was used for Confirmatory Factor Analysis and data from 230 students were used for criterion validitym.

The instrument

The English version of the Sources of Middle School Mathematics Self-Efficacy Scale (SMSMSEC thereafter) was taken from the article by Usher and Pajares (2009). The SMSMSEC consists of 24 items; 6 items for personal experiences, 6 items for vicarious experiences, 6 items for social persuasions and finally 6 items for emotional and physiological states. Items 3, 19, 20, 21, 22, 23, and 24 on the scale are reversed scored and the rest of them are positive scored items. Answering the scale takes about 15 to 25 minutes. The respondents of the scale are required to indicate on a Likert scale of definitely disagree (1) to definitely agree (100).

The originals scale's construct validity was investigated via Exploratory Factor Analysis, Confirmatory Factor Analysis. For its construct validity, A. Bandura, B. J. Zimmerman and D. H. Schunk were consulted. It was found that structure of the scale with four factors had the best fit for the model. To investigate the criterion validity of the scale, scores of areas such as self-concept, math skills self-efficacy, math courses self-efficacy, self-regulatory self-efficacy, task-goals and Semester GPA were taken into consideration. The correlational values of those selected scores and four factors in the SMSMSEC ranged between 0.88 and -0.65. The internal consistency of the original scale was tested via Cronbach alpha. The alpha values for four factors in the scale ranged between, 0.84 and 0.88 (Usher and Pajares, 2009).

Analyzis of the Data and Procedures

As in the original study, Exploratory Factor Analysis and Confirmatory Factor Analysis were done using the scores gathered from Turkish students to investigate the factorial structure of the scale. By this way, construct validity of the scale was investigated via two types of factorial analyses.

Exploratory factor analysis (EFA) aims to uncover the underlying structure of a relatively large set of variables which are in interaction with each other (Stevens, 2009; Çokluk, Şekercioğlu and Büyüköztürk, 2010). EFA reveals which factor covers a particular item and the strength of its relation to the main factor via factor loading values. Items factor loading value is required to be 0.45 and above. However, items with a 0.30 factor loading value can remain in the scale (Kline, 2011). There are many techniques to reveal factors in factor analysis. These techniques can be listed as principle component analysis, image factor analysis, maximum likelihood estimation factor analysis, basic factor analysis. The most widely used and the easiest one to interpret is principle component analysis (Büyüköztürk, 2002). Since it is intended to gather the variables under a smaller number of components reducing the number of them, principal component analysis was used (Tabachnick and Fidell, 2007). SPSS 18.0 was used to compute the exploratory factor analysis.

Confirmatory Factor Analysis is used to test whether data fits a measurement model of factors and their indicators (Çokluk et al., 2010). In other words, it is used to test whether measures of a construct are consistent with a researcher's understanding of the nature of that construct or factor. AMOS 19.0 was used to compute Confirmatory Factor Analysis.

In Confirmatory Factor Analysis, many fit indices are used to test the adequacy of the model. Fit indices are used to test the fit between actual data and the hypothesized model. To test the fit of the model, using several fit indices at the same time is advised because of their relative weaknesses and strengths (Kline, 2011). Additionally, there are four fit indices which are advised to be reported in SEM analysis (Kline, 2011). These are Chi-Square Goodness, (χ^2); Root Mean Square Error of Approximation (RMSEA); Standardized Root Mean Square Residual (SRMR); and Comparative Fit Index (CFI). There are additional indices such as Goodness of Fit Index (GFI); Adjusted Goodness of Fit Index (AGFI); Incremental Fit Index (IFI) and Normed Fit Index (NFI) (Bollen, 1989; Bentler, 1992; Anderson ve Gerbing, 1984; Jöreskog ve Sörbom, 1993; Cole, 1987; Sümer, 2000). In the present study all of the fit indices mentioned above were computed.

As a first step, an un-rotated principle component analysis was computed to investigate the factor structure of the scale. Second, equimax rotation was used to interpret factors more easily. Equimax rotation, which is a hybrid of varimax and quartimax rotations and rotates simultaneously, simplifies factors and variables (Çokluk et al., 2010). After the completion of exploratory factor analysis, Confirmatory Factor Analysis was done to see if the original scale is valid in the Turkish context. In Confirmatory Factor Analysis, maximum likelihood estimation factor analysis was computed.

Additionally, to determine the scales suitability in the Turkish context, criterion validity was carried out. As a result of this aim, scores from four factors of the scale, the mathematic anxiety scale and self-efficacy scales were used to compute Pearson's product-moment coefficient.

Corrected item-total correlation was computed to test the items' facilityto distinguish people in terms of their characteristics assessed in the scale and to investigate the test's internal consistency, t-test was investigated to see if there is a significant difference between top 27% and bottom 27 % of the participants based on the total scores (Büyüköztürk, 2011). Cronbach Alpha was computed to test the scale's internal reliability. Additionally, factors' means and standard deviation values of the scale were calculated. Finally, correlations between factors were computed using Pearson's product-moment coefficient.

Ethical issues and conducts of scale development process

Required permission for adaptation of the scale was obtained by e-mail from Ellen Usher who was the correspondent author of the original scale development study. In order to perform validity and reliability tests, required application permissions were obtained from the Ministry of National Education office in Konya. Besides, willingness of the participants was a priority in filling out the scale form.

Results

Translation of the SMSMSEC into Turkish

The original English scale was translated in to Turkish separately by three professional interpreters. The translated versions of the scale were examined by 3 experts in the field of psychological assessment end evaluation. A tentative version of the scale was formed based on their recommendations. As a next step, this tentative version was examined in terms of its suitability in cultural context, linguistics, scientific methods and evaluation by experts using Expert Evaluation Form (EEF). EEF consisted of two sections. The first section gave general information about the study and a brief literature review on the theoretical underpinning of the scale. The second section consisted of Likert scale items corresponding to the each evaluation criteria. The Likert scale ranged between 1 "this item is definitely unsuitable" to 5 "this item is definitely suitable". There was also space for suggested corrections. Based on the EEF, items with a mean score of 4.0 above and standard deviation of 0.7 and below were selected. This version of the scale was back translated into English by a linguist and an education specialist. Both Turkish and English translations were checked against the original form by two English instructors at a Turkish University. They indicated that both forms express the same ideas in the original Scale.

Results of the Exploratory Factor Analysis

One assumption of Exploratory Factor Analysis is sampling adequacy (Çokluk et al., 2010). To test the sampling adequacy, Kaiser-Meyer-Olkin Coefficient was calculated and it was 0,932. Based on this result, assumption of sampling adequacy was met (Tavşancıl, 2010). Another assumption of the Exploratory Factor Analysis is normal distribution of the data (Çokluk et al., 2010). The distribution of the data was tested via Bartlett test to compute its chi-square value (χ^2=4927.7, p<0.001). The results indicated the data gathered met the assumptions of exploratory factor analysis. The computation of exploratory factor analysis showed that there were four factors whose eigenvalue is above 1. Additionally 5 of the items got high loading in more than one factor. To boost the loading value of the items, factor analysis was computed again using Equamax rotation technique. The results of this procedure showed that the present data showed a model similar to the one in the original study. The results of the factor analysis are presented in table 1.

The percentage of variance that was explained by the scale with four factors was 69%. Factors' eigenvalues and their percentage of variances were 10.51 and 43.78%; 3.11 and 12.96%; 1.78 and 7.40%; 1.20 and 4.99% respectively. These results indicated that items were similar to the ones in the original scale with four factors.

Table 1. Results of the Exploratory Factor Analysis of the Sources of Middle School Mathematics Self-Efficacy Scale

Items	Total Factor Variance	Factor Loading Values *			
		Faktor 1	Faktor 2	Faktor 3	Faktor 4
i4	,69	***,75***		,32	
i2	,80	***,70***		,49	-,22
i1	,74	***,69***		,46	-,21
i3	,62	***,65***			-,40
i6	,66	***,65***	,44		
i5	,60	***,60***	,45		
i10	,65		***,77***	,23	
i8	,60		***,74***		
i9	,60		***,72***		
i7	,57		***,72***	,23	
i11	,60	,28	***,61***	,38	
i12	,31	,30	***,45***		
i15	,83		,21	***,83***	-,24
i14	,80		,24	***,83***	
i16	,80	,28	,31	***,77***	
i17	,77	,39	,27	***,71***	-,20
i13	,72	,33	,28	***,68***	-,26
i18	,60	,34	,31	***,62***	
i23	,83	-,21		-,23	***,85***
i21	,78				***,85***
i22	,82	-,30			***,84***
i24	,80	-,21		-,24	***,83***
i19	,69				***,81***
i20	,70				***,80***

*indicates values below ±0, 20

Results of the Confirmatory Factor Analysis

The SMSMSEC, which was developed based on Bandura's Social Cognitive Theory (1997) and was considered acceptable by Turkish experts, was investigated via Confirmatory Factor Analysis. As in the original study, its fit for the four- factor model was computed. The fit indices (χ^2=825.67, p<0.001, CFI=0.88, GFI=0.78, AGFI=0.74, RMSE=0.09, SRMR=0.07, NFI=0.83) showed that the model does not fit the data well. When calculated modifications indices are examined, error covariance of some items (i4-i5, i1-i2, i9-i11, i7-i8, i10-i12, i10-i8, i13-i14, i13-i16, i14-i16, i15-i18, i16-i17, i19-i22, i22-i23, and i23-i24) were found to be related at a significant level. These pairs of items were also found to be under the latent factor in the original study. After consultation with an expert, the model was tested again by feeding the error correlations between these items into the model. The results of the final confirmatory factor analysis are presented in figure 1. The items' factor loading values ranged between 0.42 and 0.94 and all items factor loading values are statistically significant (p<0.001).

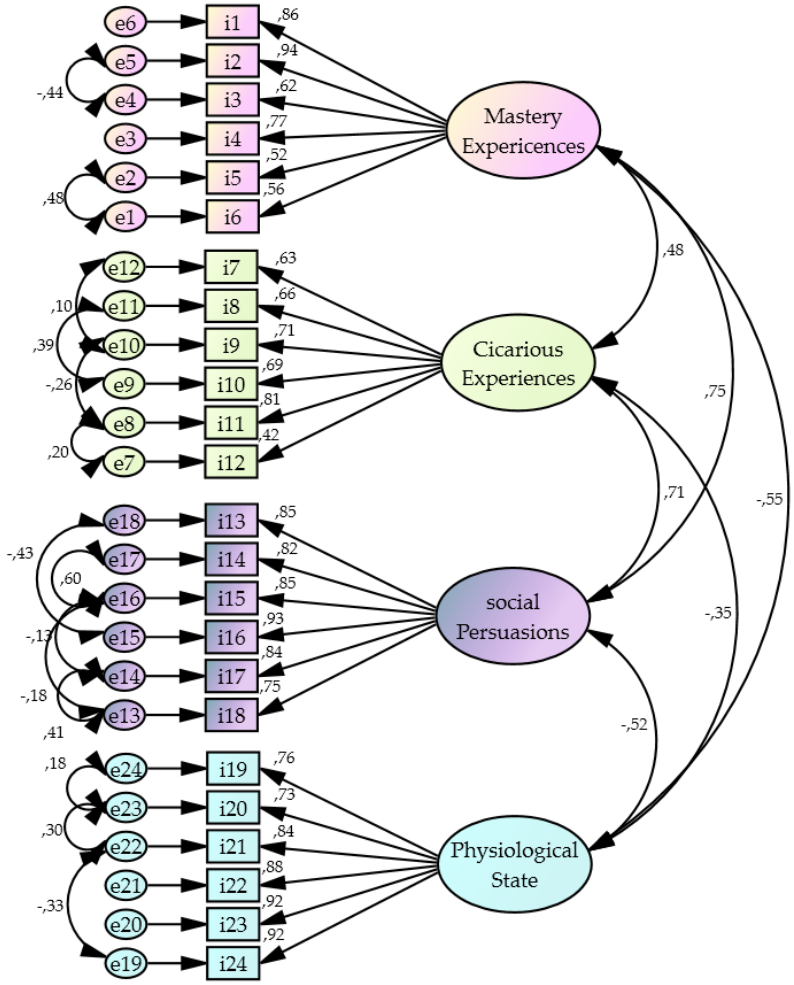

Figure 1. CFA Result for the Four Factor Model, n= 254,χ^2=488.15, N=254, sd=233, p<0.00.1

When the fit indices of the model is examined, chi-square value is significant (χ^2=488.15, N=254, sd=233, p<0.001). However, as the sampling size increases so does the likelihood of having a significant chi-square value and to counter this situation, looking at ratio of χ^2/sd is suggested in the literature (Büyüköztürk, Akgün, Özkahveci and Demirel, 2004). The calculated ratio of χ^2/sd was 2.20. Fit indices values were RMSEA=0.07, SRMR=0.07, CFI=0.95, GFI=0.87, AGFI=0.85, NFI=0.90 and IFI=0.95 (see table 2).

Table 2. Fit indices of the Sources of Middle School Mathematics Self-Efficacy Scale and acceptable fit indices values

Fit Indices	Original Scale	Turkish Scale	Acceptable Indices Values	Sources
χ^2/sd	2.44	2.10	≤5	Bollen (1989), Sümer (2000)
IFI	-	0.95	≥0.90	
RMSEA	0.04	0.07	≤0.08	Browne and Cudeck (1993), Hu and Bentler (1999), Sümer, (2000), Byrne (1998)
SRMR	0.04	0.07	≤ 0.08	
GFI	-	0.87	≥0.85	Anderson and Gerbing (1984), Jöreskog and Sörbom (1993), Cole (1987), Marsh, Balla and McDonald (1988)
AGFI	-	0.85	≥0.80	
NFI	-	0.90	≥0.90	Bentler (1992), Sümer (2000)
CFI	0.96	0.95	≥0.95	

Results of the Reliability Analysis

The reliability of the SMSMSEC's each component was tested via Cronbach alpha. Additionally, items' discriminatory power was tested by (*i*) calculating corrected item-total correlation; (*ii*) running a t-test comparing the total scores of top 27% and bottom 27 % of the participants for each item. The results are displayed in table 3.

Table 3. Corrected item-total correlation and the t-test values of the total scores of top 27% and bottom 27 % of the participants for each item of the Sources of Middle School Mathematics Self-Efficacy Scale

Factor Name	Item No	Corrected item-total correlation	t (Top 27%-bottom 27%)	Factor Name	Item No	Corrected item-total correlation	t (Top 27%-bottom 27%)
Personal Experiences	i1	,72	15,92**	Social Persuasions	i13	0.72	21.61**
	i2	,72	17,45**		i14	0.74	19.43**
	i3	,35	4,79**		i15	0.73	19.51**
	i4	,62	11,9**		i16	0.77	26.89**
	i5	,53	13,7**		i17	0.77	28.56**
	i6	,63	18,43**		i18	0.70	28.28**
Vicarious Experiences	i7	,62	15,34**	Physiological States	i19	-0.28	-4.29**
	i8	,52	15,05**		i20	-0.25	-2.33*
	i9	,56	13,45**		i21	-0.31	-3.1**
	i10	,56	18,31**		i22	-0.27	-3.08**
	i11	,65	16,25**		i23	-0.33	-4.03**
	i12	,51	9,83**		i24	-0.35	-3.72**

*p<0.05, **p<0.001

The results indicate that the SMSMSEC's items' corrected item-total correlation ranged between 0.77 and -0.25. T-tests comparing the total scores of top 27% and bottom 27 % of the participants for each item indicate that there is a significant difference in scores from all items. Cronbach alpha values for the Turkish and the original versions are presented in table 4. The Cronbach alpha values of the Turkish version ranged between 0.80 and 0.94.

Table 4. Cronbach Alpha values of the Sources of Middle School Mathematics Self-Efficacy Scale

Factor Name	Alpha Value	
	Original	Turkish
Personal Experiences	0.88	0.87
Vicarious Experiences	0.84	0.80
Social Persuasions	0.88	0.93
Physiological States	0.87	0.94

In the next step, mean values and standard deviation of the SMSMSEC's four components were calculated (see table 5). Correlation values between its components were also calculated. The correlation values between the SMSMSEC's four components ranged between -0.30 and 0.71. The mean value for the Personal Experiences was 439.47 (Sd=127.34), for Vicarious Experiences, 419.87 (Sd=144.21); for the Social Persuasions, 361.33 (Sd=178.15); for the Emotional and Physiological Situations; 201.30 (Sd=174.92).

Table 5. The Sources of Middle School Mathematics Self-Efficacy Scale's Correlation values between its components and mean values and standard deviation of its four components

	Değişkenler	$\bar{X}$	Sd	V1	V2	V3	V4
V1	Personal Experiences	439.47	127.34	-			
V2	Vicarious Experiences	419.87	144.21	0.48**	-		
V3	Social Persuasions	361.33	178.15	0.71**	0.61**	-	
V4	Physiological States	201.30	174.92	-0.54**	-0.30**	-0.49**	-

**p<0.01

Results of the Criterion Validity

To investigate whether the scale serves well, criterion validity was carried out. The scores from SMSMSEC's four components were correlated with scores from the mathematic anxiety scale (Bindak, 2005) and self-efficacy scale (Karadeniz et al., 2008). The results are displayed in table 6. The results indicated that SMSMSEC's four components and the mathematic anxiety scale and self-efficacy scale produced medium and high correlation values.

Table 6. Correlation between the mathematic anxiety scale and self-efficacy scale and The Sources of Middle School Mathematics Self-Efficacy Scale's four components

Variables	Personal Experiences	Vicarious Experiences	Social Persuasions	Physiological States
Self-Efficacy	0.69**	0.51**	0.67**	-0.56**
Mathematic Anxiety	-0.74**	-0.49**	-0.61**	0.72**

**p<0.01

Discussionsn and Conclusion

This study investigated the validity and reliability of Usher and Pajares's Sources of Middle School Mathematics Self-Efficacy Scale (2009) in Turkish context. The construct validity of the scale was carried out via Exploratory factor analysis, and then via confirmatory factor analysis.

The results of the exploratory factor analysis produced results similar to the ones from the original study. The factors revealed via exploratory factor analysis in this study were given the Turkish translations of the original scale; Mastery Experiences; Vicarious Experiences; Social Persuasions; Physiological States. The SMSMSEC's four-component structure was investigated via confirmatory factor analysis as it was done in the original study. When the fit indices (χ^2/sd= 2.10; RMSEA=0.07, SRMR=0.07, CFI=0.95, GFI=0.87, AGFI=0.85, NFI=0.90, IFI=0.95) were examined, the ratio of χ^2/sd (2.10) and IFI (0.95) showed that the model fits the data very well (Bollen, 1989; Sümer, 2000). The other fit indices were examined, the values of RMSEA (0.07) and SRMR (0.07) fit indices were very close. RMSEA and SRME fit indices ideally need to be as close to zero as possible. However, a value of 0.05 and below for RMSEA and SRME fit indices is considered acceptable in the literature (Browne and Cudeck, 1993). Additionally, other researchers (Browne and Cudeck, 1993; Hu and Bentler, 1999; Sümer, 2000; Byrne, 1998) suggested a value of 0.10 and below for RMSEA and SRME fit indices are acceptable too (Anderson and Gerbing, 1984; Marsh, Balla and McDonald, 1988; Cole, 1987). In short, the model tested in this study fit the data at an acceptable level since it had many and complicated factors; and the values for RMSEA, SRMR ranged between 0.05 and 0.08.

The other fit indices, GFI and AGFI, are absolute fit indices. Some researchers (Hooper, Coughlan and Mullen, 2008) suggested that a value 0.95 and below for GFI and AGFI indices show perfect fit while some others (Baumgartner and Hombur, 1996; Hooper, Coughlan and Mullen, 2008) suggested a value ranging between 0.90-0.95 show nearly perfect fit. On the other hand some researchers (Anderson and Gerbing, 1984; Jöreskog and Sörbom, 1993; Cole, 1987; Marsh, Balla and McDonald, 1988) stated that a value of 0.85 for GFI and a value of 0.80 and above for AGFI are acceptable. The values of GFI (0.87) and AGFI (0.85) computed in this study are close to 0.90. Therefore, the fit of the modal is acceptable.

The other fit indices are NFI and CFI fit indices. A value of 0.95 and above for them are suggested to show perfect fit (Hu and Bentler, 1999), a value ranging between 0.90 and 0.95 shows acceptable level of fit (Bentler, 1992; Sümer, 2000). The fit indices calculated in this study for NFI (0.90) and CFI (0.95) are acceptable.

When the fit indices of this study and the original study are compared, the ratio of χ^2/sd and CFI are very close to each other, and they both show acceptable fit. The values for RMSEA (0.04) and SRMR (0.04) calculated in the original study show god fit while the values for RMSEA (0.07) and SRMR (0.07) calculated in this study show acceptable fit.

The t-test results from the total scores of top 27% and bottom 27% of the participants showed that there is a significant difference for mean values of all items. Therefore the items 'discrimination power was good. Cronbach alpha values calculated for the SMSMSEC's four components ranged between 0.80 and 0.94. These values are very close to the ones calculated in the original study. Additionally, criterion validity was investigated by correlating scores from the SMSMSEC's four components, the mathematic anxiety scale and self-efficacy scale. The correlations ranged between 0.72 and -0.74. Therefore, usefulness of the scale is quite high.

In conclusion, Turkish version of the SMSMSEC consists of four factors as in the original model; four -factor model fit the data from students participated in the research; internal consistency of the factors is at an acceptable level and it serves its purpose well. When these results are taken into consideration, the Turkish version of the SMSMSEC can be used to assess the Turkish middle school students' sources of mathematics self-efficacy.

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