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Psychometric Properties of Turkish Version of Metacognition Applied to Physical Activities Scale (Mapas-tr): A Study on Early Adolescents*

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ABSTRACT

The aim of the present study was to evaluate the psychometric properties of the Turkish version of Metacognition Applied to Physical Activities Scale (Settani et al., 2012). The study sample consists of 145 (38.4%) female and 233 (61.6%) male students in their adolescence (aged 11-14). In order to explore the factor structure of the scale, the data set obtained was analyzed with Explanatory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Item analysis was carried out based on the 27% lower and upper group means difference for the criterion validity; and item-total correlation (rjx) and internal consistency coefficient (Cronbach's alpha) calculations were done within the scope of reliability analyses for the factors that were found to have good fit with the data in the factorial model. All the results concerning the psychometric properties of the measurement instrument reveal that Metacognition Applied to Physical Activities Scale is a valid and reliable measurement instrument that can be used on school age individuals within the Turkish speaking society

Keywords:
Physical activity, metacognition, early adolescents, validity, reliability

Introduction

The concept of metacognition, which was first used by John Flavell and has been approved by scientific circles to be extremely important in the realization of learning, has maintained its popularity in the field of cognitive psychology and education since the 1970s (Bağçeci, Döş, & Sarıca, 2011). Particularly in studies focusing on self-regulatory activities, the utility of cognitive and metacognitive awareness strategies by individuals and the effects of these skills on students' direct learning activities have been examined frequently (McCann, & Garcia, 1999). However, metacognition, which is a term that does not have a meaning alone but can only makes sense within the context of cognition (Akpunar, 2011), is interpreted as the information one has about the cognitive processes s/he has and his/her control over these processes with the capacity of this information (Flavell, 1987). Metcalfe and Shimamura (1996) state that metacognition is also effective in controlling and regulating cognitive processes such as learning, problem solving, comprehension and reasoning. Metacognition which is used to regulate efficient thinking and learning is structured upon three fundamental skills namely planning, observing and evaluation. These three basic skills provide the individual with the opportunity to regulate his/her self-learning and memory processes (Karakelle, & Saraç, 2007). Individuals with high awareness of these skills and processes can properly plan the required effort and time to learn new information and skills (Cao, & Nietfeld, 2007).

Starting to be formed at early ages and considered to increase parallel with the individual's growth and development, metacognitive awareness is seen as a skill which can be controlled and arranged to be used in learning processes (Akpunar, 2011). Although the understanding of modern education mainly aims

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at educating individuals who are creative, critical and aware of their own learning, learning activities to develop these abilities are not included very often (Doğan, 2013). Within the learning process, which includes behavior change and is the transfer period of skills learnt previously, cognitive, affective and psychomotor processes should be dealt with as a whole (Kiremitci, 2011). In addition, it is strongly emphasized that the development of metacognitive skills is extremely necessary as well as the transfer of information that takes place in all areas of education (de Jager, Jansen, & Reezigt, 2005). From this point of view, it is considered that an individual who has the knowledge of movement can transfer information deliberately or automatically in the field of motor skills as well; in other world, s/he uses metacognitive strategies (Wall, 1986).

Considering the studies which have revealed that increasing metacognitive awareness and using metacognitive skills increase students' achievement significantly, it becomes clear that teachers must be more sensitive and active in this regard (Doğan, 2013). When metacognitive awareness in the field of physical activity and motor skills is considered in particular, the relationship between procedural information and feedback during adolescence attracts attention as a focus to be emphasized. However, the number of studies carried out to reveal the relationship between metacognitive ability and physical activity is yet limited (Settanni, Magistro, & Rabaglietti, 2012). Although studies on the relationships between metacognitive awareness and psychomotor domain in which theory and practice are intensively evaluated have not been matured yet, carrying out studies at academic levels would be useful in order to construct theory and relationships (Martini, & Shore, 2008).

Some of the measurement instruments used in the academic studies in the field measure metacognitive processes in general terms while some of them evaluate metacognition as a subscale while measuring such skills as learning strategies, comprehension etc. In studies carried out to determine metacognitive awareness levels of Turkish speaking populations, on the other hand, the number of measurement tools adapted from different languages of developed originally is quite limited. These limited number of measurement instruments consist of great numbers of items and are designed for use by adults (Karakelle, & Saraç, 2007).

In this respect, it is extremely important to add economical and usable measurement instruments to the literature in order to determine adolescents' metacognitive awareness of physical activity in particular. The aim of the present study was to carry out a psychometric evaluation of The Metacognition Applied to Physical Activities Scale (MAPAS), which was designed considering the principal of economy, on a Turkish speaking population and to test its applicability.

Method

Participants

The study was participated by secondary school students attending 6th, 7th and 8th grade and aged between 11 and 14, which is defined as early adolescence. Of the 378 participants, 145 (38.4%) were female and 233 (61.6%) were male students.

Measures

"Metacognition Applied to Physical Activities Scale (MAPAS)" developed by Settanni *et al.* (2012) consists of 10 statements and a single dimension. The items on the scale are scored on a 4-point Likert type scale ranging from "1= Disagree completely" to "4= Agree completely". The one-dimensional factor structure obtained as a result of the Exploratory Factor Analysis was tested with a Confirmatory Factor Analysis and was calculated as $\chi 2/df= 2.17$, RMSEA= .061 CFI= .97 from fit indices.

Procedures

In the translation phase of the scale, the original form of the scale was translated into Turkish by an English linguist in the first place. The translated form was checked by a domain expert with good command of English through comparison with the original form. Items that could bear problems in terms of meaning were corrected by the domain expert and the Turkish form of the scale was developed. The understandability Turkish form of the scale was applied on 20 secondary school students by asking them to

evaluate the terms in terms of understandability. Finally, the items on the scale were given their final form for application using the feedback obtained. The data set analyzed in the study was collected using the face to face interview technique in the spring semester of the 2013-2014 academic years. Before the study was initiated, the required permissions were taken from the administrators of the three different secondary schools of application as well as the approval of the ethics committee. The students who voluntarily participated in the study were informed about the purpose of the study and all the questions about the study were answered.

Data Analysis

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were carried out to reveal the validity of the data obtained from the scale. Within the scope of the EFA applied on SPSS 13.0, first the results of Barlett test of Sphericity and Kaiser-Meyer-Olkin (KMO) were taken into consideration for the appropriateness of the data for factor analysis. Also, the number of factors was assessed considering the Scree test and Eigen Values, and factor loads were determined. The factor structure obtained from the EFA was examined with CFA using LISREL 8.52 and Lambda, t and R^2 values of the items were evaluated. In addition, different fit indices, $\chi 2/df$ (chi square / degrees of freedom), RMSEA (Root Mean Square Error of Approximation), CI (90% Confidence Interval), SRMR (Standardized Root Mean Square Residual), NFI (Normed Fit Index), NNFI (Non-Normed Fit Index), CFI (Comparative Fit Index), GFI (Goodness-of-Fit Index), AGFI (Adjusted Goodness of Fit Index), were evaluated within the scope of the CFA.

Total-item correlation (r_{jx}) analysis, internal consistency reliability (Cronbach's alpha) calculations and 27% lower and upper item analysis were carried out on the data set in order to test item distinctiveness within the scope of reliability analyses using the SPSS 13.0 software program.

Results and Discussion

Exploratory Factor Analysis

In the first place, the data collected from students were tested to see whether they were appropriate for Exploratory Factor Analysis. The KMO value concerning the adequacy of the data set was calculated as .869 and the chi square value was found as 815.568 (Sd.=45; p=.000) as a result of the Barlett test (Table 1).

Table 1. Results of KMO and Bartlett's test

Kaiser-Meyer-Olkin (KMO)	.869		
Bartlett's Test	χ^2	Sd.	p
	815.568	45	.000

The KMO value, which shows the adequacy of the data set obtained from the sample for factor analysis, approaching 1 is accepted as adequacy at excellent level while values under .50 are considered as inadequate (Field, 2009). In addition, high and statistically significant (p<.05) Barlett test results obtained from the data set indicate that the data set has a normal distribution (Tavşancıl, 2002; Field, 2009). The results obtained show that the data set used in the present study is adequate for factor analysis and has normal distribution.

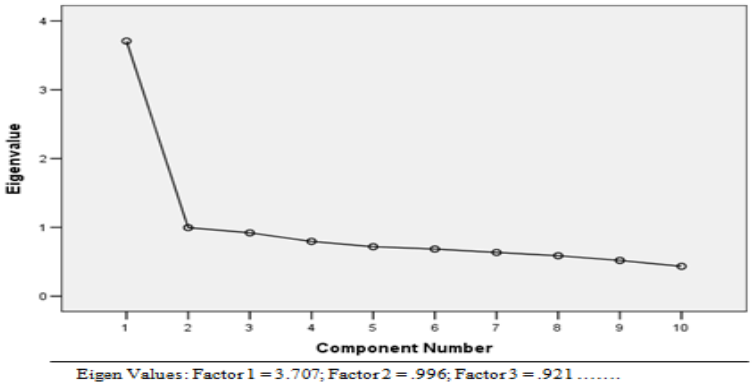

Figure 1: Scree plot graph of Mapas-tr's factors

Scree test results show that the items of the scale gather under one single factor (Figure 1). Considering the Eigen values of the factors, the first factor is seen to be quite higher than the others with a value of 3.707. Factors with an Eigen value of 1 and over are evaluated as significant factors (Büyüköztürk, 2002). In addition, a difference of more than 3 times between the Eigen value of the first factor and the Eigen value of the second factor supports the fact that the scale consists of a single dimension (Lord, 1980).

Table 2: Means, standard deviations, factor loadings and common factor loads of Mapas-tr's items

Items	$\bar{X}$	Sd.	Common Factor Loads	Factor Loads
1. When I cannot accomplish something I attempted, I want to understand the reason why.	3.41	.76	.395	.629
2. I like to find an explanation for the reason why sometimes I succeed in a movement and other times I do not.	3.52	.67	.361	.601
3. When I work out, I think of the best way to tackle the task.	3.45	.75	.386	.621
4. When I prepare for a physical activity test, I keep in mind what the teacher considers important.	3.50	.75	.325	.570
5. If I fail in a physical activity test, I try to understand the causes.	3.37	.72	.432	.657
6. I try to have a clear picture of my training schedule.	3.44	.78	.421	.649
7. When I work out, I repeat what I was taught step by step.	3.25	.85	.323	.568
8. When I work out, I always try to understand what I am taught.	3.37	.83	.437	.661
9. When the teacher speaks I pay attention in order to remember and understand better.	3.27	.88	.165	.406
10. In my personal preparations, I always devote time to verify what I am capable of doing.	3.41	.80	.462	.680

Finally, Varimax vertical axis rotation was used within the scope of Exploratory Factor Analysis and item loads were determined in the factor they belonged to. Considering the results obtained, factor loadings of the items were found to range between .406 and .680 (Table 2). The loading taken by the scale items within the factor they belong to must be minimum .30 and over (Kline, 2011). This shows the measurement instrument has a single dimension factor structure.

Confirmatory Factor Analysis

Table 3: Confirmatory factor analysis results of Mapas-tr's items

Items	Standardized λ	R^2	t
1. When I cannot accomplish something I attempted, I want to understand the reason why.	.56	.32	10.86**
2. I like to find an explanation for the reason why sometimes I succeed in a movement and other times I do not.	.54	.29	10.22**
3. When I work out, I think of the best way to tackle the task.	.55	.31	10.71**
4. When I prepare for a physical activity test, I keep in mind what the teacher considers important.	.50	.25	9.44**
5. If I fail in a physical activity test, I try to understand the causes.	.60	.36	11.67**
6. I try to have a clear picture of my training schedule.	.60	.36	11.64**
7. When I work out, I repeat what I was taught step by step.	.51	.26	9.55**
8. When I work out, I always try to understand what I am taught.	.61	.37	11.83**
9. When the teacher speaks I pay attention in order to remember and understand better.	.34	.12	6.18**
10. In my personal preparations, I always devote time to verify what I am capable of doing.	.53	.40	12.45**

**p<.01

A covariance matrix was developed and a CFA was carried out in order to test the appropriateness of the single factor structure obtained from the EFA to the data set. Fit statistics were calculated for the ten-item single factor model. The standardized Lambda values of the items were found to range between .34 and .61 and R^2 values between .12 and .40. In addition, t values ranged between 6.18 and 12.45 for all items and were significant at the level of .01 (Table 3).

Considering the other fit indices concerning the model, Chi-Square statistics was calculated as 2.39. Fit indices were found as .061 for RMSEA, .044 for SRMR; and the 90%CI value was found between .044 and .078. Moreover, for the fit indices, calculations were found as .93 for CFI and AGFI, .90 for NFI, .92 for NNFI and .96 for GFI (Table 4).

Table 4: Chi-square statistic and fit indexes of the Mapas-tr

χ^2/df	RMSEA	%90 CI	SRMR	CFI	NFI	NNFI	GFI	AGFI
2.39	.061	.044 - .078	.044	.93	.90	.92	.96	.93

The results of chi square statistics (χ^2/df) obtained under 2 shows excellent model-data fit and results ranging between 2 and 5 are accepted as good fit (Byrne, 1998; Chau, 1997; Schmelleh-Engel, Moosbrugger, & Müller, 2003). In addition, RMSEA and SRMR values under .05 indicate excellent fit while vales between .05 and .08 show good fit (Byrne, 1998; Kelloway, 1998; Hu, & Bentler, 1999; McDonald, & Moon-Ho, 2002; Schmelleh-Engel, et al., 2003). Values under .05 for the lower limit of confidence intervals (90% CI) range which is accepted as the supporter of the RMSEA value mean that fit is rejected alt (Kline, 2011). When the other fit indices are considered, values of minimum .90 and over were found to be an important criterion for the lower bound of the values required for CFI, NFI, NNFI, GFI and AGFI for good fit (Marsh, Balla, & McDonald, 1988; Hu, & Bentler, 1999; Schmelleh-Engel, et al., 2003; Farias, & Dixon, 2005). All these indicators prove that the structure of the Mapas-tr consisting of 10 items and a single factor has good fit with the data.

Results of Reliability Statistics

Item Analysis (27% Lower and Upper Groups)

Criterion validity of the items on the scale was tested using t test based on average differences obtained from the 27% lower and upper groups. In the item analysis which was conducted in order to present the distinctiveness of the items on the scale, level of significance was considered as minimum .05 for t value.

Table 5: Item analysis results for Mapas-tr

	Items	Lower 27% (N=102)		Upper 27% (N=102)		t
		$\bar{X}$	sd.	$\bar{X}$	sd.	
1.	When I cannot accomplish something I attempted, I want to understand the reason why.	2.74	.81	3.91	.31	-13.44**
2.	I like to find an explanation for the reason why sometimes I succeed in a movement and other times I do not.	2.97	.69	3.90	.35	-12.01**
3.	When I work out, I think of the best way to tackle the task.	2.88	.85	3.95	.21	-12.17**
4.	When I prepare for a physical activity test, I keep in mind what the teacher considers important.	2.89	.87	3.92	.27	-11.32**
5.	If I fail in a physical activity test, I try to understand the causes.	2.71	.76	3.87	.36	-13.82**
6.	I try to have a clear picture of my training schedule.	2.76	.93	3.91	.29	-11.69**
7.	When I work out, I repeat what I was taught step by step.	2.51	.91	3.85	.35	-13.79**
8.	When I work out, I always try to understand what I am taught.	2.63	.92	3.90	.30	-13.19**
9.	When the teacher speaks I pay attention in order to remember and understand better.	2.80	.89	3.87	.36	-11.22**
10.	In my personal preparations, I always devote time to verify what I am capable of doing.	2.70	.91	3.93	.25	-13.13**

**p<.01

The item analysis shows that t values of the items range between -11.22 and 13.82 (p<.01) (Table 5). In order to accept the t values which are required for the items to be distinctive as statistically significant, they have to be minimum 1.96 at p<.05 level (Kelloway, 1998; Hair, Black, Babin, Anderson, & Tatham, 2006) and minimum 2.57 at p<.01 level (Şimşek, 2007). This results shows that the 10 items on the Mapas-tr have significant levels of distinctiveness.

In order to test the reliability of the scale, Item-Total Correlation and Internal Consistency Reliability analyses were applied on the data set obtained from students. The results of the analyses showed that the correlation coefficients of the 10 items on the Mapas-ranged between .309 and .556. In addition, internal consistency coefficient was calculated as .805 for the Mapas-tr (Table 6).

Table 6: Results of item-total correlation and internal consistency reliability analysis

Items	Item-Total Correlation (r_{jx})	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
1. When I cannot accomplish something I attempted, I want to understand the reason why.	.502	.785	.805
2. I like to find an explanation for the reason why sometimes I succeed in a movement and other times I do not.	.468	.789	
3. When I work out, I think of the best way to tackle the task.	.498	.785	
4. When I prepare for a physical activity test, I keep in mind what the teacher considers important.	.452	.790	
5. If I fail in a physical activity test, I try to understand the causes.	.538	.781	
6. I try to have a clear picture of my training schedule.	.521	.783	
7. When I work out, I repeat what I was taught step by step.	.449	.791	
8. When I work out, I always try to understand what I am taught.	.542	.780	
9. When the teacher speaks I pay attention in order to remember and understand better.	.309	.809	
10. In my personal preparations, I always devote time to verify what I am capable of doing.	.556	.778	

The criterion of statistical significance in terms of item-total correlation is .30 for the correlation coefficients of the items, which is an indicator of good distinctiveness property (Büyüköztürk, 2005). It is stated that a value of .70 and over for the internal consistency coefficient (Cronbach's alpha) calculated for a psychological measurement instrument is considered to be adequate for the reliability of the scale (Tezbaşaran, 1996; Büyüköztürk, 2005). According to all these criteria, MAPAS-tr is a reliable measurement instrument in terms of internal consistency.

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