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Adaptation Study of the Problem Solving Inventory on the Turkish Athlete Population

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Abstract

The aim of this study was to examine the reliability and validity of Problem solving inventory (PSI) with Turkish athletes. The PSI was designed to clarify utility of problem-solving constructs across sports environment and thus facilitate the development of more comprehensive acknowledges about problem solving and mental health. The subjects were 204 males and 109 females totaling 313 athletes. Participants voluntarily completed the 32 item problem solving inventory. Afterwards, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were undertaken. EFA results yielded a satisfactory three-factor solution, the same as the English version. Cronbach alpha (α) reliability indices for the respective subscales were as follows: problem solving confidence (PSC) (.69), approach and avoidance (AA) (.73), and personal control (PC) (.68). The PSI explained 66% of the total variances. Moreover, CFA results provided the fit indices as Chi-Square (X^2)=912.8, df=461, X^2/df=1.98, Root Mean Square Error Approximation (RMSEA)=.07, Comparative Fit Index (CFI)=.93, Goodness of Fit Index (GFI)=.92, Normed Fit Index (NFI)=.90, Non Normed Fit Index (NFI)=.89 with 32 items and 3 sub-dimensions. The fit indices of the PSI in relation to EFA and CFA were at an acceptable level. The original 3-factor solution was supported by the Turkish athlete subjects. Results of the study introduced that the Turkish version of the Problem Solving Inventory is a valid and reliable measurement for Turkish athletes.

Key words: *problem solving, exploratory and confirmatory factor analysis, Turkish athletes*

Introduction

Psychological skill set of athletes and mental preparedness are major decisive contributor of the performance in sport setting (Mahoney, Gabriel, & Perkins, 1987; Gee, 2010). Athletes' psychological abilities such as concentration, emotional control, motivational orientation, coping with stress and anxiety are essential dimensions for peaking the performance (Crust, 2007; Smith, Smoll, & Cumming, 2007). Harmison (2011) indicated that developing the necessary psychological skills is not solely important factor for peaking athletic performance, but adversity-coping skills are also decisive factor on athletic performance.

Acceptance, positive reinterpretation and problem solving are emphasized as adversity coping strategies in sport setting (Galli & Vealey, 2008). Although each of those strategies are important for athletic development and better performance, problem solving skills has unique construct due to the dealing with the stressor directly. Heppner and Krauskopf (1987) defined the problem solving as "the complex interplay of cognitive, affective, and behavioral processes for the purpose of adapting internal or external demands or challenges."

In addition to problem-solving appraisal, researchers have used a number of strategies and measurements to assess applied problem solving (Heppner & Wang, 2003). First one has been to assess the nature and frequency of personal problems; the basic assumption has been that fewer problems suggest more effective problem solving. One of the earliest measures was the 330-item Mooney Problem Checklist (Mooney & Gordon, 1950); a second one has been to assess what is assumed to be problem-solving ability by providing a task that requires cognitive processes related to applied problem solving. The Means-End Problem

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Solving Procedure (MEPS) (Platt & Spivack, 1972) assesses one's cognitive ability to plan, step-by-step, the means of moving toward an effective solution of interpersonal problems. A third one has been to assess problem-solving attitudes and skills through self-report assessments, such as the Social Problem Solving Inventory (SPSI) (D'Zurilla & Nezu, 1980). A fourth strategy has assessed verbal reports of one's problem-solving activities that facilitate or inhibit progress toward resolving problems, such as the Problem Focused Style of Coping (PF-SOC) (Heppner, Cook, Wright, & Johnson, 1995). The multiple assessment strategies reflect the multifaceted nature of applied problem solving. Only the PSI, however, is conceptualized as a measure of problem-solving appraisal and has been recognized as one of the most widely used self-report inventories in applied problem solving (A.M. Nezu, C.M. Nezu, & Perri, 1989).

In sport context, implementing executive functions requires problem solving skills (Diamond, 2006). Moreover, problem solving skills has a major role on actual motor performance, besides processing information and making decision, (Ripoll, Kerlirzin, Stein, & Reine, 1995; Hristovski, 2012). Participating regular sport activities may lead to better problem solving skills. To illustrate, Jacobsen and Matthaeus (2014) examined the executive functions by administering tests of problem solving, decision making and inhibition among athletes and non-athletes. Their results indicated that athletes demonstrated higher problem solving scores compared to non-athletes. Similarly, Senduran and Amman (2015) demonstrated that high-school aged athletes feel more confident when they encounter the problem comparing to non-athletes. Furthermore, this study also indicated that the type of the sport was also major factor effecting the problem solving skills of athletes. Thus, investigating the problem solving approaches of athletes become an important topic in order to explicate how to improve athletic performance.

Although evaluating psychomotor approaches in problem solving strategies are important (Ripoll et al., 1995), assessing the individual differences in problem solving is another necessary aspect in sport context. Heppner and Petersen (1982) developed to an instrument to explicate personal problem solving approaches of individuals. Problem Solving Inventory aims to differ individuals with effective problem solving skills such as confidence, personal control, avoiding problems from those who perceive themselves as ineffective problem solvers (N. Sahin, N.H. Sahin, & Heppner, 1993). The first adaptation of PSI into Turkish language was completed among university students (Sahin et al., 1993), and results of primary-component analyses revealed a six factor structure, namely thinking approach, avoiding approach, estimator approach, self-trust approach and planned approach, unlike to three factor structure revealed by Heppner and Petersen (1982). All Cronbach's Alpha values of sub-dimensions were larger than 0.65 in Turkish version of the PSI. Although Turkish version of PSI was implemented among students from the School of Physical Education and Sports (Sözen, 2012), high school athletes (Senduran & Amman, 2015) and sport referees (Karaçam & Pulur, 2016) and found reliable, none of the study analyzed the validity of the instrument among these populations. Because the PSI was not developed specifically for the sport context, the validity of the model of the Turkish version that used in sport studies might be a doubtful, especially for studies focused on athletes.

Therefore, the purpose of this study was to investigate the reliability and validity of the Turkish version of the PSI among Turkish athletes in order to propose a valid model to measure problem solving skills.

Methods

Participants

The study sample consisted of 204 males (mean=21.34±4.10 years) and 109 females (mean=20.72±2.90 years) totaling 313 athletes (mean=20.87±3.65 years) who voluntarily participated.

Ethical administrative procedures

Prior to data collection, approval was obtained from the Ethics Committee of Nevşehir Hacı Bektaş Veli University. The author of the original scale was contacted to ask for permission which he kindly granted. During the questionnaire administration, each participant was briefed with regards to what is involved in the study and how their responses would be kept confidential. After participant briefing, athletes were informed that participation was voluntary and that they could withdraw at any time during the data collection process. After this, data was only collected from athletes who gave consent and volunteered to participate.

Measuring Instrument

Problem Solving Inventory which consists of total 35 items, was developed to measure self-understanding of individual athletes about problem-solving abilities. These abilities, also the sub-dimensions of the questionnaire, are; "Problem Solving Confidence" (items of 5, 10, 11, 12, 19, 23, 24, 27, 33,34, 35, α=.85), "Approach-Avoidance" (items of 1, 2, 4, 6, 7, 8, 13, 15, 16, 17, 18, 20, 21, 28, 30 and 31, α=0.84) and "Personal Control" (items of 3, 14, 25, 26 and 32, α=0.72). The range of correlation coefficients among these three factors vary from 0.38 to 0.49 (Heppner & Petersen, 1992).

Athletes who respond the PSI are provided with a likert scale and composed of 35 items, including 3 filler items and evaluated according to scoring system with the numbers of 1-6 (1=strongly agree to 6=strongly disagree). The lowest score that can be obtained from the inventory is 32 and the highest score is 192. Higher scores obtained from the scale indicate self-inability perception of individual about problem solving abilities and lower scores show that the one perceives himself/herself as adequate. 9^{th}, 22^{th} and 29^{th} items in scoring order are out of scoring in accordance with protocol. Moreover, there were inverse-scored items include; 1^{th} 2^{th}, 3^{th}, 4^{th}, 11^{st}, 14^{th}, 15^{th}, 17^{th}, 21^{th}, 25^{th}, 26^{th}, 30^{th} and 34^{th} items.

Procedure

The Turkish version of the PSI was only completed by Turkish athletes who voluntarily participated and signed consent forms. The translation procedure of the PSI was made by faculty members from English Language Department of Nevşehir Hacı Bektaş Veli University. They forward-translated the English version into Turkish, and the translated versions of the PSI were compared for deviations. Then another bilingual language expert back-translated the Turkish version into English to examine the retention of the meaning of the items. Three academics who are experts in the areas of physical education & sports sciences, sports psychology and psychometrics, reviewed the content of the preliminary PSI version to ensure that the questions were culturally appropriate to the Turkish athlete population.

Data analysis

Results of EFA & CFA analyses are presented in the following section. To determine the factor structure of the

multidimensional questionnaire, exploratory factor analysis that conducted by Statistical Package for the Social Sciences (SPSS) 21.0 was firstly used. Following this, confirmatory factor analysis was conducted by analysis moments of structures (AMOS) 18 to check statistical model. Comparative fit index (CFI>0.90, acceptable), non-normed fit index (NNFI>0.90 acceptable), normed fit index (NFI>0.90) and root mean square error of approximation (RMSEA<0.08, adequate model fit) (Maruyama, 1998) were used to check the data. Internal consistency of the adapted scale was checked by computation of Cronbach's coefficient alpha. Fit indices scores were used in order to prove model fits Öcal, 2011. The measurement model based on the fit indices was evaluated for construct validity.

Results

Descriptive statistics and Cronbach's alpha coefficients for the PSI scales are shown in Table 1. Specifically, Cronbach's alpha was 0.69 for Problem solving confidence, 0.73 for Approach-Avoidance, 0.68 for Personal control score. The mean value for Problem Solving Confidence was 26.22±7.11, for Approach-Avoidance was 53.78±12.44, for Personal Control was 24.08±6.64.

Table 1. Descriptive statistics for the three Problem Solving Inventory factors (N=313)

	No. of items	M±SD	Skewness	Kurtosis	Cronbach Alpha
Problem solving confidence	11	26.22±7.11	-.63	.59	.69
Approach – avoidance	16	53.78±12.44	1.07	1.62	.73
Personal control	5	24.08±6.64	.74	.61	.68

Initially, the factorability of the PSI (35 items) was examined. Well-recognized criteria for the factorability of a correlation were used. Firstly, it was observed that 33 of the 35 items correlated at least .3 with at least one other item, suggesting

Table 2. Factor loadings based on a principal components analysis with oblimin rotation for 32 items from the PSI (N = 313)

	1	2	3
Item5 (PSC)	.68		
Item10 (PSC)	.70		
Item11 (PSC)	.72		
Item12 (PSC)	.71		
Item19 (PSC)	.62		
Item23 (PSC)	.63		
Item24 (PSC)	.61		
Item27 (PSC)	.67		
Item33 (PSC)	.75		
Item34 (PSC)	.58		
Item35 (PSC)	.69		
Item1 (AA)		.55	
Item2 (AA)		.52	
Item4 (AA)		.54	
Item6 (AA)		.68	
Item7 (AA)		.70	
Item8 (AA)		.74	
Item13 (AA)		.79	
Item15 (AA)		.56	
Item16 (AA)		.70	
Item17 (AA)		.52	
Item18 (AA)		.78	
Item20 (AA)		.76	
Item21 (AA)		.51	
Item28 (AA)		.75	
Item30 (AA)		.54	
Item31 (AA)		.73	
Item3 (PC)			.60
Item14 (PC)			.62
Item25 (PC)			.60
Item26 (PC)			.56
Item32 (PC)			.79

Legend: Problem solving confidence (PSC), Approach and avoidance (AA), and Personal control (PC)

reasonable factorability. Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was .70, above the commonly recommended value of .6, and Bartlett's test of sphericity was significant ($\chi 2$ (397)=2011.09, p<.05). Given these overall indicators, factor analysis was deemed to be suitable for all 35 items.

For the final stage, a principal components factor analysis of the PSI items, using varimax and oblimin rotations, was conducted, with three factors explaining 66% of the variance. An oblimin rotation provided the best-defined factor structure. The factor loading matrix for this final solution is presented in Table 2. The factor labels proposed by Heppner and Pettersen (1992) suited the extracted factors. Internal consistency for each of the scales was examined using Cronbach's alpha. The alpha levels were moderate: problem solving confidence (PSC) (11 items) (.69), approach and avoidance (AA) (16 items) (.73), and personal control (PC) (5 items) (.68). The PSI explained 66% of the total variances.

After EFA, CFA was used to test the factor structure that shows the sub-dimensions of Problem solving inventory over the data gathered from Turkish athletes. Firstly, for a model with 3 factors (problem solving confidence, approach and avoidance, and personal control) set in the original sub-dimension, goodness of fit statistics were calculated. The results

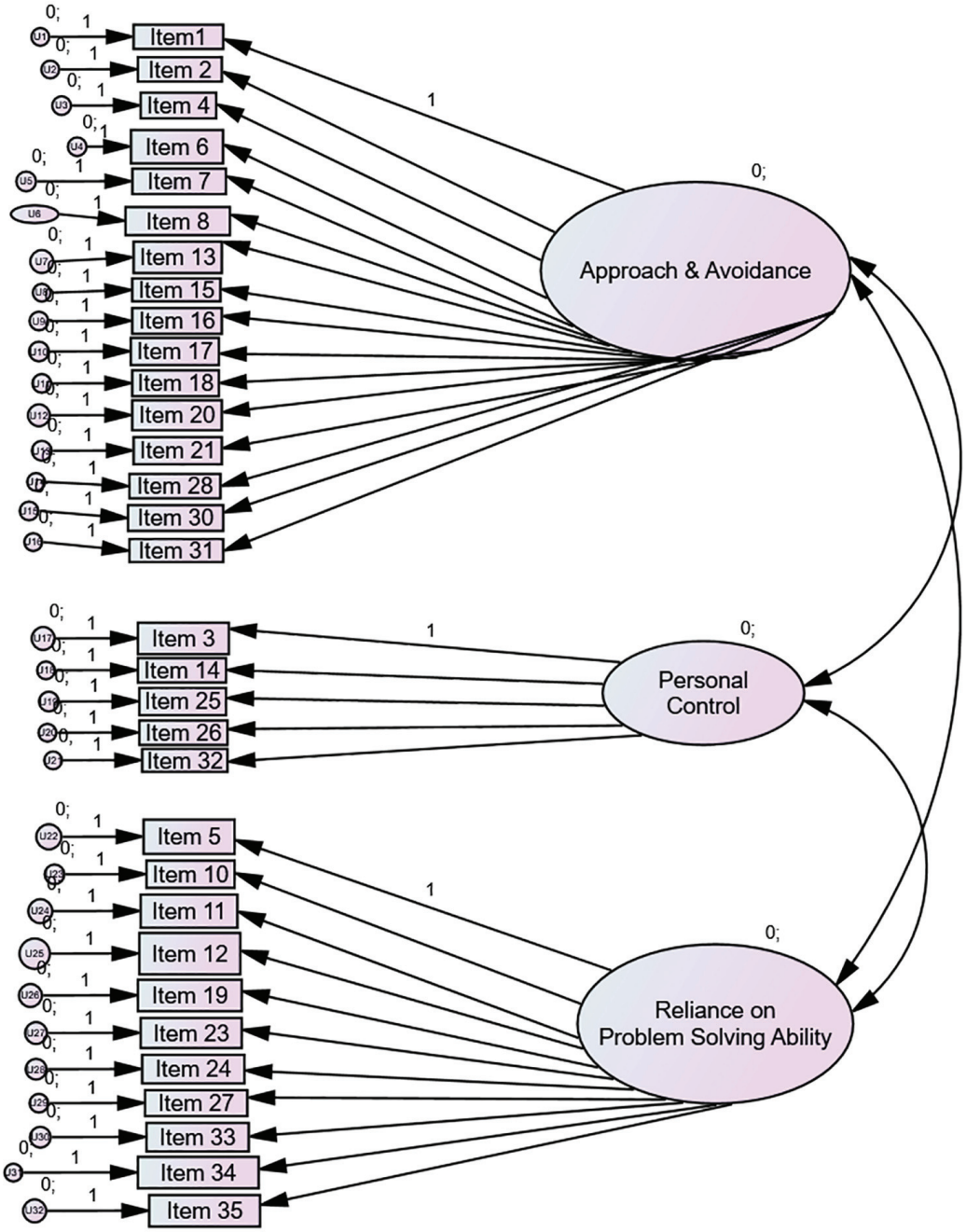

Figure 1. Hypothesized model of PSI

were as follows, Chi-Square (X^2)=912.8, df=461, X^2/df=1.98, Root Mean Square Error Approximation (RMSEA)=.07, Comparative Fit Index (CFI)=.93, Goodness of Fit Index (GFI)=.92, Normed Fit Index (NFI)=.90, Non Normed Fit Index (NFI) =.89. Therefore, it is evident that the model is coherent at a satisfactory level.

Discussion

The goal of the study was to evaluate the psychometric properties of the Problem Solving Inventory (Heppner & Petersen, 1992) on a Turkish population. Exploratory and confirmatory factor analysis results supported the initial structure of the questionnaire for the overall model.

A crucial personal resource for dealing with psychological health, stressors, and barriers etc. in sports is problem solving abilities. The competent problem solvers are flexible, adaptable people and they are able to create or find proper strategies to solve problems. It is to be expected problem solving abilities are very relevant for all sports stuff (athletes, referees, managers, sport psychologists, coaches etc.).

A number of measurement tools exist in the literature that has been developed to evaluate problem solving abilities in sports. As explained earlier, such measurements tools (e.g. the Mooney Problem Checklist, the MEPS, the SPSI and the PF-SOC) have been trialed in different environments.

The PSI has been found to have acceptable internal consistency estimates across a number of populations and cultures (e.g. Heppner, 1988; Heppner, Pretorius, Wei, Lee, & Wang, 2002). The inter-correlation among these three factors ranged from .39 to .69 across a range of studies on PSI (Heppner, 1988). Results suggest that the factors are not only interrelated but also independent enough to be considered as separate factors (Heppner & Wang, 2003). Consistent with our findings, subsequent studies using either exploratory factor analyses indicate that the PSI factors tend to replicate well across different age groups from various backgrounds, such as mid-western White college students (Cronbach's Alpha reliability values from .72 to .90) (Heppner, Baumgardner, & Jackson, 1985); French Canadian adults (Laporte, Sabourin, & Wright, 1988), Turkish college students (Cronbach's Alpha reliability values from .69 to .78 and total internal consistency was .88) (Sahin et al., 1993); Black South African college students (Cronbach's Alpha reliability values from .71 to .84 and total internal consistency was .89) (Heppner et al., 2002); Egyptian college students (Cronbach's Alpha reliability values from .76 to .88 and total internal consistency was .75) (Soliman, 2014); Romanian adults (Cronbach's Alpha reliability values from .78 to .84) (Marian & Roşeanu, 2012), and Mexican American high school students (Cronbach's Alpha reliability values from .66 to .77 and total internal consistency was .86) (Huang, 2005). Moreover, in another Mexican American high school students Cronbach's Alpha reliability values were as follows: .86 for PSI total, .77 for PSC, .76 for AAS, and .66 for PC (Huang & Flores, 2011). Summing across studies, the PSI total obtains average alpha coefficients around .80s, whereas two of the factors (PSC and AA) obtain average alpha coefficients in the low to mid .80s, and the third factor (PC) obtains average alpha coefficients in the low .70s. These results suggest that the PSI is internally consistent across different forms of the PSI used across different cultural groups (Heppner & Wang, 2003).

Additionally, to results of exploratory factor analysis, the confirmatory factor analysis results' indicated that the factor structure of the PSI supported the three factors of the PSI and a general problem-solving factor with Turkish athlete population. That is consistent with some other scientific studies those aimed to find factor structure model of the PSI with different samples would support the use of the three factors of the PSI include; Heppner et al. (2002) study on South African college students, Huang and Flores' (2011) on Mexican American high school students, Marian and Roşeanu's (2011) on Romanian adults, and Soliman's (2014) on Egyptian college students. Moreover, this study provides additional support for the generalizability of the PSI factor structure to a Turkish athletes sample. All these results suggest considerable consistency of the PSI factor structure across various cultures and different samples. In summary, similar to the current findings, other validity and reliability studies demonstrated that PSI is a valid data collection tool in different cultures.

The results of the present study introduced that Problem Solving Inventory-Turkish version has relatively strong psychometric properties, and is a valid and reliable test instrument to evaluate mental skills levels in Turkish sports contexts (athletes, university students, etc.).

The present study has some limitations. The sample of the study were formed by Turkish amateur athletes from a number of team and individual sports. Additionally, professional level athletes should be evaluated for applicability for use in a high level sport environment. Thus, continued evaluation of the PSI is necessary. Moreover, additional types of invariance testing (e.g., temporal, cross-cultural, and sport type), as well as other ongoing construct validity evaluation, needs to be considered in future research to gather new evidence on problem solving abilities.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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