

Short Versions of Turkish Flow Scales for Athletes: Reliability and Validity Study

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The purpose of this study was to test the validity and reliability of the “Short Flow State Scale-2 (SFSS-2)” and “Short Dispositional Flow Scale-2 (SDFS-2)” for Turkish athletes in two separate studies. One hundred ninety-seven athletes ($M_{age} = 22.05$, $SD = 3.60$) voluntarily participated in the first study to test the psychometric properties of SDFS-2 and completed SDFS-2, Long Dispositional Flow Scale-2, and Sport Motivation Scale. In the second study, 423 athletes ($M_{age} = 20.00$, $SD = 3.46$) constituted the sample group and completed SFSS-2, Flow State Scale2, and Situational Motivation Scale for testing the psychometric properties of SFSS-2. Factor structures of both scales were examined by confirmatory factor analysis (CFA). Concurrent validity of the scales was examined by Pearson Product Moment Correlation analysis. The reliability evidence was obtained by a Cronbach’s alpha values. The results of CFA from both studies revealed that both scales have nine items with one factor. All the correlation coefficients calculated for concurrent and convergent validity were significant (between 0.45-0.92 for SDFS-2 and 0.33-0.79 for SFSS-2). Cronbach’s alpha coefficients calculated for internal consistency were 0.77 for SDFS-2 and 0.82 for SFSS-2. The results from both studies indicated that Turkish versions of SDFS-2 and SFSS-2 are valid and reliable instruments to be used in sports contexts.

Key words: flow, construct validity, reliability, sport

Introduction

Positive psychology emerged around the turn of the millennium and researchers started to

focus on positive qualities instead of focusing on the negative aspects and repairing the worst outcomes (Seligman & Csikszentmihalyi, 2000). Flow is one of the positive qualities, which was originally developed by Csiksz-

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entmihalyi through his systematic research (Csikszentmihalyi, 1975). Flow is a specific subjective state that individuals experience during strong task engagement, becoming completely immersed in an activity perceived as rewarding in itself (Csikszentmihalyi, 1975). Flow generally occurs when an individual's level of skill matches the situational challenge and they are both high and broadly in balance (Csikszentmihalyi, 1990). In his book, Csikszentmihalyi (1997) reported that flow is a complete immersion in an activity a person is experiencing, such as singing in a choir, dancing, playing bridge, or reading a good book. People also experience flow during a complicated surgical operation, closing a business deal, talking with a good friend, or playing with a baby (Csikszentmihalyi, 1997). In a flow state, people are deeply involved in some activity to the point of forgetting everything else, except the activity itself (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2014). Experiencing flow is rewarding in itself and therefore this is the reason why people are highly committed to their tasks even when there is no external reward (Nakamura & Csikszentmihalyi, 2009). The flow state is also very functional because individuals are in a state of high concentration while feeling optimally challenged and in control of their action, which can also lead people to high performance (Garcia et al., 2019; Engesser & Rheinberg, 2008).

The prevalence of flow research in diverse contexts stems from the fact that flow has a significant relationship with many factors that can contribute to individuals' optimal functioning, feelings, behavior and performance (Crust & Swann, 2013; Stavrou, Psychountaki, Georgiadis, Karteroliotis, & Zervas, 2015; Harworth, 1993). Due to the evidence from the relevant literature the topic of flow is popular among researchers from different disciplines. Flow experience has been an appealing topic for psychology researchers in recent years

(Cheron, 2016; Nakamura & Csikszentmihalyi, 2014; Csikszentmihalyi, 2014; Ilies, Wagner, Wilson, Ceja, Johnson, DeRue, & Ilgen, 2017). General psychology is not the only field in which the topic of flow is popular. Scientists from different disciplines such as education (Hsieh, Lin, & Hou, 2016), business administration (Kasa & Hassan, 2016), health (Yoshida et al., 2018), and physical activity (Carter, River, & Sachs, 2013) have focused on this topic as well. For example, Liu et al., (2016) investigated flow experiences of the drivers of customers during online consumption and social shopping and the underlined role of flow experience in influencing customers' purchase intention on social shopping sites. The research of Liu and his colleagues (2016) is an example of the marketing-oriented perspective.

One of the earliest attempts to assess flow was performed by Csikszentmihalyi (1975), who used semi-structured interviews and tried to discover the constructs of flow by a qualitative method. Csikszentmihalyi's research (1975) focused on the experiences of people involved in various activities such as rock climbing, composing, dancing, playing chess, and basketball.

Following previous research of Csikszentmihalyi (1975), the recognition of the flow construct has led to the development of new measurements in particular environments. The Flow State Scale (FSS) (Jackson & Marsh, 1996) and Dispositional Flow Scale (DFS) (Jackson, Kimiecik, Ford, & Marsh, 1998) were developed to measure situational and dispositional flow in sport and physical activity settings. Situational flow refers to the experience an individual has with an activity at a certain time. On the other hand, dispositional flow refers to a general experience of an individual with a particular activity (Jackson & Marsh, 1996).

The Flow State Scale (FSS), which was developed by Jackson and Marsh (1996), has

36 items constituting nine dimensions. The dimensions are: challenge-skill, action-awareness, clear goals, unambiguous feedback, concentration, sense of control, loss of self-consciousness, transformation of time, and autotelic experience. FSS is a situational measure and it measures flow experienced for a particular activity, which has just been performed. Later, Jackson et al. (1998) developed the Dispositional Flow Scale (DFS) for measuring feeling of flow in general along nine dimensions by changing the wording and the tense of the phrases in FSS. The first dimension is challenge-skill and stands for a perception of a balance between the challenge of a situation and one's skills, with both operating at a personally high level. The second dimension, action-awareness, indicates a very deep involvement in the flow activity making the activity spontaneous or automatic since there is no awareness of self as being separate from the activity. The third dimension is clear goals, and it indicates clearly defined goals about the activity and the person experiencing flow has a strong sense of what he or she is going to do. The fourth dimension is unambiguous feedback, indicating immediate and clear feedback received usually from the activity itself, which allows the person to know he or she is succeeding in the set goal. The fifth dimension labelled as concentration describes total concentration on the task at hand, which occurs when a person is experiencing flow. The sixth dimension is sense of control and it indicates that the person experiencing flow has the activity under control without having to actively exert control. The seventh dimension is loss of self-consciousness, which indicates that the concern for self has disappeared during flow, as the person becomes one with the activity. It is also stated that when freed from self-consciousness, the athlete often becomes a more natural performer. The eighth dimension is labelled

as transformation of time, which indicates a perceptible alteration of time, the time either slows down or speeds up. Alternatively, time may also simply become irrelevant and out of one's awareness. The last dimension is labelled autotelic experience, which indicates an intrinsically rewarding experience when the person is experiencing flow (Jackson & Marsh, 1996). Nakamura & Csikszentmihalyi, (2002) reported that the challenge-skill balance, clear goals and unambiguous feedback dimensions are a necessary condition for flow occurrence and the other remaining six dimensions are the characteristics of flow when it occurs.

The flow scales were used in various cultures. For instance, the psychometric qualities of FSS and DFS were tested in athletic samples in Greek (Doganis, Iosifidou, & Vlachopoulos, 2000; Stavrou & Zervas, 2004), Japanese (Kawabata & Harimoto, 2000) and Spanish (Calvo, Castuera, Ruano, Vaíllo, & Gimeno, 2008) cultures. It was reported in these research studies that FSS and DFS are valid and reliable instruments to use in sport context. Later, Jackson and Eklund (2002) revised the FSS and DFS because they noted that appropriate evaluation of the psychometric properties of these scales required consideration of both conceptual and statistical issues. The revised forms of both scales were named The Flow State Scale-2 (FSS-2) and Dispositional Flow Scale-2 (DFS-2). FSS-2 and DFS-2 demonstrated acceptable factorial validity with 36 items and nine dimensions. Like the original version, the revised forms of both scales were tested in French (Fournier et al., 2006), Japanese (Kawabata, Mallett, & Jackson, 2007), Turkish (Aşçı, Çağlar, Eklund, Altıntaş, & Jackson, 2007), Chinese (Liu, Liu, Ji, Watson, Zhou, & Yao, 2012), Norwegian (Dammyr, 2011) and Portuguese (Gouveia, Ribeiro, Marques, & Carvalho, 2012) samples. All of these studies confirmed that DFS-2 and

FSS-2 can be used as a measurement tool to measure flow experience.

Recently, short flow scales (dispositional and state) were developed by Jackson, Martin, and Eklund (2008) using 1653 participants from Australia. The short forms were developed because of the fact that short-form questionnaires may be potentially useful when an instrument is frequently used or when time is limited for the assessment (Ubersax, Wyman, Shumaker, & McClish, 1995). The short dispositional and state flow scales each contain nine items, with one item from the four-item measures of each of the nine flow dimensions. It was pointed out that the short flow scales provide a brief assessment of the nine-dimensional conceptualization of flow and it is a practical tool. These short versions of the scales were tested in different languages such as Swedish (Harmat et al., 2015), Chinese (Zhang et al., 2016a) and Arabic (Koehn & Díaz-Ocejo, 2016). The short forms were also used in various samples such as collegiate swimmers (Karageorghis et al., 2013), elite youth swimmers (Briegel-Jones et al., 2013), participants with computer game activity (Harmat et al., 2015), university students who participated in dart throwing (Zhang et al., 2016a), elite and sub-elite athletes from team and individual sports (Thienot, 2013), and students from collegiate music programs (Miksza & Tan, 2015).

As explained above, the concept of flow has been examined in various activities such as music (Fritz & Avsec, 2007), computer game (Harmat et al., 2015), physical education (González-Cutre, Sicilia, Moreno, & Fernández-Balboa, 2009) and sports (Koehn & Díaz-Ocejo, 2016) by using different flow scales. However, Jackson et al. (2008) indicated that, compared to the long forms, the short forms of flow scales might be useful in the research projects, which require participants to complete a lot of questionnaires. By

this way, using the short form of flow scales can enable researchers to have more space for other variables. Jackson et al. (2008) also stated that short forms of these scales can allow researchers to have one flow score, which can be used in research projects where nine dimensions of the long flow scales are irrelevant. Lastly, it is known that cross-cultural research is necessary to reveal cultural differences (Duda & Allison, 1990). Therefore, short forms of these scales validated in different languages can be used to measure flow in cross-cultural research projects. Therefore, the aim of this study was to validate the Turkish version of the short forms of dispositional and state flow scales in sport setting.

Two separate studies were carried out in the present research to examine psychometric properties of both scales. In Study 1, factor structure of the Turkish version of the Short Dispositional Flow Scale-2 was examined by confirmatory factor analysis and concurrent validity, convergent validity and reliability of this scale were investigated as well. Similarly, the aim of Study 2 was to examine factor structure of the Turkish version of the Short Flow State Scale-2 and to explore concurrent validity, convergent validity and reliability.

We hypothesized that Short Dispositional Flow Scale-2 and Short Flow State Scale-2 would positively correlate with their long version scales, which were previously validated as a measurement tool for flow construct. Moreover, relevant literature revealed that flow experience was associated with more autonomous forms of motivation and intrinsic motivation (Valenzuela, Codina, & Pestana, 2018; Mills & Fullagard, 2008; Moreno, Cervelló, & Cutre, 2010; Mallett et al., 2007; Jackson, Kimiecik, Ford, & Marsh, 1998; Kowal & Fortier, 1999). Therefore, we hypothesized that Short Dispositional Flow Scale-2 would positively correlate with intrinsic motivation as an evidence for convergent validity. Last-

ly, we also expected that Short Flow State Scale-2 would positively correlate with identified regulation and intrinsic motivation.

Study 1

Method

Participants

Convenience sampling strategy was adopted to recruit participants. The Short Dispositional Flow Scale-2 was administered to 196 athletes ($M_{age} = 22.05$, $SD = 3.60$), who comprised 150 males ($M_{age} = 22.09$, $SD = 3.50$) and 46 females ($M_{age} = 21.89$, $SD = 4.00$). The average number of trainings per week was 5.26 ($SD = 2.58$) times for males and 5.53 ($SD = 2.65$) times for females. Sport experience was 8.64 ($SD = 4.20$) years for males and 9.91 ($SD = 5.37$) years for females. The athletes were chosen from team and individual sports such as volleyball, football, wrestling, karate, athletics, boxing, swimming, and badminton. Informed consent form was obtained from each participant. Sample size is an important issue for CFA. One common rule of thumb is to ensure a person-to-item ratio of 10:1 for an adequate sample size (Worthington & Whittaker, 2006). Therefore, the sample size of this research can be considered as suitable.

Data Collection Instruments

Short (9-item) Dispositional Flow Scale-2 (SDFS-2, Jackson et al., 2008): The scale contains nine items comprising one item from each dimension of Dispositional Flow Scale-2 (DFS-2), (e.g., "I have a strong sense of what I want to do" from "clear goals" dimension). SDFS-2 is a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores obtained from this scale indicate higher feeling of dispositional flow. Turkish

validation of the long form of this scale was made by Aşçı et al. (2007). Turkish forms of the nine items in the Short (9-item) Dispositional Flow Scale-2 were obtained from the long form of the Turkish scale adapted by Aşçı et al. (2007).

Dispositional Flow Scale-2 (DFS-2, Jackson & Eklund, 2002): DFS-2 contains 36 items and 9 subscales. This scale measures an individual's general tendency in experiencing flow in sport. Each item in this scale was responded to on a 5-point Likert scale. The answers range from 1 (*never*) to 5 (*always*). This scale was adapted into Turkish by Aşçı et al. (2007).

Sport Motivation Scale (SMS, Pelletier et al., 1995): This scale consists of seven subscales that measure three types of Intrinsic Motivation (IM) (IM to know, IM to accomplish things, and IM to experience stimulation), three forms of Extrinsic Motivation (identified, introjected, and external), and Amotivation. On the scale, which has 28 items, the athletes were asked the question; "Why do you practice your sport?" and the appropriate answer was circled on a seven-point scale ranging from 1 (*does not correspond at all*) to 7 (*corresponds exactly*). The validity and reliability of the Turkish version of SMS were determined by Kazak (2004). Only the intrinsic motivation subscale was used in the present study to measure concurrent validity because intrinsic motivation has a similar structure to flow. Intrinsic motivation subscale contains 12 items (e.g., "For the pleasure I feel in living exciting experiences").

Data Collection

The coaches of participants were informed by the researchers about the aim of the studies. Then the participants were recruited via their coaches. Only participants who returned signed written consent forms participated in the study. The measures were set in the

following order: demographic information sheet, SDFS-2, SMS, and DFS-2. These questionnaires were administered to participants in group settings in their training facilities before training sessions. Participants were informed verbally that involvement in the study was voluntary and results would be strictly confidential. Researchers provided verbal and visual instructions on how to respond to items in each questionnaire. Self-report questionnaire responses were anonymous. The participants spent about 15-20 minutes to fill in the questionnaires.

Data Analysis

Means, standard deviations and frequency analysis were calculated in IBM SPSS 17. Skewness and kurtosis values were checked and these values were found to be between -2 and +2, which indicated adequate univariate normality (George & Mallery, 2016). Multivariate normality was tested by Mardia's coefficient of multivariate kurtosis (Mardia, 1985). It is reported that this value should be less than the recommended value. Recommended value is calculated using the formula " $p(p + 2)$ " where p = total number of observed indicators (Raykov & Marcoulides, 2008). Using this formula to test multivariate normality is prevalent among researchers (e.g., Teo et al., 2010; Baki, 2017; Lau & Yuen, 2014; Vecchione & Alessandri, 2013). This formula is $9(9 + 2) = 99$ for our data and we obtain the value of 99. Mardia's coefficient of multivariate kurtosis for this study is 3.48, which is lower than 99. This result revealed that the multivariate normality assumption has been met. Factor structure of the Turkish version of the scale was examined by confirmatory factor analysis (CFA) using maximum likelihood estimation procedure in AMOS 20. Standardized Root Mean Square Residual (SRMR), Comparative Fit Index (CFI), Root Mean Square Error

Approximation (RMSEA) and Non-Normed Fit Index (NNFI) were utilized to test model fit. The result of chi square (χ^2) test was also reported. A value of 0.05 or lower for RMSEA and SRMR shows a very good fit, whereas a value between 0.05 and 0.08 is an indication of an acceptable model fit. While NNFI and CFI values, which are equal to or above 0.95, reveal an excellent model fit, values between 0.90 and 0.95 can be interpreted as an indication of a good model fit (Hooper, Coughlan, & Mullen, 2008; Schermelleh-Engel, Moosbrugger & Müller, 2003; Sümer, 2000).

Pearson correlation coefficients between SDFS-2 and Dispositional Flow Scale-2 were calculated for concurrent validity. Convergent validity was also tested by Pearson's correlation coefficients between SDFS-2 and intrinsic motivation. Level of significance was determined to be 0.05 in all the analyses. Internal consistency was measured by Cronbach's alpha values. Composite reliability of the scale was also tested.

Results

Descriptive statistics along with Cronbach's alpha values can be seen in Table 1. Cronbach's alpha values ranged from 0.63 to 0.94. Considering the flow scores, it appeared that the lowest scores belonged to loss of self-consciousness and action-awareness sub-dimensions whereas the highest scores were obtained from autotelic experience and clear goals.

Construct Validity

Factor structure of the Turkish form of SDFS-2 was tested for consistency with the original short form, which contains nine items with one dimension. CFA was conducted and then model fit indices, t -values and the standardized regression weights were examined. The model fit indices were lower than cut-off

Table 1 Descriptive statistics and internal consistencies of the variables in Study 1

Variables	Minimum	Maximum	M	SD	Cronbach's alpha	
Short Dispositional Flow Scale-2	2.78	5.00	4.31	0.44	0.77	
Dispositional Flow Scale-2	2.91	5.00	4.33	0.43	0.94	
Intrinsic Motivation	2.92	7.00	6.05	0.88	0.91	
Sub-Dimensions of Dispositional Flow Scale-2	Challenge-skill	2.33	5.00	4.26	0.58	0.63
	Action-awareness	2.00	5.00	4.13	0.67	0.80
	Clear goals	2.50	5.00	4.50	0.51	0.78
	Unambiguous feedback	2.75	5.00	4.38	0.54	0.73
	Concentration	2.50	5.00	4.41	0.55	0.79
	Sense of control	3.00	5.00	4.40	0.50	0.77
	Loss of self-consciousness	1.00	5.00	3.74	1.02	0.91
	Transformation of time	2.25	5.00	4.25	0.71	0.84
	Autotelic experience	2.75	5.00	4.66	0.47	0.81

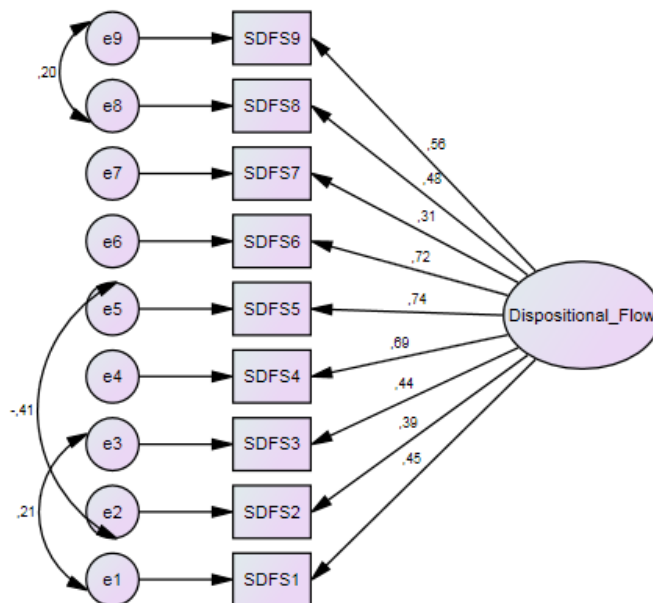


Figure 1 Path diagram of Short Dispositional Flow Scale-2

criteria (SRMR = 0.07, CFI = 0.84, RMSEA = 0.11, NNFI = 0.78) with a significant χ^2 test ($\chi^2 = 93.242$, $df = 27$, $p = 0.001$). Therefore, the recommended modifications were examined and three modifications were applied (Figure 1), consistent with the theoretical explanations of Nakamura and Csikszentmihalyi (2002), which are explained in the introduction. Based on this theoretical explanation, three items of SDFS-2 are the items for the necessary condition of flow to occurrence while the remaining six items are the characteristics of flow experience. Items 1, 3, and 4 are the items for measuring necessary condition while the rest of the six items (2, 5, 6, 7, 8, and 9) are the items for measuring characteristics of flow in the Turkish form of SDFS-2. Therefore, the three correlated error terms, which were allowed between the items, were within either condition or characteristic items. Estimated parameter changes for these three modifications were 17.78 (items 2 and 5), 7.06 (items 1 and 3) and 6.46 (items 8 and 9). After modifications, we obtained marginally improved fit indices (SRMR = 0.06, CFI = 0.92, RMSEA = 0.08, NNFI = 0.88).

Standardized regression weights of the items were between 0.31 and 0.74 and t -values were found to be between 7.06 and 9.67 for SDFS-2 (Table 2). The squared multiple correlations, which can also be seen in Table 2, are the communality estimate for an indicator variable. This value measures the percent of variance in a given indicator variable explained by its latent variable. Squared multiple correlations, which are labelled as R^2 , range from 0.10 to 0.54. Composite reliability was determined to be 0.78 for this scale. The results indicated that Turkish form of SDFS-2 had similar factor structure as the original scale's factor structure.

Concurrent and Convergent Validity

The Pearson correlation coefficient showed that SDFS-2 was positively and significantly correlated with intrinsic motivation and DFS-2. Furthermore, SDFS-2 was significantly and positively associated with sub-dimensions of DFS-2 (Table 3). Overall, the relationships between these variables showed promising support for the concurrent and convergent validities of the SDFS-2.

Table 2 Descriptive statistics, standardized regression weights and t -values for Short Dispositional Flow Scale-2

Items	<i>M</i>	<i>SD</i>	Std. Regression Weights	t -value	R^2	Composite reliability (CR)
1	4.09	0.75	0.46	9.36*	0.21	0.78
2	4.10	0.74	0.39	9.32*	0.16	
3	4.46	0.63	0.44	9.40*	0.19	
4	4.30	0.70	0.69	8.10*	0.47	
5	4.63	0.59	0.74	7.06*	0.54	
6	4.33	0.67	0.72	7.73*	0.52	
7	3.78	1.08	0.32	9.67*	0.10	
8	4.29	0.78	0.48	9.26*	0.23	
9	4.68	0.53	0.56	8.95*	0.32	

Note. *Significant p value at .05 level of probability

Table 3 Correlations between SDFS-2 with Intrinsic Motivation, Dispositional Flow Scale-2 and Sub-dimensions of Dispositional Flow Scale-2

Variables		SDFS-2
Intrinsic Motivation		0.45
Dispositional Flow Scale-2		0.92
Sub-Dimensions of Dispositional Flow Scale-2	Challenge-skill	0.64
	Action-awareness	0.65
	Clear goals	0.75
	Unambiguous feedback	0.70
	Concentration	0.70
	Sense of Control	0.73
	Loss of Self-Consciousness	0.56
	Transformation of Time	0.56
	Autotelic experience	0.65

Note. All correlations are significant at the $p < .05$ level

Reliability

Cronbach's alpha was calculated as a reliability coefficient of the Turkish form of SDFS-2 and was found to be 0.77. This coefficient is acceptable, as it is not lower than Nunnally and Bernstein's (1994) 0.70 cut off value. In addition, composite reliability of the scale was 0.78, exceeding the desired cut off of 0.70, showing adequate convergence (Hair et al., 2010).

Study 2

Method

Participants

Following the sampling procedures outlined in Study 1, 423 athletes participated in this study, mean age was 20.00 ($SD = 3.46$). The participants comprised 169 female and 254 male athletes. The mean number of trainings per week was 4.77 ($SD = 2.36$) times for males

and 5.04 ($SD = 2.37$) times for females. Athletes had between 1 and 21 years of sport experience ($M = 6.13$, $SD = 3.52$ for females and $M = 7.29$, $SD = 4.23$ for males). The athletes were chosen from a variety of sports including karate, weight lifting, boxing, volleyball, handball, football, athletics, and basketball. Informed consent form was obtained from each participant. Sample size should be adequate for CFA. One common rule of thumb is to ensure a person-to-item ratio of 10:1 (Worthington & Whittaker, 2006). It can be assumed that the sample size of this research is adequate.

Data Collection Instruments

Short (9-item) Flow State Scale-2 (SFSS-2, Jackson et al., 2008): The scale contains nine items comprising one item from each dimension of the full-length of the Flow State Scale-2 (FSS-2). The scale assesses intensity of flow state in one specific activity that the participants have just completed (e.g., "I do things spontaneously and automatically with-

out having to think"). Participants are asked to circle the number that best matches their experience on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicate higher feeling of flow.

Flow State Scale-2 (FSS-2, Jackson & Eklund, 2002): This scale is a post-event assessment of flow. Respondents answer the items on a 5-point Likert scale which range from 1 (*strongly disagree*) to 5 (*strongly agree*). This scale was adapted for the Turkish culture by Aşçı et al. (2007).

Situational Motivation Scale (SIMS) (Guay, Vallerand, & Blanchard, 2000): The scale consists of 16 items and four subscales (intrinsic motivation, identified regulation, external regulation, amotivation). Each item is answered on a 7-point Likert scale ranging from 1 (*does not correspond at all*) to 7 (*corresponds exactly*). The scale was initially developed by Guay, Vallerand, and Blanchard (2000) and translated into Turkish by Kazak-Çetinkalp (2010). Participants are asked to answer the following question: "Why are you currently engaged in this activity?" For the purpose of this research only intrinsic motivation (example item: "Because I think that this activity is interesting") and identified regulation (example item: "Because I think that this activity is good for me") subscales were used.

Data Collection

The measures were set in the following order: demographic information sheet, SFSS-2, SIMS, and FSS-2. SFSS-2 and FSS-2 are situational measurement tools. Therefore, the scales were administered to participants just after their training sessions. Only participants who returned signed written consent forms participated in the study. Participants were met by the researchers at their training facilities when their training sessions were over.

Data collection was performed before the participants went to the changing room. The aim of the research was explained to all the participants and they were informed verbally that the data would only be used for research purposes. Each athlete was then given the questionnaire package with a pen to fill in. Data collection took approximately 15-20 minutes.

Data Analysis

First, data were screened for univariate and multivariate normality as in Study 1. Skewness and kurtosis values were found between -2 and +2 showing univariate normality (George & Mallery, 2016). Multivariate normality was tested by Mardia's coefficient of multivariate kurtosis (Mardia, 1985) as explained in Study 1. Mardia's coefficient of multivariate kurtosis for Study 2 was 22.02. In line with the information regarding the formula provided in Study 1, we concluded that the data have multivariate normal distribution.

In line with the data analysis procedures used in Study 1 factor structure of the Turkish version of SFSS-2 was examined by CFA using maximum likelihood estimation in AMOS 20. Same model fit indices used in Study 1 were also utilized in Study 2.

Concurrent validity was examined by correlation coefficient between SFSS-2 and FSS-2 (long version). For convergent validity, we used intrinsic motivation and identified regulation sub-dimensions of Situational Motivation Scale because of the fact that these types of motivation are the most autonomous types of motivation. Thus, these sub-dimensions are the most suitable ones to determine convergent validity. Level of significance was determined to be 0.05 in all the analyses. Internal consistency was measured by Cronbach's alpha coefficient. Composite reliability was also calculated.

Results

Descriptive statistics along with Cronbach's alpha values belonging to SFSS-2 can be seen in Table 4. Cronbach's alpha values ranged from 0.69 to 0.93. Among the flow scores, the lowest scores belonged to action-awareness and loss of self-consciousness sub-dimensions whereas the highest scores were obtained from autotelic experience and clear goals.

Construct Validity

Factor structure of the Turkish form of SSFS-2 was tested to see whether it was similar to the 9-item original short form of the scale.

Confirmatory factor analysis was conducted and model fit indices were found to be lower than the cut off criteria (SRMR = 0.05, CFI = 0.93, RMSEA = 0.09, NNFI = 0.90) with a significant χ^2 test ($\chi^2 = 122.711$, $df = 27$, $p = 0.001$). Therefore, recommended modifications were

examined and one modification was applied (Figure 2) by considering the theoretical explanations of Nakamura & Csikszentmihalyi (2002), which were detailed in the result section of Study 1 along with the conceptual explanations in the introduction. Estimated parameter change for this modification was 23.05. After modifications, we obtained marginally improved fit indices.

Standardized regression weights for the items of SSFS-2 were between 0.32 and 0.81 as it is seen in Table 5 and t -values were between 10.84 and 14.31. All the factor loadings were above 0.32 for Short Flow State Scale-2. The squared multiple correlations, which can also be seen in the table above (labelled as R^2), range from 0.10 to 0.65. Composite reliability was determined to be 0.83. CFA results for SFSS-2 revealed that the model fits the data well (SRMR = 0.039, CFI = 0.95, RMSEA = 0.074, NNFI = 0.94) and indicated that the Turkish form of SFSS-2 had similar factor structure as the original scale's factor structure.

Table 4 Descriptive statistics and internal consistencies of the variables in Study 2

Variables		Minimum	Maximum	<i>M</i>	<i>SD</i>	Cronbach's alpha
Short Flow State Scale-2		2.11	5.00	4.17	0.59	0.82
Flow State Scale-2		1.41	5.00	4.18	0.50	0.93
Intrinsic motivation		1.00	7.00	5.71	1.22	0.84
Identified regulation		1.00	7.00	5.96	1.16	0.86
Sub-Dimensions of Flow State Scale-2	Challenge-skill	1.33	5.00	4.19	0.71	0.69
	Action-awareness	1.00	5.00	3.67	1.04	0.83
	Clear goals	1.75	5.00	4.31	0.64	0.76
	Unambiguous feedback	1.50	5.00	4.22	0.65	0.72
	Concentration	1.25	5.00	4.21	0.68	0.74
	Sense of control	1.00	5.00	4.22	0.68	0.77
	Loss of self-consciousness	1.00	5.00	3.98	0.89	0.83
	Transformation of time	1.50	5.00	4.21	0.70	0.78
Autotelic experience		1.25	5.00	4.50	0.57	0.74

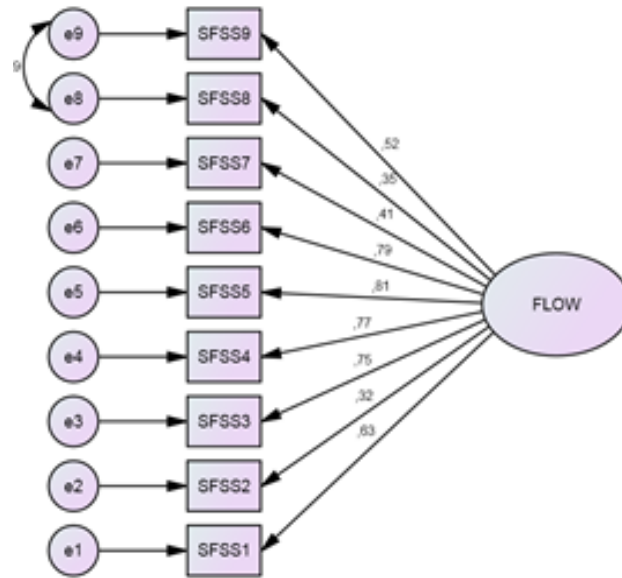


Figure 2 Path diagram of Short Flow State Scale-2

Table 5 Descriptive statistics, standardized regression weights and *t*-values for Short Flow State Scale-2

Items	<i>M</i>	<i>SD</i>	Std. Regression Weights	<i>t</i> -value	<i>R</i> ²	Composite reliability (CR)
1	4.08	0.98	0.63	13.24*	0.40	0.83
2	3.74	1.17	0.32	14.31*	0.10	
3	4.29	0.85	0.75	12.10*	0.56	
4	4.13	0.87	0.77	11.66*	0.60	
5	4.27	0.86	0.81	10.84*	0.65	
6	4.25	0.90	0.79	11.37*	0.62	
7	3.91	1.08	0.41	14.13*	0.17	
8	4.34	0.85	0.32	14.25*	0.12	
9	4.57	0.66	0.52	13.80*	0.28	

Note. *Significant *p* value at 0.05 level of probability

Table 6 Correlations between SFSS-2 and Intrinsic Motivation, Flow State Scale-2, and Sub-dimensions of FSS-2

Variables		SFSS-2
Intrinsic Motivation		0.33
Identified regulation		0.38
Flow State Scale-2		0.79
Sub-Dimensions of Flow State Scale-2	Challenge-skill	0.58
	Action-awareness	0.34
	Clear goals	0.65
	Unambiguous feedback	0.64
	Concentration	0.63
	Sense of Control	0.66
	Loss of Self-Consciousness	0.41
	Transformation of Time	0.49
	Autotelic experience	0.58

Note. All correlations are significant at the $p < .05$ level

Concurrent Validity and Convergent Validity

Pearson correlation coefficients showed that SFSS-2 was significantly correlated with intrinsic motivation ($r = 0.33, p < 0.05$), identified regulation ($r = 0.38, p < 0.05$), and FSS-2 ($r = 0.79, p < 0.05$). Furthermore, SFSS-2 was significantly and positively associated with sub dimensions of FSS-2 (Table 6). Overall, the relationships between these variables showed acceptable support for the concurrent and convergent validities of the SFSS-2.

Internal Consistency

Cronbach's alpha was used as a reliability indicator of the Turkish form of SFSS-2. Cronbach's alpha was found to be 0.82. This coefficient is acceptable as it is higher than the 0.70 cut off value (Nunnally & Bernstein, 1994). In addition, composite reliability of the scale was 0.78, which was also higher than the de-

sired cut off of 0.70, showing adequate convergence (Hair et al., 2010).

Discussion and Conclusion

After Csikszentmihalyi's (1975) first attempts to explain flow constructs and the relevant studies, which highlighted the importance of flow in various contexts (Jackman, Hawkins, Crust, & Swann, 2019; Cheron, 2016; Nakamura & Csikszentmihalyi, 2014; Csikszentmihalyi, 2014; Ilies, Wagner, Wilson, Ceja, Johnson, DeRue, & Ilgen, 2017), it appeared important to measure flow construct related to various experiences. Therefore, Flow State Scale (Jackson & Marsh, 1996) and Dispositional Flow Scale (Jackson, Kimiecik, Ford, & Marsh, 1998) were developed for physical activity and sport settings. These scales were then revised and named as FSS-2 and DFS-2 both of which were shorted in the subsequent studies conducted by Jackson, Martin, and Eklund (2008). The shortened versions were named SDFS-2 and SFSS-2. The purpose

of the current study was to test the validity and reliability of the Turkish version of SDFS-2 and SFSS-2 by two studies.

The results of the confirmatory factor analysis from both studies revealed that both scales were confirmed to have nine items with one factor for each. These results are consistent with the factor structure of the original scales (Jackson et al., 2008). An inspection of the model fit indices revealed that the models fit the data. SRMR, CFI, RMSEA and NNFI values showed a good model fit for both scales, except that the only NNFI value reported for SDFS-2 in Study 1 was just below the cut off criteria. Considering that NNFI value for this scale was not much below the threshold, both models were evaluated as adequate. Previous research also showed that goodness-of-fit indices of the short scales (nine items with one dimension) were acceptable in the samples, such as athletes from Australia (Jackson et al., 2008) and Chinese students (Liu, 2010). However, Zhang et al. (2016b) conducted a research in which they removed items 2 and 8 from SDFS-2 due to low factor loading in a Chinese sample.

An inspection of the items in the models revealed that factor loadings were between 0.31 and 0.73 for the SDFS-2. Study 2 showed that factor loadings of the state scale were between 0.32 and 0.82. It was reported that factor loadings should be above 0.32 (Tabachnick & Fidell, 2007). There was only one item which was just below this value. As the factor loading of this item was close to the threshold level, it was not removed from the model in order to keep the theoretical structure of flow. In addition, *t*-values in the models show that all the observed variables were significantly predicted by the latent variables.

For concurrent validity, the correlations of short flow scales with their long versions were examined. Convergent validity was inspected by the correlation between SDFS-2

and intrinsic motivation. Also, the correlation of SFSS-2 with intrinsic motivation and identified regulation subscales of Situational Motivation Scale were examined as an evidence of convergent validity. Statistically significant moderate or large correlation coefficients were observed, which confirmed our hypotheses and provided evidence for concurrent and convergent validity of SDFS-2 and SFSS-2. These findings showed that SDFS-2 and SFSS-2 were positively and significantly correlated with the other previously established measurement tools, which measure the same and theoretically related constructs. From a psychological point of view, the correlation of flow with intrinsic motivation and identified regulation revealed, in line with relevant research, that flow experience is linked to intrinsic motivation and identified regulation, which are autonomous forms of motivation (Valenzuela et al., 2018). These significant correlations, as expected, were the evidences for concurrent validity and convergent validity of the scales. Relevant literature, examining the relationship between flow and intrinsic motivation, revealed similar findings. For example, a positive correlation between flow and intrinsic motivation was reported in conservatoire students (Valenzuela et al., 2018) and Australian students (Mallet et al., 2007). Kowal and Fortier (1999) also examined the association between flow and motivation in the swimming context, and revealed that there is a significant positive relationship between flow and intrinsic motivation.

Reliability findings indicated that both scales were reliable for measuring flow in sport contexts. It is reported that a Cronbach's alpha value between 0.70 and 0.80 can be interpreted as acceptable (Field, 2009). Cronbach's alpha values in the present study were at an acceptable level (above 0.70), showing internal consistencies of both scales. These internal consistency coefficients were also

similar to the previous research studies with elite and sub-elite athletes from team and individual sports (Thienot, 2013), with students performing dart throwing (Zhang et al., 2016a), and students of collegiate music programs (Miksza & Tan, 2015). Furthermore, composite reliability was also used to determine reliability and it refers to the degree of consistency between latent variable and its corresponding observed variable (Hair et al., 2010). Composite reliability (CR) scores were 0.78 for Short Dispositional Flow Scale-2 and 0.83 for Short Flow State Scale-2. The rule of thumb of CR is 0.70 or higher, indicating good reliability (Hair et al., 2010, p. 710). Both composite scale reliabilities exceeded the desired cut off of 0.70, showing good reliability.

It can be concluded that the Turkish version of Short Dispositional Flow Scale-2 and Short Flow State Scale-2 are valid and reliable measures for measuring flow in sport context. Each of these two scales has nine items in one dimension and can be used to measure flow in athletic populations. These short measures may be preferred by researchers as alternatives to the long versions. Sports psychologists can also easily use this instrument when they need a one-dimension flow measurement tool instead of using long versions of these scales. In addition, these short flow scales can be useful in those experimental studies in which there are some sportive performance tests and some specific measurement protocols where the participants and the researchers have limited time.

There are some limitations of this study. Firstly, the data collected in this paper was cross-sectional and correlational in nature. Although this approach was appropriate for validating the measure and examining relationships, future research should use longitudinal designs to examine how athletes experience flow over time (e.g., during a season; between transitions in stages of athlete devel-

opment). Future research might also consider examining these scales using different validity and reliability measurement methods. For example, the factor structure of these scales might be examined through investigations of its cross-cultural invariance or measurement invariance across groups (e.g., by gender, competitive level). In addition, adaptation of these scales in this research was performed in two athletic samples. Therefore, the scales can be adapted for the other contexts such as exercise, music, painting and other specific games and activities.

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