Perceived Physical Literacy Scale for Adolescents (PPLSA): Validity and Reliability Study

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ABSTRACT

The aim of this study is to adapt the "Perceived Physical Literacy Scale for Adolescents" into Turkish version. The research was designed with the descriptive survey model. Research data were obtained from a total of 585 participants aged between 12 and 19 years. The research was carried out with data obtained from four different study groups in 2019. In the study, language validity was performed with 20, Explanatory Factor Analysis (EFA) 218, Confirmatory Factor Analysis (CFA) 300, and reliability (test-retest) analysis with data from 47 participants. AFA and CFA were made to test the construct validity. Pearson Correlation Analysis was used to determine the relationship between factors. For item discrimination, item test correlation and 27% lower-upper group comparison were determined. Convergent and divergent validity analysis were made. Cronbach's Alpha and test-retest analysis were used within the scope of reliability analysis. As a result of EFA, a structure with 3 factors and 9 items was determined. This structure has been verified by CFA. One-dimensional and three-dimensional models were tested for the scale structure, and it was determined that the fit indices of the 3-dimensional pattern were more significant. A positive significant relationship was found between physical literacy, which is a measured feature in the scale, and its sub-dimensions. Reliability analysis results showed that the measuring tool can measure reliably. Descriptive analysis (mean, standard deviation) showed that the perceived physical literacy scale for adolescents is high in general and in its sub-dimensions. Analyzes conducted within the context of the construct validity of the measuring tool show that the perceived physical literacy scale for adolescents is a valid and reliable instrument that can measure. Measurement tool is important in determining the physical literacy of adolescents. Specialists working in the field of physical education and sports can provide the necessary support with appropriate intervention programs in line with the determinants of the physical literacy of adolescents.

Key words: Physical Literacy, Adolescents, Scale Adaptation, Validity, Reliability

INTRODUCTION

In recent years, the development of technology and the widespread use of technological tools and equipment in our lives have made our lifestyle increasingly inactive. In fact, individuals in different development areas have the opportunity to carry out some activities such as hobbies, entertainment, conversation, shopping and games through platforms enabled by technology. These possibilities provided by technology have started to cause some pathological problems such as phone addiction, digital game addiction and television addiction (Hollander, 1993). Studies have revealed that adolescents often spend their free time on the internet, phone or virtual games (Chou & Chou, 2019; Sureda et al., 2020). This situation has led to increase in the risk of obesity (Cleland et al., 2008) and metabolic disorders (Laird et al., 2018) with the effect of the change in the eating habits of adolescents (fast-food) as well as sedentary life. In addition,

adolescents may face some problems such as depression, anxiety, attention deficit and sleep problems (Kim et al., 2010), and thus their quality of life can be negatively affected. Physical activity has an important place in preventing this negative situation (Gill et al., 2013). Adolescents should be physically literate in realizing the importance of physical activity (Cairney et al., 2019).

The concept of physical literacy, which has a positive effect on the quality of life, is expressed as the knowledge and understanding, motivation, self-confidence and physical competence that an individual has in order to participate in physical activity at an appropriate level throughout life (Whitehead, 2010). Beyond movement skills, physical literacy contributes to different development areas as emotional development (trust, motivation), social development (cooperation, sharing) and cognitive development (awareness of where to act in response to environmental

movements). This concept consists of different components: motivation, knowledge and understanding, physical competence (Almond, 2013; Whitehead, 2013). Motivation includes the willingness to participate in the activity, positive attitude, trust in one's physical abilities, and enjoying the movement. Physical competence is the physical skills required to do physical activities. It is the ability to develop movement patterns and skills, and the capacity to perform physical skill at different movement intensity and duration. At the same time, it is the participation of the individual in physical activities of different content in various environments. Another component, knowledge and understanding, includes how adolescents will perform the movement, the adequacy of their performance, and health and fitness (the relaxation and sleep state that physical activity creates in the individual) (Whitehead, 2013). Components related to the clutch are shown in Figure 1.

Barnett et al. (2020) states that interaction with the environment is also important in terms of physical literacy. As physically literate adolescents have the ability to read the physical environment, they can give appropriate responses by anticipating movement needs and possibilities (Corlett & Mandigo, 2013; Hastie & Wallhead, 2015; Mandigo et al., 2009). It is stated that physically literate individuals have the acquisition of basic motor skills and sportive activities in a safe and controlled manner in water, land, ice and different rough terrain (Dudley et al., 2011; Dudley, 2015; Tremblay & Lyold, 2010). Canada and Northern Ireland emphasized the importance of acquiring basic motor skills in a range of multimedia environments to contribute to the development of all individuals (Delaney et al., 2008). In addition, the positive reflections of physical activity on the health of adolescents (cardiovascular fitness, strength, motor skills, psychological, social and physical development) have made it necessary to raise awareness of the importance of physical literacy (Edwards et al., 2017).

In order to improve physical literacy, meeting different sports branches from an early age can provide the individual with physical development in multiple ways. Thus, physical literacy develops as the individual recognizes his/her abilities, knows what s/he can and cannot do, and can act in a more balanced, economical and safe manner under difficult conditions (Côté & Vierimaa, 2014; Whitehead, 2001; 131). In addition, s/he can define the value of physical activity and movement, use physical activity as a tool to achieve certain goals, control their own body as s/he wishes,

Figure 1. Dimensions of physical literacy (Whitehead, 2013)

skillfully demonstrate the basic motor skills that form the basis of sportive skills, and give appropriate responses to the environmental conditions in which they perform physical activity (Higgs et al., 2005), establish positive relationships with his/her environment through movement, be aware of the basic characteristics that may affect his/her performance and give appropriate responses, and are aware of the importance of sleep and balanced nutrition in achieving successful results of physical activity (Whitehead, 2013).

Some developed countries aim to build a society that has the knowledge, skills and equipment to meet the mobility needs of individuals, adopts the importance of physical activity and has the motivation and responsibility to sustain it throughout life (Giblin et al., 2014; Keegan et al., 2013; Roetert & Jefferies, 2014). Australia has allocated $ 200 million to develop and implement physical literacy-based physical activity programs. Some countries have encouraged the public to be physically literate through physical activity in schools and public health organizations (Keegan et al., 2013). Hong Kong, on the other hand, emphasized the importance of physical education classes (Choi et al., 2018) in order to ensure that students are physically active. Some countries have seen physical education classes as a central goal and result in gaining physical literacy. They also benefited from physical education classes in order to contribute to students at different levels of education in maintaining their physical literacy (SHAPE America, 2014). Physical literacy is not an alternative concept to physical education and does not compete with it. While physical education is a subject in the curriculum, physical literacy is an achievement of physical education. The individual bears the responsibility of maintaining this habit, which s/he acquired as an outcome of physical education lessons, throughout his/her life. The contribution of researchers and practitioners in the field of physical education is important in bringing this responsibility to individuals (Hastie, 2017).

The perception, awareness and belief that physical education teachers have about physical literacy are important in transferring the features of the concept to students. Since the participation and continuity of students with low physical literacy level will be negatively affected, the teachers gaining positive attitude towards this concept, taking into account individual differences in teaching skills and respecting differences will improve the student's sense of self-confidence. In this context, a measurement tool adopted by Munusturlar and Yıldızer (2020) in order to measure physical literacy perceptions of physical education teachers in the Turkish literature can overcome this deficiency in the field. However, although there are several measurement tools abroad (Li et al., 2020; Ma, Sum, Hu & Gao, 2020; Sum et al., 2018) in determining the perceptions of adolescents regarding this concept, there is no measurement tool in our country to meet this need. Especially today, due to the sedentary life culture, there is an increase in chronic disease risk factors in adolescents (May, Kuklina & Yoon, 2010), and the rate of participation in physical activity decreases significantly in the youth period (Ortega et al., 2013). In order to raise awareness about the effects of physical activity on the health of the individual
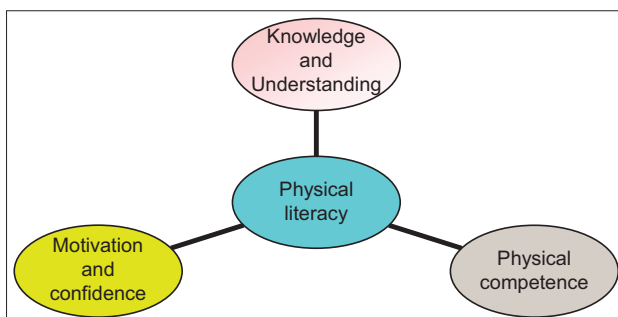
and at least to adopt the importance of sports and physical activity for health, it is important to determine the levels of physical literacy that will support the quality of life of adolescents, who constitute a significant portion of the Turkish population. This concept, which offers adolescents the ability to use the innate potential of the individual by giving appropriate answers to environmental factors, is influenced by the talent, capacity, movement potential and culture they have in demonstrating their potential (Whitehead, 2013).

Considering that physical literacy has a critical importance in acquiring basic skills required for both a healthy life and a successful sportive future, the validity and reliability study is aimed in this study in order to test the suitability of the perceived physical literacy scale to Turkish Culture for adolescents.

METHOD

The assessment process of the validity and reliability of the Turkish version of the perceived body literacy scale for adolescents is given below.

As shown in Figure 2, in the first phase of the study, permission was obtained from the responsible author of the measurement tool to be adapted to Turkish. In the next step, the items in the original scale were translated into Turkish. In order to test the clarity and clarity of the items, the items were sent to different field experts for examination. The Turkish form was finalized in line with their feedback. In order to measure the consistency between the Turkish and English forms, both forms were applied to 20 participants with an interval of three weeks. Analysis was made for the validity of the language with the obtained data. Within the scope of construct validity, firstly, EFA and item analyses were carried out with the data obtained from 218 participants. The structure revealed was tested with the data obtained from another participant group of 300 people. In addition, convergent and divergent validity analyses were also performed. Reliability analyses were also carried out. Test-retest reliability analysis

(Intraclass correlation coefficient) was carried out with the data obtained from 47 participants.

Study Groups

The validity and reliability analyses of the perceived physical literacy scale for adolescents were carried out on four different study groups. Criterion sampling technique, one of the purposeful sampling methods, was used in the study (Patton, 2002). Since the study will be carried out on adolescents, participants who meet the definition of adolescent according to the World Health Organization criteria, aged between 10 and 19, were included in the study. However, considering that the critical age limit for children to acquire abstract thinking skills regarding concepts is over 11, according to Piaget (2007), this age was accepted as the lower limit in the study. Firstly, in order to ensure the linguistic equivalence of the scale, first the English form and the Turkish form were applied to 20 students studying at the department of English Language Teaching in the fall semester of the 2019-2020 academic year. For the exploratory factor analysis, participants, 42 (19.3%) women and 176 (80.7%) men, participated in the study. Their age range is between 13 and 18, and their average age is (X_{Years} = 15.21 ± 2.28). Among these participants, it was determined that the average age of sports ($X_{Sport\text{-}years}$ = 5.77 ± 3.09) of those who do sports. For the exploratory factor analysis, a total of 218 participants, 42 (19.3%) female and 176 (80.7%) male, participated in the study. Participants' ages range from 13 to 18 (X_{Years} = 15.21 ± 2.28). Among these participants, the sports background of those engaged in sports ranges from 1 to 13 ($X_{Sports\ background}$ = 5.77 ± 3.09). In the context of the research, the Exploratory Factor Analysis data were obtained from 218 participants who interested in different sports branches [92 (42.2%) football, 32 (14.7%) volleyball, 15 (6.8%) basketball, 14 (6.4%) swimming, 13 (6.0%) athletics, 9 (4.1%) boxing, 8 (3.6%) taekwondo, 5 (2.3%) handball, 4 (1.8%) wrestling, 4 (1.8%) table tennis, 4 (1.8%) Muay-Thai, 3 (1.4%) karate, 3 (1.4%) kick-boxing, 3 (1.4%)
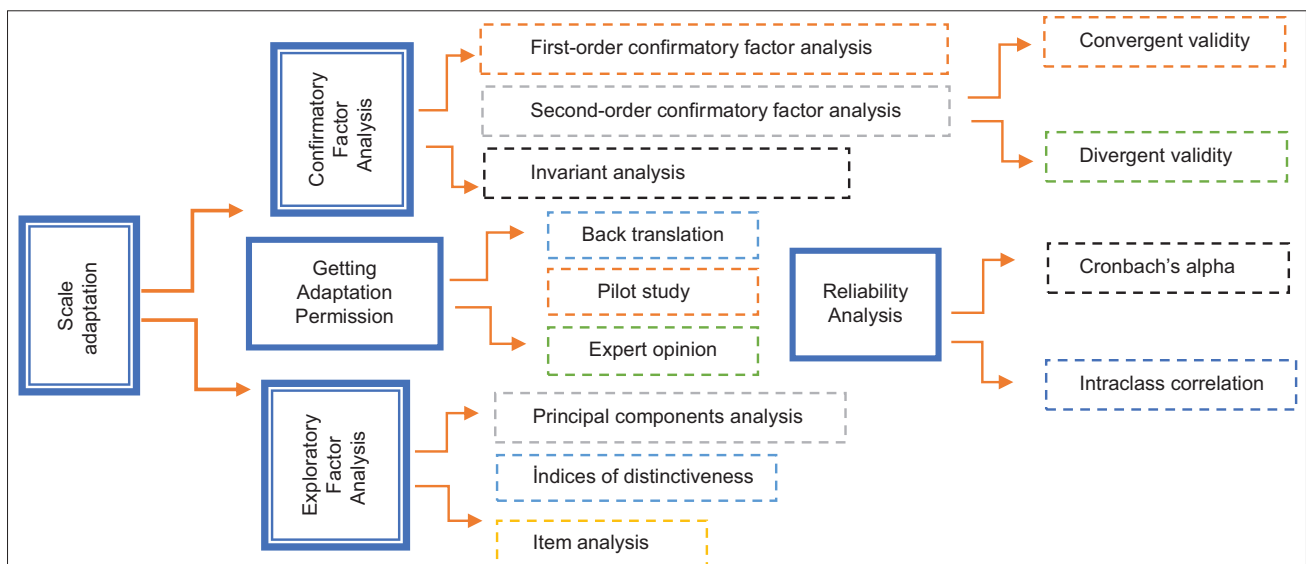

Figure 2. Research flow chart

fitness, 2 (0.9%) canoeing, and 1 (0.4%) fencing]. In scale development and adaptation studies, CFA should be performed on a different data set than the one with EFA (Schumacker & Lomax, 2010). In line with this information, the validity of the structure consisting of 3 dimensions and 9 items revealed as a result of EFA was tested with Confirmatory Factor Analysis over different data sets. This data set was obtained from a total of 300 participants, 128 female and 172 male, with an average age of 16.38, ranging from 12 to 19 years old. Confirmatory factor analysis data, 201 participants interested in different sports branches [47 (15.6%) volleyball, 15 (5%) athletics, 41 (13.7%) basketball, 11 (3.6%) boxing, 33 (1%) taekwondo, 14 (4.6%) football, 16 (5.3%) swimming, 9 (3%) table tennis, 5 (1.6%) handball, 5 (1.6%) tennis 5 (1.6%) badminton] and not interested in any sporting activities [99 (33%)] were obtained from the participants. Intraclass correlation analysis (ICC) was performed in the context of reliability analysis. This analysis was carried out with the data obtained from a total of 47 participants, 26 women and 21 men.

Tool of Data Collection

Perceived Physical Literacy Scale for Adolescents: Sum et al. (2018) whose validity and reliability study was conducted "Perceived physical literacy instrument for adolescents: A further validation of PPLI "measurement tool was used. The measuring tool consists of 3 factors and 9 items: 3 items for "knowledge and understanding", 3 items for "self-expression and communication with others" and 3 items for self-confidence. The increase in the average scores obtained from the sub-dimensions means that the physical literacy perceptions of the individuals are higher. The measuring tool is a 5-point Likert type. Likert is classified as 1 = Disagree at all, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly Agree. Convergent and factorial validity were examined within the scope of construct validity. In this context, AVE and CR values were calculated. AVE values took values between 0.43 and 0.54. CR values were found to be higher than 0.60. As an alternative to the three-factor structure, one-factor structure and three two-factor structures were tested. According to the research hypothesis, the fit indices of the three-factor model was found to be better than other alternative factors. Fit indices of the three-factor structure showed that the resulting structure can explain the property. These fit indices were determined as chi-square (X^2 = 321.54, df = 24, p <.05), CFI = 0.95, RMSEA = 0.08, SRMR = 0.04. It was found that the item factor load values obtained from the scale took values between 0.51 and 0.82. It is stated that these values show that the structure consisting of three factors is sufficient in explaining the property.

Language Validity of the Scale and Collection of Data

Prior to the scale adaptation study, the first author, Raymond Kim-Wai SUM, was contacted by e-mail and necessary permissions were obtained. Within the scope of this research, back translation technique suggested by Brislin (1986) was used. In order to test the linguistic equivalence of the scale,

the items of the original scale were translated into Turkish by three linguists who know English and Turkish well. The Turkish form was given to two linguists and translated back into English. After the back translation, it was concluded that the items in the Turkish and English forms of the scale are close to each other. The scale translated by language experts into Turkish was made into a single form in line with the opinions of the experts. The harmony between the original scale and the scale translated into Turkish was checked by language experts as well as experts with at least a doctorate degree in one Turkish language education, 3 physical education and sports. The scale form was finalized in line with the feedback provided by the experts. In order to test the linguistic equivalence of the scale, the English language teaching department students were administered the English language and then the Turkish form at three-week intervals. As a result of applying the English and Turkish forms of the scale every three weeks, the significance was examined with correlation analysis. As a result of the correlation analysis, a high level of positive significant relationship was found between the English and Turkish forms of the scale (r = .87, p <.01).

Before the researchers started collecting data, they gave general information to the participants about the purpose of the research. The data collection process was carried out under the supervision of the researchers. Those that were filled incompletely or incorrectly were not included in the analysis. As a result of the data collection process carried out in four stages, 585 scales were analysed.

Analysis of Data

SPSS 22 Package Program and Lisrel 8.8 Statistics program were used in data analysis. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed in order to adapt the Perceived Physical Literacy Scale in Adolescents to Turkish version. Back translation technique was used to ensure the language equivalence of the items in the measurement tool. The relationship between the Turkish-English scale forms, which were applied two weeks apart, was tested with correlation analysis. Item analysis was conducted for the construct validity of the measurement tool. For this, item total test correlation and item discriminant indices (27% lower-upper group) were compared. For test-retest reliability, the Intraclass Correlation Coefficient (ICC) test was also used to determine the in-class reliability of the measuring instrument (95% confidence intervals), since the same scale was applied to the same group with three weeks intervals. This test is sensitive to measurements made at different times and is widely used to determine interrater reliability (Alpar, 2003).

FINDING

Construct Validity

Exploratory Factor Analysis was performed first in the study in order to test the validity of the current structure of the measuring tool for Turkish Version. After the structure was revealed, CFA was performed to test the structure. Convergent

and divergent validity values were also examined in validity analysis. Exploratory factor analysis is aimed at understanding the existing psychological structure, and confirmatory factor analysis is aimed at testing this structure (Costello & Osborne, 2005). In addition, item total test correlations and item discrimination indices were calculated. Data suitability can be determined by Kaiser-Meyer-Olkin (KMO) Coefficient and Bartlett's Sphericity Test.

Exploratory factor analysis

Kaiser-Meyer-Olkin (KMO) and Bartlett tests were conducted to determine whether the data were suitable for factor analysis. The fact that the KMO is greater than 0.60 and the Barlett test is significant shows that the data are suitable for factor analysis (Tavşancıl, 2014). In addition, the appropriateness of these values shows that the data come from multivariate normal distribution, allowing the use of factoring techniques between variables (Fraenkel & Wallen, 2000). If the KMO value is 0.60, "medium" is 0.70, "good" is 0.80, "very good" and 0.90 is interpreted as "excellent" (Şeker, Deniz, & Görgen, 2004). In the present study, KMO value was calculated as 0.90. The significance of the Barlett test also reveals that the data are suitable for factor analysis (Tavşancıl, 2014) and that the data obtained come from multivariate normal distribution (De Vellis, 2014. Thus, it also shows that factorization techniques can be used between variables (Fraenkel & Wallen, 2000). Barlet-Sphericity test value was found to be $X^2{}_{(218)}$=1193.971 (p <.01). These values show that the data collected through the study group are suitable for factor analysis.

Different factoring techniques are used in Explanatory Factor Analysis (Tabachnick & Fidell, 2007). Principal component analysis, one of these factorization techniques, was used in the study. This type of analysis is a transformation technique that allows the dimensions of the data set containing a large number of interrelated variables to be reduced to less dimensions while preserving as much as possible the existing changes in the data (Wold, Esbensen, & Geladi, 1987). Since this technique is psychometrically more powerful, mathematically simpler and more effective in solving potential factor uncertainties (Stevens, 1996), it was preferred to be used in the study. While deciding on the number of factors in the measurement tool, the contribution of each factor to the total variance and the latent variable with an eigenvalue greater than 1 according to the Kaiser Meyer Guttman principle were taken into account (Ferriol et al., 2003). A 3-factor structure with an Eigen value greater than 1 was determined. In this context, principal component analysis was used as a factoring technique in the study. The rotation technique was used to provide easy interpretation of the factor structure of the scale and to bring together the items in a factor with high correlation. Tabachnick and Fidell (2007) state that the direct oblimin rotation technical can be preferred in axis rotation operations in cases where scale factors are interrelated.

Some researchers (DeVellis, 2014; Büyüköztürk et al., 2012) stated that the item factor load value should be higher than 0.30. On the other hand, there are researchers who claim that 0.40 should be accepted as the cut-off point in

order to create the factor pattern (Ferguson & Takane, 1989). Therefore, in the present study, this value was accepted as 0.40. In factor analysis, when items that do not measure the same structure are removed from the measurement tool, the item factor load value should be less than 0.40 and the difference between the load values of the items should be at least 0.10 in order to avoid overlapping (Büyüköztürk, 2014). Factor load values revealed by EFA, the strength of the relationship of items with factors; the common factor variance, calculated by taking the sum of the squares of the load values shown under the accepted factors for each item, reveals the ability of the relevant item to explain the total variance of the scale along with the other items. It is a good solution to have common factor variances of items close to 1 or above 0.60. According to Büyüköztürk (2014), high common factor variance will increase the total explained variance value of the structure explaining the feature. In the study, 0.50 was accepted as the lower limit for this value. Common variance values were found to be between 0.65 and 0.86 in the study. In this context, it can be said that each item serves well to explain the feature.

Table 1 includes the dimensions in the scale, the items representing the dimensions, item factor loading values and descriptive findings. The scale of perceived physical literacy for adolescents has preserved its three-dimensional structure in Turkish version as "Sense of self and self-confidence", "Self-expression and communication on with others" and "Knowledge and understanding". The first factor of the scale "sense of self and self-confidence" consists of three items (1, 2, 3). The item factor load value of the items in this factor is 0.86. Items in this factor explain 57.55 of the feature. The dimension of "self-expression and communication with others" consists of three items (4, 5, 6). The item factor loading values of the items in this factor range between 0.73 and 0.80. This factor explains 12.837 of the feature. The "Knowledge and understanding" dimension consists of three items (7, 8, 9), it explains that item factor loads are 0.80 and 7.65 of the feature. It explains 78.05 is the variance explained by all three factors. In scale development studies conducted in social sciences, it was stated that this value between 40% and 60% is sufficient to explain the feature sufficiently (Tavşancıl, 2014). In line with this information, it can be said that the rate of explaining the feature to EFA result is sufficient. According to the common variance values obtained; It was determined that these values were between 0.72 and 0.80 in the first factor, between 0.65 and 0.82 in the second factor, and between 0.84 and 0.86 in the third factor. As a result of the EFA, it was determined that the averages in the dimensions for the first dimension were 4.37 ± 0.61, 4.30 ± 0.69 for the second dimension, 4.59 ± 0.46 for the third dimension and 4.46 ± 0.45 for the overall scale. The average score that can be obtained from the scale varies between 1 and 5. The values obtained from the scale and sub-factors show that the physical literacy level of adolescents is high. In addition, it was seen that the distribution of the data obtained from the scale and sub-factors was within the normal range. According to the correlation analysis, the correlation value between the overall scale and the first dimension of

Table 1. Items and item load values in the perceived physical literacy scale for adolescents

	Items	Common variance	SS	SC	KU
SS	1. Yaşıma göre fiziksel olarak formdayım. I am physically fit, in accordance with my age.	.724	.869	.274	.193
	2. Formda kalabilmek için yeterli öz-yönetim becerisine sahibim. I possess self-management skills for fitness.	.788	.868	.243	.166
	3. Sağlıklı olmak için öz-değerlendirme becerisine sahibim. I possess self-evaluation skills for health.	.803	.864	.244	.221
	Explained variance	**57.559**			
SC	4. Sosyal ilişkilerim güçlüdür. I have strong social skills.	.652	.222	.808	.319
	5. Vahşi/doğal hayatta kalma konusunda kendime güvenirim. I am confident in wild/natural survival.	.823	.236	.807	.285
	6. Problem ve güçlüklerin üstesinden gelebilirim. I am capable in handling problems and difficulties.	.671	.371	.736	.212
	Explained variance	**12.837**			
KU	7. Spora karşı ilgiliyim ve olumlu tutuma sahibim. I have a positive attitude and interest in sports.	.855	.117	.183	.808
	8. Kendimi veya spor yapan insanları takdir ederim. I appreciate myself or others doing sports.	.867	.222	.374	.801
	9. Sporun sağlığa olan faydalarının farkındayım. I am aware of the benefits of sports related to health.	.840	.397	.373	.809
	Explained variance				**7.658**
	Total explained variance				**78.054**

							Correlation		
Dimensions	**M**	**SD**	**Skewness**	**Kurtosis**	**α**		**SS**	**SC**	**KU**
SS	4.37	0.61	-1.24	1.84	0.84		1		
SC	4.30	0.69	-1.14	1.26	0.87		.684**	1	
KU	4.59	0.46	-1.72	1.95	0.91		.606**	.544**	1
PPLSA	4.46	0.45	-1.86	1.28	0.90		.892**	.878**	.810**

KU= Knowledge and Understanding, SC=Self-expression and Communication with others, SS=Sense of self and Self-confidence, PPLSA = Perceived physical literacy scale for adolescents (Sum et al., 2018).

the scale was 0.89; the value between the second dimensions is 0.87 and the value between the third dimension is 0.81. Considering the classification of correlation values, a value above 0.60 indicates that the relationship between the overall scale and its sub-dimensions is high.

Confirmatory factor analysis

The structure revealed as a result of EFA, which was designed to adapt the Perceived Physical Literacy Scale for Adolescents to Turkish version, was tested by CFA (Kline, 2011). In order to test the adequacy of the three-dimensional and 9-item structure tested in the confirmatory factor analysis, several fit indices results were taken into account (Büyüköztürk et al., 2012). Acceptable and good assumed value ranges regarding fit indices in line with the relevant literature and the values obtained in the research are given in Table 2.

A: One-dimensional structure B: Three-dimensional structure C: second-level confirmatory factor analyses

Figure 3 shows the factor-item relationship of one-dimensional (a), three-dimensional structure (b) and second-level confirmatory factor analysis (c). Item factor load values of the unidimensional structure showing the relationship between observed and latent variables are between 0.65 and 0.94. In Table 2; the fit indices of the single factor structure were found to have [χ2= 623.88 / df: 27 = 2.30, RMSEA = 0.27, CFI = 0.93, AGFI = 0.47, GFI = 0.68] values. Among these fit indices, RMSEA value between .05 and .08 indicates good fit, while being less than .05 indicates perfect fit (Hu & Bentler, 1999; Mc Donald & Moon-Ho, 2002; Kelloway, 1998; Schermelleh-Engel et al., 2003). This value in one-dimensional structure is not between acceptable values (AGFI 0.85 to 0.90; PGFI = 0.50 to 0.95 and GFI 0.85 to 0.90). AGFI, PGFI and GFI values are also not acceptable. Although the item factor load values were found to be high (Figure 3), the fit indices showed that the three-factor structure was more appropriate than the one-factor structure (Table 2).

In Table 2, the fit indices of the three factor structure were found to have [χ2= 48.52 / df: 24= 2.02, RMSEA = 0.05,

CFI = 0.98, AGFI = 0.93, GFI = 0.90] values. Thus, fit indices of the three-factor structure were taken into account. Item factor load values of the three-factor structure show that it is between 0.87 and 0.90 in the "Sense of self and self-confidence" dimension, 0.76 and 0.89 in the "Self-expression and communication on with others" dimension, and 0.95 and 0.96 in the "Knowledge and understanding" dimension. Kline (2011) standardized weights around 0.30 medium; He states that weights of 0.60 and above reflect large effect sizes. As a matter of fact, it can be said that item factor loads obtained as a result of CFA reflect large effect sizes.

The t-test values for the 3-dimensional model obtained as a result of CFA are shown in Table 3. It is seen that it is between 18.62 and 19.96 in the "Sense of self and Self-confidence" dimension, between 15.03 and 19.30 in the "Self-expression and Communication with others" dimension, and between 22.01 and 22.72 in the "Knowledge and Understanding" dimension. In the literature, t values greater than 1.96 at the level of .05; if it is greater than 2.58, it indicates that it is significant at the .001 level (Jöreskog & Sörbom, 1993; Kline, 2011). Accordingly, all t values obtained in CFA were found to be significant at the .001 level. Therefore, the t values obtained as a result of CFA showed that the structure presented was in accordance with the theoretical definitions and there was no need to exclude any item from the analysis. Three criteria were taken into account in order to ensure construct validity. The item factor load value of each observed variable belonging to the latent variables must be greater than 0.50 and be statistically significant. Considering the item factor load values (Figure 2), it is seen that these values range between 0.76 and 0.96. The second criterion is that the construct reliability (CR) and Cronbach's Alpha value is greater than 0.70. These values were found to be higher than the critical value (Table 3). Another criterion is that the variance explained for each structure (AVE-Average variances explained) should be higher than 0, 50 (Fornell & Larcker, 1981). It is seen that these values are above the critical value (Table 3).

Convergent Validity: The convergent validity of the model resulting from CFA was evaluated. For convergent validity, the average variance (AVE) and construct reliability (CR) were calculated based on factor load values. In the AVE value calculations, it was observed that all sub-dimensions were higher than .50 (Kline, 2011). In addition, it has been observed that the general CR value has values greater than 0.70 (Fornell & Larcker, 1981). AVE values from 0.69 to 0.92; CR values were found to be between 0.87 and 0.97. In this case, it can be said that the perceived physical literacy scale for adolescents has good convergent validity.

Divergent Validity: The lack of high correlation between the factors of the structure to be measured is a desired feature for divergent validity. In other words, scale sub-dimensions are not wanted to measure the same feature, but they are expected to be in harmony with each other (Kline, 2011). Table 4 shows the correlation relationship between latent variables and AVE values and square roots.

Table 2. Fit values of the proposed model and standard fit criteria

Compatibility Indices Model	Good Fit	Acceptable	PPLSA Single factor structure	PPLSA Three factor structure
X²/sd	0<X²/sd<2	2<X²/sd<3	2.30	2.02
RMSEA	0.00<RMSEA<0.05	0.05<RMSEA<0.10	0.27	0.05
AGFI	0.90<AGFI<1.00	0.85<AGFI<0.90	0.47	0.93
CFI	0.95<CFI<1.00	0.90<CFI<0.95	0.93	0.98
PGFI	0.95<PGFI<1.00	50<PGFI<0.95	0.41	0.51

Kline, 2011; Tabachnick & Fidell, 2007; Thompson, 2004; Hooper et al., 2008; Schermelleh-Engel et al., 2003; PPLSA: Perceived Physical Literacy Scale for Adolescents

Table 3. Structural equation model results obtained from CFA in PPLSA

Factors – Items Three Factor Model	t-values	R²	Building Reliability (ω)	Average variances explained (AVE)	Cronbach's Alpha (α)
SS	**item**				
1	18.62	0.75			
2	19.96	0.82	0.92	0.79	0.84
3	19.91	0.81			
SC					
4	17.66	0.71			
5	15.03	0.57	0.87	0.69	0.87
6	19.30	0.79			
KU					
7	22.36	0.92	0.97	0.92	0.91
8	22.72	0.93			
9	22.01	0.90			

Fornell & Larcker (1981) stated that AVE values larger than shared variance (square of the correlation between structures) estimates support divergent validity. That is, the fact that the square roots of the AVE values are higher than the correlation coefficients between latent variables is evidence of discriminative validity. In this context, "knowledge and comprehension dimension" and "self-expression / communication with the environment" and "self-perception and self-confidence" and "self-expression / communication with the environment" did not differ from each other. The square root of the AVE value ($\sqrt{0.69}$) (0.83) is smaller than the non-diagonal elements of the matrix (0.85). The square root of the AVE value ($\sqrt{0.79}$) (0.89) is smaller than the non-diagonal element of the matrix (0.93). Divergent validity has not been provided for these factors. However, discriminating validity has been provided in "Sense of self and Self-confidence" and "knowledge and comprehension" dimensions. The factors are sufficiently separated from each other.

Model comparisons

The findings in Table 5 show the invariance of the perceived physical literacy scale for adolescents between men and women. The ΔCFI and ΔRMSEA values obtained from the model comparisons show that there is no significant deterioration in the model. The unconstrained, measurement weights, structural covariance, and measurement residuals invariance

analyses used for measurement equivalence show that the perceived physical literacy scale for adolescents functions in the same way for women and men, and that physical literacy measurement does not change according to the gender variable. The factor loads obtained for men and women in measurement equivalence analyses are given in Table 6.

Table 6 shows the factor load values by gender. Considering the factor loadings, it is seen that there is no significant difference between men and women. In this context, it can be said that the "Perceived Physical Literacy Scale for Adolescents" has measurement invariance according to the gender variable.

Item analysis

For item analysis, item total test correlation and item discriminant indices were found. In the first stage of item analysis, item total test correlation was calculated. Item total test correlation shows the relationship between the score of each item in the test and the total test score. The positive and high level of this relationship reveals that the items in the test exemplify similar behaviors and the internal consistency of the test is high (Büyüköztürk et al., 2012). If the relationship between an item in the test and the total score is low, it indicates that the item measures a different property from the items in the test (Karasar, 2014). In other words, it can be said that the item in the test does not serve the feature to be measured. In the second stage of item analysis, item discrimination indices was calculated. In order for each item to be able to distinguish between those with and without the desired feature to be measured, the difference between the average scores of the upper-lower 27% group, which was determined according to the total scale scores, was examined with the independent group t-test. The values obtained as a result of the analysis are shown in Table 7.

In Table 7, it is seen that the values obtained as a result of the item-total test correlation analysis varied between 0.55 and 0.72 and the t-values were significant (p <.001). If the item-total test correlation is over 0.30, it shows that

Table 4. Relationship coefficients and AVE values between latent variables

Dimensions	SS	SC	KU
SS	0.89		
SC	0.93	0.83	
KU	0.85	0.85	0.95
AVE (Explained Variances)	0.79	0.69	0.92

*The diagonal elements between correlations are the square root of the AVE. All correlations are significant at the *p*<.01 level.

Table 5. Measuring equivalence between men and women (CFA)

	Model						Model Comparisons					
	x^2	Df	TLI	CFI	RMSEA	SRMR	Δx^2	Δdf	ΔTLI	ΔCFI	ΔRMSEA	ΔSRMR
Unconstrained	113.908	48	0.96	0.97	0.068	0.025						
Measurement weights	117.954	54	0.97	0.97	0.063	0.023	4.046	6	0.18	0.00	0.001	-0.005
Structural covariances	136.567	60	0.96	0.97	0.065	0.068	18.613	6	0.09	-0.00	-0.004	-0.002
Measurement residuals	146.326	69	0.97	0.97	0.061	0.082	9.759	9	0.15	0.00	-0.001	-0.004

Table 6. Factor loadings for measurement equivalence between men and women (CFA)

Gender	SS			SC			KU	
	Female	Male		Female	Male		Female	Male
M1	0.881	0.848	M4	0.879	0.812	M7	0.983	0.936
M2	0.946	0.869	M5	0.841	0.716	M8	0.974	0.954
M3	0.934	0.876	M6	0.945	0.851	M9	0.960	0.937

the discrimination of the items is good (Erkuş, 2014). Considering the total item test correlation values, it can be said that each item in the measurement tool is related to the overall scale. When the item discrimination indices values were examined, it was found that t values were significant and these values varied between 7.56 and 13.52. The fact that the item total test correlation is higher than the critical value (0.30) and the upper-lower 27% group comparison is significant shows that the reliability of the items in the measurement tool is high and each item in the scale serves the measured feature (Büyüköztürk, 2014).

Reliability analysis

Cronbach's Alpha Internal Consistency Coefficient and test-retest reliability analyzes were performed within the scope of reliability analysis. The Cronbach's Alpha Internal Consistency Coefficient of the scale was calculated as 0.90 for the overall scale, 0.84 for the "Self-perception and self-confidence" dimension, 0.87 for the "Self-expression and communication with the environment" dimension and 0.91 for the "Knowing and comprehension" dimension. In addition, test-retest technique was used to provide evidence

Table 7. Results of item analysis

Dimensions	I.	27% Upper-group n=58		27% Sub-group n=58		t	p	Item total test correlation
		M	SD	M	SD			
Sense of self and Self-confidence	1	4.97	0.18	3.69	0.79	11.84	0.00	0.704
	2	4.97	0.18	3.66	0.71	13.52	0.00	0.709
	3	4.97	0.18	3.55	0.77	13.49	0.00	0.721
Self-expression and Communication with others	4	4.98	0.13	3.57	0.81	12.98	0.00	0.642
	5	4.88	0.32	3.24	0.86	13.48	0.00	0.557
	6	5.00	0.00	3.66	0.80	12.69	0.00	0.718
Knowledge and Understanding	7	5.00	0.00	4.12	0.81	8.18	0.00	0.698
	8	5.00	0.00	4.14	0.86	7.56	0.00	0.704
	9	5.00	0.00	4.16	0.83	7.71	0.00	0.674

p<.01; I= Item

Table 8. Comparison and correlations of test-retest mean scores for PPLSA and its sub-dimensions (n = 47)

Scale and sub-dimensions	Application 1 M±SD	Application 2 M±SD	t	P	ICC	95% confidence interval	P
SS	4.52±0.41	4.54±0.40	1.291	0.20	0.88	0.78-0.93	0.000
SC	4.40±0.68	4.39±0.52	1.423	0.67	0.96	0.94-0.98	0.000
KU	4.71±0.22	4.67±0.31	2.923	0.17	0.77	0.59-0.87	0.000
PPLSA (Scale)	4.59±0.40	4.55±0.35	-2.489	0.62	0.91	0.85-0.95	0.000

ICC: Intra-class Correlation Coefficient

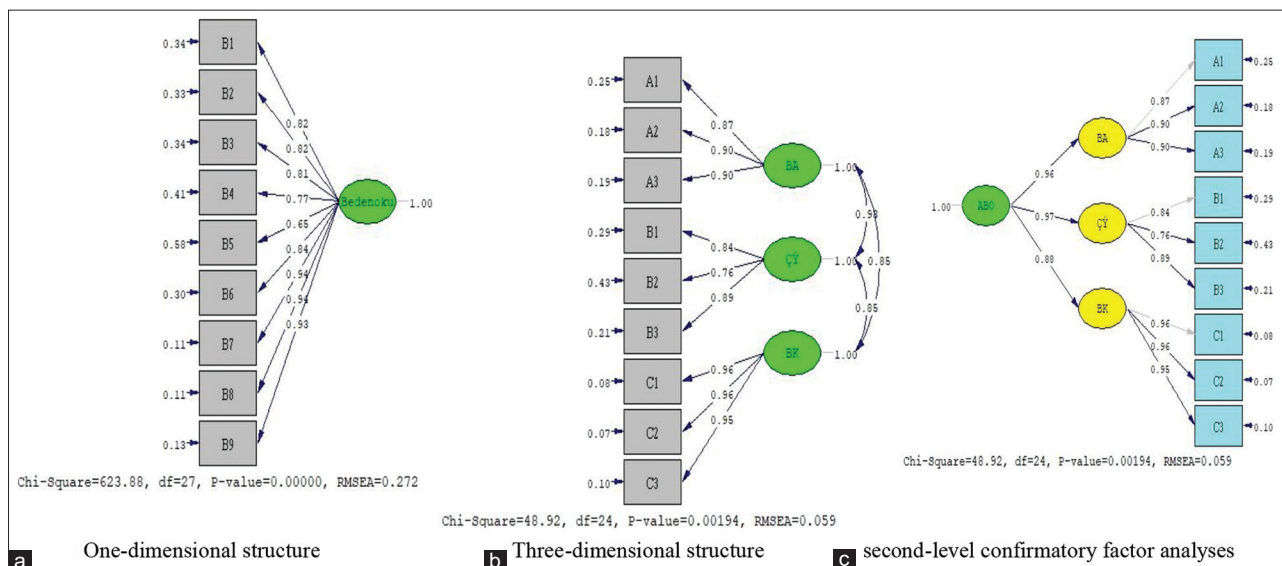| a | One-dimensional structure | b | Three-dimensional structure | c | second-level confirmatory factor analyses |

Figure 3. (a-c) Item factor relationship of one and three-dimensional structure and level 2 CFA results

for the reliability of the measurement tool. In order to test the rater reliability in the study, the intra-class correlation coefficient-R1 (in-class reliability coefficient) was calculated. The findings obtained as a result of the analysis are shown in Table 8.

According to Table 8, when the sub-dimensions and general of the scale are examined, it was found that the test-retest reliability coefficients (R1) ranged between 0.77 and 0.96, and there was a significant relationship in all of them. According to Alpar (2003), R1 value between 0.95-1.00 is expressed as "perfect"; between 0.85-0.94 as "High"; between 0.70-0.84 as "Medium"; and between 0.0-0.69 as "Not acceptable". In this context, the fit value between the two raters is 0.88 for SS, 0.96 for SC, 0.77 for KU and 0.91 for PPLSA. These values show that rater reliability is high.

Evaluation of the scores obtained from PPLSA

There are 9 items in PPLSA. The scale is 5-point Likert type. Scale items are scored between I strongly disagree (1) and I strongly agree (5). The scale has three sub-dimensions and each dimension has 3 items. The total score is obtained from the scale. While the lowest score that can be obtained from the scale is 9, the highest score is 45. All items in the scale contain positive statements. If the score obtained from the scale is higher, it means that the physical literacy perceptions of the participants are high.

DISCUSSION AND CONCLUSION

In the study, it is aimed to introduce the measurement tool to the literature by examining the psychometric properties of the measurement tool developed by Sum et al. (2018) on adolescents in Turkey, which measures the physical literacy perceptions of adolescents in a valid and reliable way. The high number of correlation coefficients between the applications performed with three weeks intervals to ensure language equivalence shows that the original and Turkish form of the measurement tool are similar to one another. The original scale developed by Sum et al. (2018) consists of three sub-dimensions and 9 items. There are three items in each dimension of this scale. This scale includes "Knowledge and Understanding", "Self-expression and Communication with others" and "Sense of self and Self-confidence" dimensions, which are latent variables of physical literacy by Whitehead (2013). EFA and CFA findings, which were made to test the existing structure in original scale, show that it measures the physical literacy of young people in Turkey with the same structure. Different models were tested to measure physical literacy in the original scale. Among these models, the model fit indices of those with one-dimensional and two-dimensional structure were not good, but the fit indices of the model containing only the three-dimensional structure showed acceptable values. While this study was being tested on adolescents in Turkey, the researchers tested different models, but as in the original scale, they only obtained appropriate results from the three-dimensional structure. Whitehead's (2013) statement that physical literacy is not only related to physical competence/skills, but also includes different latent variables can be a basis for this finding. Whitehead (2010) argued that the most important component of physical literacy is knowledge and understanding. It is seen that there are knowledge and understanding latent variables in measurement tools that examine physical literacy on different cultures and samples. In the study by Ma et al. (2020) on adolescents in China, while self-confidence, interaction with the environment, knowledge and understanding dimensions are similar to our current measurement tool, it differs from our measurement tool in terms of motivation dimension. Ma et al. (2020) also developed a measurement tool that includes latent variables, which Whitehead (2013) explained physical literacy.

Considering physical literacy as the capacity of the individual to exhibit his innate potential, it can be concluded that the culture in which each individual lives has an effect on the concept. While Whitehead (2013), Ma et al. (2020), and Dudley (2015) describe physical literacy, they included some or all of the latent variables of motivation, confidence and physical competence, interaction with the environment, physical activity knowledge and understanding, self-confidence and self-expression, and communication with others in their studies. Physical literacy serves cognitive development that includes knowledge and understanding and produces solutions to the problem situation, social development that develops the ability to communicate with the environment and self-expression, as well as emotional development that includes a sense of self-confidence with its movement capacity. In this context, it is significant that the adolescents get good scores from the measurement tool in which these characteristics are measured and their level of physical literacy is determined by a physical education teacher. As a result of the descriptive analysis conducted to determine the physical literacy levels of the adolescents participating in the present study, it shows that the adolescents got a high mean score in the sub-dimensions of the measurement tool. In the "Knowledge and Understanding" dimension, the mean score is 4.56±0.46. In the dimension of "Self-expression and Communication with others", this value is 4.30±0.69. Whitehead (2001) emphasized that communication skills are an important concept in explaining body literacy and stated that using verbal and non-verbal communication skills is an important skill. In this sense, it can be said that physical literacy provides adolescents with the opportunity to communicate with the environment and express themselves. In the "Sense of self and Self-confidence" dimension, the adolescents participating in the study have a mean score of 4.37±0.61. Longmuir et al. (2015) emphasized that the concept of self-confidence is one of the basic concepts used to explain body literacy. Physical literacy is also important for the teaching profession, where communication skills are important. In studies that reveal physical literacy of physical education teachers (Sum et al., 2016), there is also a latent variable that measures communication skills with other people.

In the study, Cronbach's Alpha Internal Consistency Coefficient, composite reliability and intra-class reliability analysis were conducted to measure the reliability of the

scale. The values obtained showed that consistent information was obtained in the general and sub-dimensions of the scale. It showed that the three-dimensional model's fit indices are better than the one-dimensional model. Second level confirmatory factor analysis results did not show good fit values. Item analysis results showed that the indices of distinctiveness of the scale was good and the item total test correlation was higher than the critical value (0.30) (Büyüköztürk, 2014). Thus, it can be said that each item (observed variable) in the scale adequately explains the latent variables that are the sub-dimensions of the scale. It is stated in the literature that the factor load value of an item should be at least .30 or .40 (Şencan, 2005). The high correlation between the scale and its sub-dimensions indicates that the internal consistency of the scale is also high (Dennis & Vander Wal, 2010). In our study, it is seen that the relationships of the sub-dimensions with the scale vary between 0.81 and 0.89. In this context, it can be said that the internal consistency of the measurement tool is high. In addition, measurement equivalence analyses of the scale according to gender were made. The result of the analysis showed that the scale functions in the same way for both groups and that the scale has measurement equivalence.

Determining the physical literacy levels of adolescents will guide physical education teachers, trainers and parents, who are the practitioners of physical literacy, in terms of shaping the content of the basic skills to be given to them and shaping the teaching approaches to be applied to them. Since physical literacy is a life-long journey, this education, which will start with a parent or caregiver in the family, will be shaped by different trainers at different stages of development. In this respect, it is important to introduce this measurement tool to the literature in order to eliminate this deficiency. The research sample was chosen by appropriate sampling. In this context, it is limited in terms of generalizability. This structure of the scale can also be tested on participants in different regions and developmental stages.

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