International Journal of Evaluation and Research in Education (IJERE)
Vol. 14, No. 2, April 2025, pp. 1557~1566
ISSN: 2252-8822, DOI: 10.11591/ijere.v14i2.32279

Validity confirmation of the Lithuanian form for mental toughness questionnaire among sport schools' students

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Article Info

Article history:

Received Jul 30, 2024
Revised Sep 20, 2024
Accepted Sep 30, 2024

Keywords:

Adaptation
Adolescents
Mental toughness
Sport schools
Validation

ABSTRACT

Currently, there is a growing interest in measuring mental toughness in Lithuania, but there are no validation measures in place which take contextual factors into account. The scientific problem deals with a limited availability of psychometrically tested mental toughness assessment tools in student populations, specifically within Lithuanian sport schools' context. Therefore, the purpose is to confirm validity of the Lithuanian form for mental toughness questionnaire (MTQ48) among young sport schools' participants. The study involved 581 participants aged 15-18 from various Lithuanian basketball sports schools. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) of the questionnaire were performed. Six factors were identified by applying an EFA which explained 63.0% of the total variance. Modelling of the structural equations showed that the six-factor MTQ48 model has a reasonable fit. Analyses of reliability and validity demonstrated a strong internal consistency among the factors. With these suitable reliability and validity characteristics, adapted mental toughness measurement (MTQ48) is suitable for use in research investigating mental toughness among students within Lithuanian sport schools' contexts.

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1. INTRODUCTION

The relevance of research on mental toughness has recently been undisputed [1]. Mental toughness is considered to be a dynamic process that helps to adapt easily in unfavorable circumstances and is a protective factor in a wide range of life situations [2]. Therefore, mental toughness as a significant psychological resource is most often analyzed in the context of coping with stress or in the context of sport [2]. It is a widely held view in sporting society that players which are mentally tough are better placed to succeed at sport [3].

Mental toughness has been widely examined by researchers due to its strong associations with sport success and hardiness more generally [4]. It is suggested that ninety percent of studies on mental toughness in sport found that players which are mentally tough outperformed their counterparts who had a lower level of mental toughness [4]. The very positive impact of mental toughness on sport success is mainly due to increased engagement in training and increased motivation to achieve a goal. Additionally, mental toughness can decrease competitive anxiety and its harmful effects on sporting results and athletes' effort (commitment) [5].

There is strong evidence that mental toughness is linked to stress resilience in youth. For instance, Gerber *et al.* [6] have demonstrated that high mental toughness separates the symptoms of perceived stress

from those of depression. Gucciardi and Jones [7] revealed that young athletes who had high level of mental toughness had higher rates of growth outcomes and lower rates of adverse emotional states than their counterparts with a medium rating of mental toughness. The latest research Kalinin *et al*. [5] have identified an inverse link between mental toughness and competitive anxiety among young sport schools' participants, as mentally powerful sport schools' athletes are more adaptable to high-pressure circumstances and see threatening events as less distressing [6]. Equally relevant is to concentrate on the growth of athletes' mental toughness during adolescence, as this is the most appropriate period of development [8]. Mental toughness is crucial in sport school context, as it helps young athletes to maintain the difficult balance between sport, education and personal development because it not only helps them to achieve immediate success in competition and academics, but also helps them to overcome the long-term challenges of their athletic career and life after sport [9], [10]. Developing mental toughness in such an environment helps students to develop the resilience, discipline and emotional control necessary for success in all areas of life [10]. This encourages us to test the validity of the methods in a specific sample of young sport schools' participants.

Various testing instruments can be applied to assess mental toughness. These instruments usually consist of several items that measure multiple dimensions of mental strength. For example, psychological performance inventory-alternative (PPI-A) [9] is a tool that contains four factors: positive cognition, self-belief, visualization, and determination. It comprises fourteen elements. Mental toughness questionnaire (MTQ48) contains 48 statements [10] and is made up of six factors: commitment, challenge, confidence-abilities, confidence-interpersonal, control-emotional, and control-life. A number of studies have used the conceptualization (the 4C model of mental toughness) proposed by Clough *et al.* [10] and questionnaire MTQ48 developed by Clough *et al.* [10]. Currently, the 4C model of mental toughness represents the most common model of mental toughness in different contexts, particularly in sports and performance contexts. This model breaks mental toughness into four key components, often referred to as the 4Cs: confidence, commitment, control, and challenge. Each of these dimensions represents a crucial aspect of mental toughness that enhances an individual's capacity to perform effectively under pressure. Certain facets are subdivided into subfacets. Control is further subdivided into emotional control and life control; confidence subdivided into self-confidence and confidence in interpersonal interaction [10]. In the context of sport psychology, mental toughness can be understood as a core attribute that supports a player's capability to use and obtain the benefits of psychological skills. MTQ48 was chosen for adaptation and confirmation because PPI-A was recently adapted in Lithuanian context [11]. Adaptation of MTQ48 to the Lithuanian context is also relevant because the MTQ48 is the most widely used mental toughness assessment instrument in the world [10], [12] and according to Perry *et al.* [13] is a robust psychometric instrument.

Validity verification of the Lithuanian form for MTQ48 among young sport schools' participants is relevant because this instrument may considerably enhance validity and efficiency of psychological testing in youth sport settings. Participants of the sports schools experience specific psychological needs and difficulties compared to the average student in the general population [14] because sport schools fostering not only academic but also sporting excellence. Adapted MTQ48 could contribute to the determination of the psychological skills of sports school students that need to be enhanced. After the validation of the measure, targeted interventions can be put in place to enhance athletes' mental toughness and sporting performance, doing so guarantees that the tool tested is reliable and valid in specific context can ensure the precision of the results [15].

It was hypothesized that the Lithuanian form for MTQ48 [10] will confirm six-factors model structure, acceptable internal consistency of all subscales and the construct validity of the current validated/adapted MTQ48 questionnaire. This presumption was based on the results of the Perry *et al.* [13] study, that it is a robust psychometric instrument, as well as on the premise of a study conducted with a sport school population using a different mental toughness instrument [11]. The factors and their elements were fully compatible with the factors and their elements identified in the previous work [9], and the internal coherence of all the subscales was deemed adequate. Therefore, the study aim is to validate the Lithuanian form for MTQ48 among young sport schools' participants and describe its psychometric properties.

2. RESEARCH METHOD

2.1. Participants

The study included 581 sport schools' participants (students) from different national sports institutions. Our sample contained 274 students aged 15-16 years and 307 students aged 17-18 years. Sports schools that train basketball players were selected using a random sampling program. Participants who took part in the study have been randomly chosen from the lists of selected sports schools that train basketball players.

2.2. Instrument

The sport school participants completed the MTQ48 [10] to evaluate indicators of mental toughness. The instrument includes 48 questions and six different scales. Nine questionnaire items make up the challenge scale (i.e., "Unexpected changes to my schedule generally throw me"); 10 items form the commitment scale (i.e., "I can normally sustain high levels of mental effort for long periods"). Seven questionnaire items form control-life scale (i.e., "I generally feel that I am in control of what happens in my life") and seven items create control-emotional scale (i.e., "Even when under considerable pressure I usually remain calm"). Six questionnaire items make up confidence-interpersonal interactions scale (i.e., "I am comfortable telling people what to do"), and nine items form confidence-abilities scale (i.e., "I am generally confident in my own abilities"). A 5-point Likert scale is applied to rate every item of the instrument: 5-strongly agree; 4-agree; 3-neither agree nor disagree; 2-disagree; and 1-strongly disagree.

The MTQ48 has been translated into Lithuanian and translated into English in accordance with the methodological guidelines for double translation and harmonization. Throughout the translation and adaptation processes, linguistic and psychological differences within the Lithuanian population, as well as specific aspects of sports practices, were taken into account by choosing appropriately qualified experts, e.g., proficiency in Lithuanian language, knowledge of sport psychology, and knowledge of sport. Both forward and backward translators had language skills, sports psychological skills, and some sports experience. A consensus approach was utilized to get agreement about the correct wording of the 48 items. There were no items with special challenges during this translation/adaptation process. The confidentiality and anonymity of the data was ensured during the study. A pilot study was previously carried out with 107 pupils aged 15-18, representing sports schools. During the pilot study, participants have been invited to provide feedback on the clearness of the items and the assessment system [16]. Internal consistency of the instrument (Cronbach's alpha=0.79) and its subscales (Cronbach's alpha=0.76–0.82) was acceptable for the pilot study.

2.3. Procedure

The study was carried out only in those Lithuanian basketball sports schools that gave their consent. The study maintained strict anonymity and confidentiality of the data. The questionnaires were designed to exclude any identifying information about the research participants. The study has been approved in advance by the university's social research ethics committee. The investigator also gained the consent of the coaches of the sports schools to provide the questionnaire to the participants of the sports schools.

2.4. Statistical data analysis

IBM SPSS statistics version 28.0 has been applied for quantitative data analysis. Means, standard deviations, minimum and maximum values of the estimates were calculated. The internal consistency Cronbach's alpha coefficients were calculated for all questionnaire scales. The reliability of the measure was tested using McDonald's omega coefficients. Skewness and kurtosis coefficients were used to test the normality of the data.

According to the recommendation by Hair *et al.* [17], sample size for validation studies offered 200 participants as a good number for exploratory factor analysis (EFA) and 300 participants as a good number for confirmatory factor analysis (CFA). According to recommendation by Lorenzo-Seva and Ferrando [18], the total sample of 581 was randomly (random number generator of SPSS has been used) split into two groups, where 40% (about 200 participants) to EFA and 60% (about 300 participants) go to CFA. For the EFA was used the first students' group (n=203) and for the CFA was used the other group (n=378). In order to identify the factors and to evaluate whether they match the factors identified by the authors of the tool, mathematical EFA model was used. CFA was conducted using Jamovi software [19]. Chi-square statistics, Tucker-Lewis index (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR) have been applied to estimate the model's goodness of fit. Average variance extracted (AVE) and Pearson correlation coefficients have been computed with Jamovi program. We used these parameters to test discriminant and convergent validity of the measure. We computed Pearson-correlations between the MTQ48 and psychological performance inventory subscales [11] to demonstrate the convergent validity of current validated/adapted MTQ48 questionnaire, and evaluated discriminant validity by testing the square root of AVE.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Descriptive analysis

Table 1 shows the variables' descriptive statistics and the skewness and kurtosis of the whole treated sample. The range of values for the skewness in the study sample is -0.41 to 0.38. The range of values for the

kurtosis is -0.08 to 0.92. The skewness and kurtosis estimates supported the normal pattern of the data distribution, as all values of asymmetry and excess indicators fell into an acceptable interval between -2 and 2.

To explore the relationships between the components/factors of mental toughness in the full sample, Pearson correlation coefficients were used, as shown in Table 2. Significant correlations were found between all factors. The most substantial positive correlations appeared between control-emotion and confidence-abilities, also between commitment and confidence-abilities. There were no negative correlations among the variables studied. Considering that the observed correlations did not exceed 0.85, the presumption of multicollinearity has not been breached [20], and CFA could be performed.

Table 1. Descriptive statistics for the whole sample (N=581)

Scale	M	SD	Min.	Max.	Skewness	Kurtosis
Challenge	3.65	0.39	2.00	4.78	-0.21	0.74
Commitment	3.49	0.39	2.40	4.50	-0.21	-0.08
Control-emotion	3.30	0.44	1.43	4.43	-0.20	0.52
Control-life	3.29	0.36	2.14	4.57	0.38	0.92
Confidence-abilities	3.53	0.57	1.33	5.00	-0.41	0.64
Confidence-interpersonal	3.34	0.39	2.17	4.33	-0.13	-0.10

Notes: Min. and Max. – minimum and maximum values, M ± SD - mean and standard deviation

Table 2. Correlations of study variables (N=581)

Factors	Challenge	Commitment	Emotional control	Life control	Confidence-abilities	Confidence-interpersonal
Challenge	1	0.545**	0.314**	0.576**	0.480**	0.246**
Commitment		1	0.544**	0.228**	0.642**	0.475**
Control-emotion			1	0.226**	0.675**	0.401**
Control-life				1	0.269**	0.109*
Confidence-abilities					1	0.499**
Confidence-interpersonal						1

Notes: *p<0.05; ** p<0.01

3.1.2. Exploratory factor analysis

In the beginning, the Kaiser-Meyer-Olkin (KMO) of sampling adequacy and Bartlett's test of sphericity were calculated to check eligibility of an EFA. Only items with a loading of 0.40 or greater on one factor were used to create latent variables [21]. EFA, conducted with principal component analysis (PCA) and the VARIMAX rotation method, demonstrated good sampling quality, as indicated by the KMO index (KMO=0.91) and a significant Bartlett's sphericity test (χ^2=5781.514; df=1128; p<0.001), demonstrating that the EFA is relevant. The maximum likelihood extraction method was utilized alongside a 'varimax' rotation. Table 3 shows the factors of the Lithuanian version of the MTQ48 and the proportion of variance explaining them. Six factors have been found to explain 63.0% of the total variance, as revealed by PCA and orthogonal Varimax rotation. The factors and associated items identified in this study were fully consistent with those identified by the authors of the tool [10]. The internal consistency scores for all scales are satisfactory, ranging from 0.69 to 0.83 [21].

3.1.3. Confirmatory factor analysis

CFA was conducted to confirm the validity of the MTQ48 tool using the Jamovi 1.2.27 program [19]. To see how well the predetermined model is supported by the findings from previous study, we applied CFA (the study subsample comprised 378 young basketball players aged 15–18). The results obtained from the CFA, using the MTQ48 are summarized in Table 4. As illustrated in table, all standardized estimate values are greater than 0.45 and statistically significant, according to Comrey and Lee recommendations [22] (i.e., >0.71=excellent, >0.63=very good, >0.55=good, >0.45=fair, and >0.32=poor), demonstrates that all variables having loadings greater than 0.45 are reasonable for the pre-specified six-factor model.

CFA results showed that indices (Chi-square fit index [χ^2(1065)=3697.0, p<0.001]; CFI=0.896≅0.9; TLI=0.875, SRMR=0.079, RMSEA=0.076)) were fair (adequate) and proposed an acceptable data fit to the 48-item MTQ structure. For CFA 'models with a good fit, the Chi-square normalized by degree of freedom (Chi-square/df) should be less than 5.0' [23] indicating that our model meets this criterion for a well-fitting model. CFI is considered very good if it is equal to or greater than 0.95, good between 0.90 and 0.95, marginal fit (borderline tolerable) between 0.80 and 0.90 [24], [25]. A TLI value between 0.8 and 0.9 shall be considered as an indication of marginal fit [25]. SRMR should be <0.08 [26], [27]. The parsimonious index RMSEA should be less than 0.08 [18], [28].

The model's indicators (factors) were evaluated for reliability and validity. Means, standard deviations, composite reliability (CR, such as McDonald's ω), Cronbach's alpha, and AVE are presented in Table 5. The internal consistency was found to exceed 0.60 for all factors, with a range of coefficient values between 0.61 and 0.70, indicating an acceptable level of internal consistency for the questionnaire [29]. The composite reliability values were above 0.60 for all the factors, the internal reliability of the questionnaire items deemed satisfactory.

The AVE was utilized to evaluate convergent validity of the instrument. As stated by Psailla and Wagner [30], AVE values greater than 0.40 signify that the instrument's convergent validity is acceptable. The AVE for all factors ranges from 0.43 to 0.66 (Table 5). This indicates that the criterion for convergent validity has been satisfied.

Table 3. Factors and explained variance for the MTQ48 in Lithuanian (n=203)

Questionnaire statement (ST)	Factors					
	Challenge	Commitment	Control-emotion	Control-life	Confidence-abilities	Confidence-interpersonal
ST1	0.762					
ST2				0.645		
ST3					0.519	
ST4	0.747					
ST5				0.733		
ST6	0.635					
ST7		0.687				
ST8					0.659	
ST9				0.703		
ST10					-0.558	
ST11		0.631				
ST12				0.515		
ST13					0.488	
ST14	0.579					
ST15				-0.483		
ST16					0.603	
ST17						-0.452
ST18					0.594	
ST19		0.538				
ST20						-0.417
ST21			-0.635			
ST22		0.646				
ST23	-0.521					
ST24					0.523	
ST25		0.513				
ST26			0.644			
ST27			0.638			
ST28						-0.520
ST29		-0.525				
ST30	0.476					
ST31			0.479			
ST32					0.489	
ST33				0.464		
ST34			0.501			
ST35		0.481				
ST36					0.443	
ST37			-0.496			
ST38						0.459
ST39		0.472				
ST40	0.495					
ST41				0.467		
ST42		0.513				
ST43						0.441
ST44	0.507					
ST45			0.471			
ST46						0.428
ST47		-0.534				
ST48	0.487					
Variance %	19.8	12.1	9.2	7.8	7.5	6.6
Cumulative variance %	19.8	31.9	41.1	48.9	56.4	63.0

Note: Factor loadings less than 0.40 are not shown

Table 4. Indicators of the CFA for MTQ48

Factor	Questionnaire statement (M)	Estimate	SE	Z	*p*	Standardized estimate
Challenge	M4	0.578	0.0342	16.91	<0.001	0.758
	M6	0.537	0.0355	15.14	<0.001	0.701
	M14	0.530	0.0416	12.73	<0.001	0.613
	M23	0.517	0.0371	13.96	<0.001	0.658
	M30	0.348	0.0351	9.92	<0.001	0.496
	M40	0.371	0.0336	11.03	<0.001	0.539
	M44	0.641	0.0394	16.29	<0.001	0.738
	M48	0.498	0.0366	13.58	<0.001	0.639
	M1	0.408	0.0378	10.80	<0.001	0.536
Commitment	M7	0.646	0.0428	15.11	<0.001	0.710
	M11	0.647	0.0495	13.08	<0.001	0.625
	M19	0.535	0.0463	11.57	<0.001	0.576
	M22	0.665	0.0464	14.32	<0.001	0.677
	M25	0.468	0.0462	10.13	<0.001	0.536
	M29	0.507	0.0360	14.07	<0.001	0.672
	M35	0.823	0.0545	15.11	<0.001	0.699
	M39	0.592	0.0446	13.28	<0.001	0.646
	M42	0.574	0.0479	11.99	<0.001	0.591
	M47	0.737	0.0474	15.56	<0.001	0.721
Control-emotion	M21	0.812	0.0498	16.29	<0.001	0.762
	M26	0.776	0.0521	14.90	<0.001	0.719
	M27	0.638	0.0551	11.58	<0.001	0.570
	M31	0.886	0.0536	16.51	<0.001	0.750
	M34	0.757	0.0542	13.96	<0.001	0.663
	M37	0.844	0.0518	16.30	<0.001	0.764
	M45	0.739	0.0457	16.17	<0.001	0.757
Control-life	M2	0.579	0.0456	12.70	<0.001	0.620
	M5	0.498	0.0414	12.02	<0.001	0.607
	M9	0.703	0.0376	18.69	<0.001	0.828
	M12	0.515	0.0390	13.22	<0.001	0.633
	M15	0.444	0.0463	9.59	<0.001	0.489
	M33	0.567	0.0387	14.64	<0.001	0.696
	M41	0.413	0.0423	9.76	<0.001	0.490
Confidence-abilities	M3	0.524	0.0365	14.37	<0.001	0.669
	M8	0.739	0.0385	19.18	<0.001	0.826
	M10	0.542	0.0371	14.59	<0.001	0.682
	M13	0.536	0.0394	13.60	<0.001	0.641
	M16	0.615	0.0385	15.96	<0.001	0.727
	M18	0.622	0.0414	15.03	<0.001	0.693
	M24	0.639	0.0373	17.14	<0.001	0.768
	M32	0.796	0.0626	12.71	<0.001	0.621
	M36	0.472	0.0396	11.93	<0.001	0.576
Confidence-interpersonal	M17	0.415	0.0441	9.42	<0.001	0.486
	M20	0.430	0.0355	12.12	<0.001	0.605
	M28	0.623	0.0436	14.30	<0.001	0.688
	M38	0.435	0.0484	8.98	<0.001	0.477
	M43	0.556	0.0437	12.71	<0.001	0.644
	M46	0.329	0.0359	9.18	<0.001	0.490

Note: The elements are presented in a non-sequential order

Table 5. Indicators of convergent validity and composite reliability analysis (n=378)

Factors	Mean	SD	Cronbach's α	CR–McDonald's ω	AVE
Challenge	3.64	0.391	0.621	0.63	0.408
Commitment	3.48	0.383	0.624	0.64	0.420
Control-emotion	3.30	0.439	0.603	0.62	0.512
Control-life	3.29	0.368	0.604	0.62	0.402
Confidence-abilities	3.51	0.580	0.601	0.61	0.480
Confidence-interpersonal	3.34	0.389	0.692	0.70	0.401

Note: CR=composite reliability; AVE=average variance extracted

The Fornell-Larcker criterion [31] has been applied to verify the model's discriminant validity. This criterion states that the square root of a construct's AVE should exceed the correlation coefficients for each construct in the corresponding rows and columns. Discriminant validity is confirmed when this condition is satisfied. The criterion for discriminant validity was fulfilled since the correlations between the MTQ48 subscales were lower than the corresponding square roots of the AVE values, which ranged from 0.633 to 0.716, as shown in Table 6.

Table 6. Correlation matrix of questionnaire factors and square root of the AVE (n=378)

No	Factors	1	2	3	4	5	6
1	Challenge	(0.639)					
2	Commitment	0.54	(0.648)				
3	Control-emotion	0.31	0.54	(0.716)			
4	Control-life	0.62	0.23	0.23	(0.634)		
5	Confidence-abilities	0.45	0.64	0.67	0.24	(0.693)	
6	Confidence-interpersonal	0.21	0.47	0.38	0.08	0.50	(0.633)

Note: Parentheses contain the square root of the AVE

We computed Pearson-correlations between the MTQ48 and PPI-A subscales (the results were obtained for the same participants over the same time period [11]) to demonstrate the convergent validity of current validated/adapted MTQ48 questionnaire, as presented in Table 7. All significant positive correlations between the MTQ48 and psychological performance inventory subscales confirm the convergent validity of current validated/adapted MTQ48 questionnaire for the sport schools' student's sample. This correlational analysis also demonstrated the criterion validity (concurrent validity, a subtype of criterion validity) of the MTQ48, as we compared the results of the MTQ48 with an established measure (the PPI-A) used at the same time on the same participants, and the significant positive correlation between the subscales indicates that our current validated/adapted instrument is measuring a construct similar to the established measure PPI-A.

Table 7. Pearson-correlations between the MTQ48 (n=378) and PPI-A (n=378) subscales [11]

No.	Factors	1	2	3	4	5	6	7	8	9	10
1	Challenge	--									
2	Commitment	0.549**	--								
3	Control-emotion	0.316**	0.535**	--							
4	Control-life	0.600**	0.244**	0.246**	--						
5	Confidence-abilities	0.474**	0.738**	0.670**	0.265**	--					
6	Confidence-interpersonal	0.240**	0.467**	0.374**	0.107*	0.498**	--				
7	Determination	0.630**	0.628**	0.389**	0.366**	0.617**	0.340**	--			
8	Visualization	0.409**	0.713**	0.629**	0.229**	0.780**	0.421**	0.611**	--		
9	Positive Cognition	0.617**	0.607**	0.357**	0.374**	0.516**	0.307**	0.696**	0.552**	--	
10	Self-belief	0.324**	0.270**	0.107*	0.243**	0.192**	0.108**	0.343**	0.186**	0.432**	--

Notes: *p<0.05; ** p<0.01.
Subscales of psychological performance inventory–determination; visualization; positive cognition; self-belief

3.2. Discussion

School cultural environment varies across countries. The use of a country-specific and validated instrument ensures that the questionnaire of mental toughness is in line with the experience of students in sports schools and is aligned with the educational and athletic environment of that national country. Therefore, it was reasonable to conduct a study aiming to verify the validity of the Lithuanian form of mental strength questionnaire (MTQ48) among young sports school participants.

In the absence of a universally agreed single scale for assessing mental toughness in sport school participants at national level, and in view of the fact that only first steps have been taken, the PPI-A has so far been adapted and validated for sport school students only [11], this study contributes to the filling of this gap by ensuring the possibility of reliable and valid studies in sport schools' contexts. Furthermore, in comparison to earlier research [10], [12], the present study uses a combination of reliability, construct (convergent and discriminant) validity, criterion validity (concurrent validity, a subtype of criterion validity), exploratory and confirmatory factor analyses in order to provide a robust verification of the questionnaire's psychometric properties, in which all the indicators meet acceptable psychometric requirements.

An EFA has been conducted to evaluate factorial structure of the MTQ48 whether this structure corresponds original factor structure tested by the Clough *et al.* [10]. We expected that the factor structure of the Lithuanian MTQ48 would reflect the original six-factor structure, and our study confirmed the six-factor structure and construct (convergent and discriminant) validity of the current validated/adapted MTQ48 questionnaire. The results of EFA of the present study are consistent with results by Chelbi *et al.* [32] providing support for a six-factor structure for the MTQ48 among young sports school participants. In terms of convergent and criterion validity, the MTQ48 showed significant correlations with the PPI-A [11] (the results were obtained for the same participants over the same time), indicating that the MTQ48 is a suitable tool for assessing convergent and criterion validity. Further investigation might be necessary because some correlation (e.g., r<0.50) suggests only some degree of convergence.

The CFA was carried out to establish whether the data supported the theoretically developed model. The resulting goodness of fit indices indicated that the construct validity of the MTQ48 was confirmed, as the six-factor structure was sufficiently appropriate. Conceptual and psychometric analyses revealed that the factors were substantive to the pre-specified (six-factor MTQ48) instrument model developed by Clough *et al.* [10]. Similarly, Birch *et al.* [12] using CFA, found limited evidence for the hypothesized six-factor model of MTQ48 in two athletic samples.

Reliability of the MTQ48 was checked by McDonald's omega and Cronbach's alpha. We identified appropriate Cronbach's alpha for all six subscales of the tool, which were in line with results from a previous study [12]. Tools with reliability coefficients of 0.6 and above are and higher are accepted as reliable [29]. The results show that the internal consistency of the Lithuanian version of the MTQ48 is reasonable.

Therefore, researchers wishing to get comprehensive data which include essential dimensions of the mental toughness of Lithuanian students-athletes will be able to choose the MTQ48 or PPI-A tool that best suits their needs. This became possible when the findings of the current study supported a six-factor structure that is coherent with the structure of the original instrument in English. Notably, our data closely resembles the initial version of the factorization analysis when 'the resultant model fit provided reasonable support for this factor structure, $\chi^2(855)=71233.41$, CFI=0.903, TLI=0.872, SRMR=0.021, RMSEA=0.032 [90% CI=0.032, 0.032]' [33].

3.3. Limitations and future research

The sample was limited to basketball sport school participants (basketball is most popular kind of sport in Lithuania), and conclusions are drawn from the results of a cross-sectional study using a self-assessment instrument. This may limit the generalizability of the results to sports schools with different kinds of sport, as the specific sample of this study is too homogeneous. The present study did not include students of other ages, so the findings are limited to the characteristics of students of students in the 15-18 years age group. A similar study could be carried out in other age groups of sport schools' students. Further studies should include representatives of schools with different kinds of sport and could also look at gender differences. It is expected that by using a very large sample with a variety of demographic compositions, more reliable and practically useful models can be obtained. As the most common instrument for assessing mental toughness is the MTQ48, it may be possible to carry out comparative studies in different cultural contexts, including Lithuania.

4. CONCLUSION

The results of this study will contribute to the growing body of evidence about the psychometric properties and quality of the MTQ48 for assessing mental toughness among young sport schools' participants. It has been revealed that the MTQ48, which has been tailored in Lithuania, may be well applied in research investigating mental toughness of students in Lithuanian sport schools' contexts. The adapted and valid instrument can be used for the verification of mental toughness development programmed targeting young sport school participants.

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