
Transcultural Validation in Arabic Language of the Thought Occurrence Questionnaire for Sport (TOQS) Among Student Population in Tunisia

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Abstract

Goal: Design and validation of the short version in Arabic language of the Thought Occurrence Questionnaire for Sport (TOQS) for Tunisian teenagers.

Methods: A total of 747 participants who were both female and male learners and practicing several types of school and civil sports completed the adapted Thought Occurrence questionnaire for Sport TOQS-Arabic version during two exploratory (n = 197) and confirmatory phases.

Results: Examination of the psychometric properties by exploratory and confirmatory factor analysis confirmed that the factor stability of the three-factor and 17-item structure. In addition, the reliability of the instrument examined by Cronbach's alpha coefficient for the three dimensions of the tool and its total score confirmed good internal consistency. The sensitivity of the instrument has been proven by a two-factor analysis of variance (sports practice * gender) through the differences that are highlighted for these three factors and its total score.

Conclusion: The Arabic language version of the TOQS scale can be used to evaluate thought occurrence for populations of children and teenagers in Tunisia and other Arab countries.

Keywords: transcultural adaptation- Thought- Adolescent- validation- Sport.

Introduction

Optimal performance during physical activities and sports practice from childhood to adulthood depends on many factors, including physical, technical, tactical and psychological finesse, which vary according to the nature and specificity of the practice carried out (Mujika et al., 2018; Davis et al., 2018; Brown and Fletcher, 2017; Till and Baker, 2020). In recent decades, much work has paid particular attention to psychological skills that significantly contribute to success in sport. In

this regard and over time, much work has focused on examining all the psychological potentials that can improve the potential of athletes. In this process, an essential role of cognition and neuroscience in understanding, predicting and improving performance has become increasingly essential and growing in recent years (Moran et al., 2019; Katwala, 2016). As a result, much work has focused on evaluating these parameters in the context of sport and even cognitive training programs are starting to emerge (Walton et al., 2018). To enable these skills to be evaluated, many tools have been developed to attempt to measure a wide range of psychological features, qualities, potentials and abilities as variables that exhibit effects performance.

From this perspective, to establish the link between pre-competition stress and performance, research has been based on cognitions experienced during competition. As a result, a number of studies have examined cognitive interference during training and competition (Stanger et al., 2018; Broadbent et al., 2017; Hatzigeorgiadis and Biddle, 2002, Sarason, Pierce, & Sarason, 1996). From this perspective, research has that since long time demonstrated significant associations between cognitive interference and poor performance (Sarason et al., 1990; Sarason et al., 1996). Indeed, cognitive performance interference diverts attention from the task at hand during sports actions to other tasks that are not related to the context. In addition, in a recent meta-analysis Brown et al. (2020) have shown that cognitive efforts are negatively associated with subsequent physical performance. Currently, cognitive and metacognitive processes are recommended to monitor, control and regulate competitive strategies (Formenti et al., 2019; MacIntyre et al., 2014). Also, the research results of Swann and colleagues (2017) suggest that optimal performance states are supported by the use of both automated procedures and cognitive knowledge.

Indeed, previous research has found that cognitive skills contribute to the development of the adaptive capacities of athletes and their concentrations. Also, strong links have been established between these skills and stress reactions in the context of sport. Thus, research in the context has suggested the development of mental capacities especially during competitions as an effective means for the improvement and optimization of various sports-related performances (Thienot, et al., 2014; Lavalley et al., 2012; Williams et al., 2011; Moran, 2009).

For children and adolescents, the intersection of motor learning and sports psychology related to the acquisition of motor skills highlights a crucial role of several cognitive parameters such as attention and concentration and cognitive interference during competitions and training as paramount parameters in the optimization of sports performance (Doron et al., 2020; Ducrocq, 2016; McCarthy et al., 2013). Indeed, the majority of research among sportif younger people has been adopted a socio-cognitive or socio-psychological perspective to understand a variety of interpersonal and intrapersonal factors that place cognition as a central element in understanding the young athlete in a competitive context. However, limited research in these days has investigated cognitive parameters (in athletes Walton et al., 2018) and precisely youth that may be influenced by some of the individual differences and contextual factors. An improved understanding of the thought processes that a young athlete goes through during competition is important in the development of their attentional strategies that improve their mental skills (Gould et al., 2002).

Therefore, the study of cognitive behavior during competition has been a central factor in sport for adults and children alike.

However, means for the questionnaire assessment of cognitive parameters during training and competition are rare. We cite the rare means developed for athletes. For example, Early work by Neidfer (1976) resulted in the development of the Attentional and Interpersonal Style Test (TAIS). However, the Test was a very heavy measure that included 144 items and 17 subscales. Also, Sarason et al. (1986) developed another instrument for the purpose of measuring cognitive activity during task performance (Cognitive Interference Questionnaire, Occurrence of Thought Questionnaire (TOQ). This tool is as considered as to be a measure of athletes' thoughts. during competition (Sarason et al., 1986).

Subsequently, Hatzigeorgiadis and Biddle (2000) developed a valid measurement scale to evaluate the cognitive interference that athletes may experience during competition: the Thought Occurrence Questionnaire for sport (TOQS). This measure was initially designed for 24 items developed from qualitative interviews for athletes. After an in-depth examination through exploratory and confirmatory factor analysis (for four models) 17 items were retained. Also, the validity of the instrument was established with the "Test of Performance Strategies" (TOPS; Thomas et al, 1999). The 17 items of TOQS assess five dimensions of cognitive interference: Performance concerns, which are characterized by thoughts associated with a perceived failure to meet performance goals, Task-unrelated thoughts which are characterized by thoughts such as dreams and thoughts not associated with competition which are presented by thoughts linked to letting go of the situation. In addition, a total score of the scale measuring cognitive interference was justified by the factor model (Hatzigeorgiadis and Biddle, 2000).

Subsequently, Lane et al. (2005) adapted the scale for young adolescent sportsmen aged 15 and over and tested its structure by confirmatory factor analysis, successively for three different models which confirmed the three dimensions and the presence of a common second-order factor.

Indeed, the adaptation of such a measure is decisive for young athletes for two reasons: on the one hand, this population is subjected to a great pressure (Oudejans et al., 2011) which influences their cognitive capacities and on the other hand, skills must be trained from an early age. So that, they can persist into adulthood (Gould et al., 2002). Although the test has been used several times by psychologists and researchers in the context of sports, it has never been used in the context of school sports.

The objective of this study is to adapt an Arabic language version of the 17-item version of the TOQS for a population of students (children and adolescents aged from 12 to 18 years) in Tunisia, to test its psychometric properties in terms of internal consistency and factor stability. In addition, the sensitivity of the instrument will be examined by the difference between civic sport and school sport.

Methodology

Participants

A total of 747 participants were recruited during the two-phase exploratory and confirmatory study. During the exploratory phase 197 sports subjects aged 15.20 + -1.57, female (n = 96) and

male (n = 101) who practice team sports (n = 103) and individual sports (n = 94) were recruited from clubs in the city of Kef.

Subsequently, five hundred and fifty-five schoolchildren and adolescents who are belonging to seven colleges and five secondary schools from three governorates in Tunisia (Beja, Jendouba, Kef) were recruited to participate in the confirmatory study.

The subjects are female (n = 265; practitioners of civilian sport n = 81 and practitioners of school sports n = 184) and male (n = 290; practitioners of civilian sports n = 117 and practitioners of school sports n = 173). The participants had an average age of (15.09 ± 1.52 years).

The first group that exerce a school sport has never been involved in a civilian sporting activity. The sports practiced by the participants were diverse and the average level of education was 9.09 ± 2.3 years.

Instrument

For the empirical data collection, we used a version translated into Arabic and adapted from the thought occurrence questionnaire for sport (TOQS). The means was originally developed to measure inherent disruptive thoughts in the context of sport. Then, a version was designed for children was developed by Lane et al. (2005). The version designed for children was validated on 564 young volunteer athletes of both sexes who are between 15 and 18 years old. Athletes have been practicing several collective and individual sports at the national level. The results confirmed the robustness of measurement of the instrument through confirmatory factor analysis and internal consistency of the instrument. Likewise, internal consistency coefficients for the three components were greater than .70 for team sports and 0.80 for individual sports. This shows a good consistency of the instrument.

The scores of adapted version were measured on a 5-point Lickert scale to make them more familiar with our population, which has lower age groups.

Procedures

In the first step, the scale was translated by a committee made up of a professional expert in English-Arabic translation, an English-language teacher, an Arabic-language teacher and a university professor specializing in sports psychology. After the Arabic version was developed, it was reversed to ensure that the items kept the same meaning as the original version. This method was suggested by Hambleton (1993) during the cross-cultural adaptation of questionnaires in the humanities. Subsequently the version was submitted for evaluation by five sports psychology teachers who did not suggest a modification of any item in the adapted version. However, specialists have recommended using a 5-point Lickert scale or instead of seven points.

Participants

In this study were invited through their PSE teachers in their practice sessions.

School and high school officials and parents have been informed on the purpose of the survey and how it will be carried out. Participation in the survey was voluntary and there was no rewards that are given. Instrument administration was face to face and each participant was given ten minutes to respond.

This research study was approved by the ethics committee of the University of Continuing Education of Tunis.

Statistical tools

Statistical analysis of the data were performed by IBM SPSS version 26 software; and IBM SPSS Amos software version 23. The significance level was retained at 0.05 for all statistical tests performed in the study.

A prior analysis of the data collected was carried out to ensure that there are any anomalies or faulty boxes. Missing data from questionnaires completed by participants was ruled out from the study from early time. Subsequently, descriptive statistics for variables continue and normality tests (Skewness and Kurtosis) were carried out on all items of the TOQS-Arabic version scale.

The exploratory factor analysis was performed by the principal component method with a varimax rotation. Kaiser's normalization and Bartlett's sphericity test were calculated. The factors were retained for KMO index > 0.60 and a significant approximate chi² value.

The reliability of the Arabic version of the TOQS instrument was studied by the internal consistency of its three factors using Cronbach's α coefficient.

The sensitivity of the measurement tool was examined by Anova two-factor analysis of variance (gender * sport experience).

The factor structure of the instrument was examined by confirmatory factor analysis (CFA).

Several indices of CFA were retained to examine the model: (a) the test of χ^2 and its significance; (b) the value of χ^2 / dof , the index; (c) (GFI); (AGFI) (3) the comparative adjustment index (CFI); (4) the Tucker-Lewis index (TLI); and (5) the approximation mean squared error (RMSEA).

For the recommended thresholds of the various adjustment indices, we will follow the recommendations of Hu and Bentler (2007; 1999) suggested values that are close to 0.90 for GFI and AGfi and values are greater than 0.95 for the CFI and TLI. While the recommended threshold for RMSEA c error should be less than 0.08 for a good fit, the model fits reasonable.

Results

Descriptive statistics and normality

Table 1 shows the descriptive statistics from the exploratory sample which are represented by the means and standard deviations, as well as the normality coefficients for the 12 items of the Arabic version of TOQS.

After examining the two skewness and kurtosis coefficients, the distribution was found to be Gaussian for the 17 items of the scale.

Table 1. Descriptive statistics and normality of the TOQS scale (n = 197)

	Average	Standard deviation	Skewness	Kurtosis
I1	2,85	1,17	0,13	-0,68
I2	2,92	1,09	0,02	-0,62
I3	2,89	1,11	0,03	-0,69
I4	2,81	1,16	0,14	-0,80
I5	2,70	1,04	0,17	-0,56
I6	2,62	1,09	0,23	-0,66
I7	2,43	1,01	0,20	-0,78
I8	2,42	1,13	0,44	-0,57
I9	2,44	1,04	0,27	-0,69
I10	2,29	1,12	0,44	-0,78
I11	2,30	1,01	0,29	-1,00
I12	2,64	1,28	0,19	-1,11
I13	2,92	1,38	0,00	-1,24
I14	2,44	1,52	0,54	-1,21
I15	2,90	1,44	0,07	-1,34
I16	1,73	1,04	1,37	1,03
I17	2,08	1,33	0,88	-0,58

Exploratory factor analysis

An exploratory factor analysis by the unweighted least squares method with a direct oblimin rotation was carried out on the subjects who are selected for the study. At the start of the analysis, the Kaiser-Meyer-Olkin Index for measuring sample quality and Bartlett's test of sphericity were calculated. The results provided in KMO = 0.85 and a chi-square = 20690.58 (dof = 136, p <0.001). This proves that the matrix can provide an adequate factorial solution.

A second step in the analysis is the collapse plot examination which presents the eigenvalue diagram. The inflection point of the curve at the sixth factor shows that the 6-factor structure is adequate (see Figure 1).

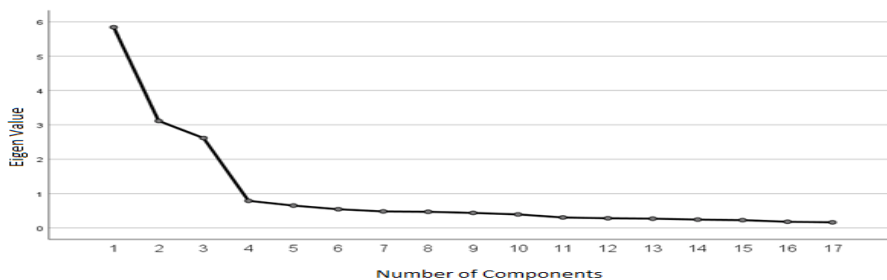


Figure 1. Eigenvalue diagram

The exploratory factor analysis showed the extraction of 3 factors which explain 68.66% of the total variance. The first factor explained 34.36%, the second explained 18.32% of the variance, while the last factor explained 15.40% of the total variance.

The table below shows the initial eigenvalues, the percentages of the variance for each factor and the percentages of the cumulative variances.

Table 2. Eigenvalues and percentages of variances explained

Components	Initial eigenvalue		
	Total	% variances	% cumulative
1	5,84	34,36	34,36
2	3,11	18,32	52,68
3	2,62	15,39	68,07

The structure matrix of the 3 factors extracted after the vari-max rotation of the principal component analysis are shown in Table 3.

No items were deleted during the scan

Table 3. Structure matrix for TOQS items - Arabic version

	1	2	3
I1	0,859		
I2	0,762		
I3	0,829		
I4	0,827		
I5	0,794		
I6	0,789		
I7			0,756
I8			0,809
I9			0,853
I10			0,873
I11			0,815
I12		0,783	
I13		0,786	
I14		0,796	
I15		0,844	
I16		0,760	
I17		0,815	

Correlation between the factors of the TOQS-Arabic version scale

The correlation matrix between the three factors of TOQS Arabic version. Correlation represents moderate positive correlation values between the three components of the measurement scale. As an example, the correlation coefficients between S1 and S2 are 0.3 and 0.26 respectively. Similarly, the correlation between S2 with S3 has a coefficient of 0.27.

Table4. Correlation matrix between the factors of TOQS Arabic version

	s1	s2	s3
s1	1		
s2	,298**	1	
s3	,261**	,273**	1

Internal consistency of the TOQS scale - Arabic version

Table 5 shows that Cronbach's alpha coefficients are good for factors F1, F2, and F3. The Cronbach's alpha coefficients were 0.90; 0.88 and 0.85 respectively, which shows good internal scale consistency are acceptable. Likewise, the Cronbach's alpha index was 0.90 for the whole scale.

Table 5. Internal consistency of the six dimensions of TOQS Arabic version

	F1	F2	F3	Total score
Alpha	0.90	0.88	0.88	0.90

TOQS-Arabic version sensitivity

To test the sensitivity of the TOQS - Arabic version scale, univariate analysis were carried out by gender * sport practice for the 3 factors of the instrument in addition to its total score. The descriptive statistics according to the two variables are presented in Table 6, while the comparative statistics of the two-factor analysis of variance tests are presented in Table 7. The two-factor analysis of variance test for the first factor showed significant differences according to gender, sport practice and gender * group interaction effect. However, the second factor and the third factor only showed significant differences for the effect of sports practice. While the total score of the scale showed significant differences of gender and sports practice simultaneously without interaction effects (see Table 7).

Table 6. Descriptive statistics for the six dimensions of TOQS Arabic version according to gender and sport practice

Gender	Sport practice	F1		F2		F3		Total score	
		Average	Standard deviation	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation
M	G1 (n=173)	2,87	0,92	2,39	0,88	2,51	0,99	2,59	0,66
	G2 (n=117)	2,45	0,88	2,19	0,83	2,29	1,01	2,31	0,67
F	G1 (n=184)	2,89	0,93	2,54	0,90	2,58	1,07	2,67	0,68
	G2(n=81)	2,81	0,83	2,35	0,88	2,36	1,03	2,51	0,64

Tableau 7. Test analysis of two factors for three factors of TOQS Arab version (DDL Hypothesis =3, DDL error =551)

Variables	F1	F2	F3	Total score
Gender	9.54**	3.84 (0.07)	0.61(0.01)	5.37*(0.02)
Groups	5.56*	6.01* (0.011)	5.83*(0.10)	13.48**(0.024)
Gender * Groups	4.68*	0.06(0.00)	0.00 (0.0)	1.03 (0.002)

*: significant at $p < 0.05$. **: very significant at $p < 0.01$

Confirmatory factor analysis

We performed confirmatory factor analysis (CFA) for the measurement instrument using the robust "Maximum Likelihood Estimation" method. Figure 2 shows the factorial weights of the different dimensions and the covariances between the factors.

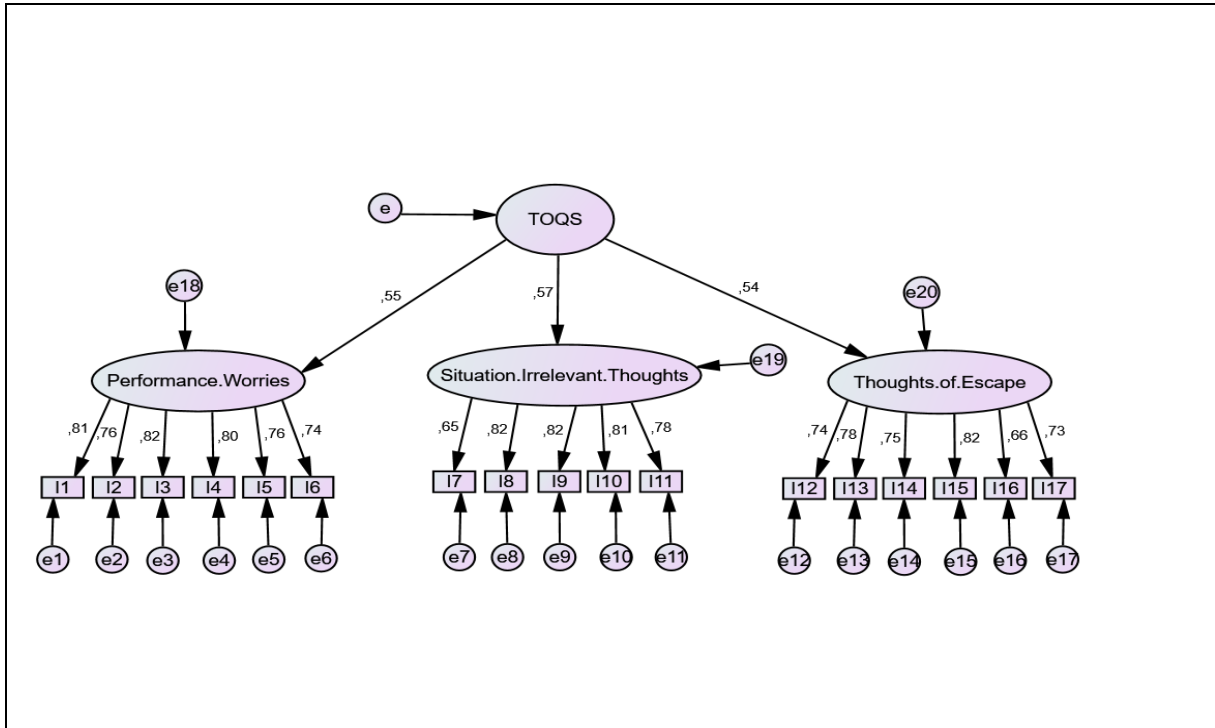


Figure 2. Confirmatory factor analysis of the TOQS Arabic version scale

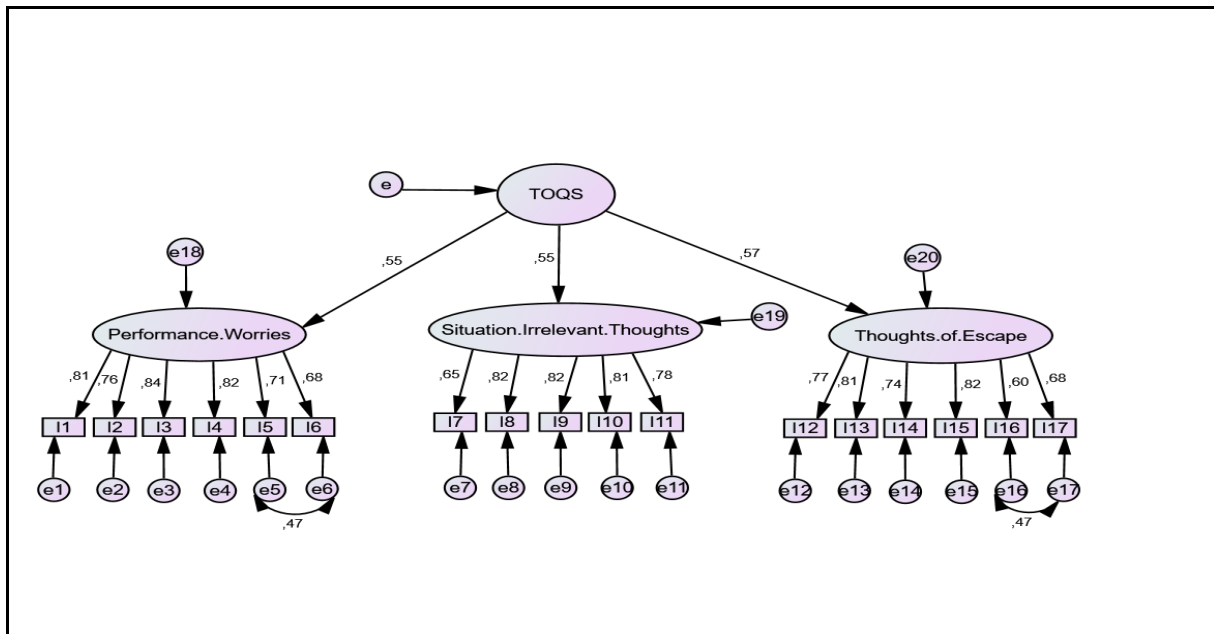


Figure 3. Confirmatory factor analysis of the TOQS Arabic version scale after correlation of errors

The results from the confirmatory factor analysis showed non-tolerable indices for the indices χ^2 / dof ($= 4.27 >$ at the recommended threshold of 3), AGFI ($= 0.87 <$ at the recommended threshold of 0.90) and the measurement error. RMSEA ($= 0.08$) which must be less than 0.08. Therefore, as recommended, we have correlated the errors that have large indices of modification. Then, the results of the adjustment indices from the analysis reveal adequate values for all the indices. Indeed, the value of χ^2 / ddl is 2.32 lower than 3, the AGFI and GFI indices are of values 0.93 and 0.95 respectively and proves a good fit of the model. In addition, the values of TLI and CFI are 0.96 and 0.97 respectively; these values respect the thresholds recommended by Hu and Bentler (1999) and Bentler (2007). Finally, the measurement error is 0.05 which shows a good fit of the model.

Table 8. Fit indices for the TOQS scale - Arabic version

Indices fit	χ^2 (p)	DDL	χ^2 / DDL	AGFI	GFI	TLI	CFI	RMSEA
Values (M1)	495.65(0.000)	116	4.27	0.87	0.90	0.92	0.93	0.08
Values (M2)	265.82	114	2.32	0.93	0.95	0.96	0.97	0.05
Recommended threshold	Not significant	----	<3	>0.90	>0.90	>0.95	>0.95	<0.08

Discussion

The objective of this study was to adapt an Arabic-language version of the abridged version of the TOQS attentional and interpersonal style test for a student population in Tunisia.

The examination of the psychometric properties of the test was carried out by exploratory and confirmatory factor analysis both during two phases. The results of the two factor analysis confirmed the factorial stability of the TOQS composed of six factors and 17 items. Therefore, this structure is consistent with the pre-established theoretical model of the instrument.

The reliability of the instrument examined using Cronbach's alpha coefficient confirmed a good internal consistency of the measuring instrument across its six factors.

The sensitivity of the instrument was partially verified by a two-factor analysis of variance (sports practice * gender) through the differences highlighted for the three-factor and the total score of the scale.

The results of the exploratory and confirmatory factor analysis were similar to those of Lane, Harwood, & Nevill (2005) who supported the three-factor structure with the presence of a common factor. Their study supported, through the adjustment indices, the model which presents three factors correlated with the presence of a higher order factor (CFI > 0.95 ; RMSEA < 0.08). Similarly, the results present very low indices of 'adjustment and did not support the presence of

a single factor (CFI close to 0.76; RMSEA = .13) for three uncorrelated factors (CFI <.90; RMSEA = .10). Regarding internal consistency, Cronbach's alpha coefficients were acceptable for team sports (> 0.70) and greater than 0.80 for individual sports. This demonstrates the similarity of our results. In contrast, the Pearson correlation coefficients between the three components of the scale were higher.

Also, for adults the same structure has been demonstrated for adults (Hatzigeorgiadis and Biddle, 2000).

Also, the adult version presented good clues indicating the good consistency of the instrument. Our results concerning the difference between civilian sports practitioners and school sports practitioners, the results are in line with a lot of recent work which has shown that athletes who perform better (eg elite athletes) are distinguished from those who perform better. Other athletes by more effective and appropriate cognitive processing (Vaughan, Laborde, & McConville, 2019; Vestberg et al., 2017).

The measure of cognitive interference seems adequate, in contrast, some research suggests that self-report is an inefficient way of measuring cognitive parameters (Reisberg & McLean, 1985). Therefore, psychologists have turned to performance-based methods to measure this construct. However, validated tests are not easily accessible and most of them are paid and require equipment.

Extensive studies in the school environment during competition and training are needed to understand the cognitive performance of athletes who evolve in this context. Indeed, this performance may depend on other factors. For example, the coach-athlete relationship (Davis et al., 2018; Gillet et al., 2010). These relationships are not the same in the context of school sport versus civic sport. Indeed, the coach is a physical education teacher. Also, during training, the cognitive tasks of athletes were generally related to stress level and not to the mode of physical sports training (Chang et al., 2017). The context of school sport is an educational environment which differs from civilian sport since pupils are often under stress and pressure of grades.

Cognitive interference is shown to be an essential measure for both psychological parameters and physical performance (Doron et al., 2020; Roberts, Jackson, & Grundy, 2019). Wylie et al., (2018). Indeed, in a study by Hatzigeorgiadis and Biddle, (2001) examined the links between the components of cognitive interference and its effects on concentration and effort achieved during athletic competition in volleyball. All three types of interference have been negatively linked to athlete concentration. Likewise, several associations between the three components of cognitive interference and effort have been identified. In this regard, in a recent study by Brown and Bray (2017) showed that a negative transfer effect from cognitive tasks to physical tasks occurs at a threshold between 4 and 6 min of exposure to cognitive tasks.

Concerning the limitations of the study, we could not determine the concurrent validity of the scale compared to other measures since we have not found reliable instruments in Arabic valid and which can measure parameters in close connection with the context of the study. In addition, the instrument has only been tested on a Tunisian population. Therefore, it was necessary to examine athletes from other Arab countries to establish construct validity of the tool.

Conclusion

The language-adapted version of the TOQS scale can be used in athletic children and adolescents to assess cognitive interference in Tunisia and others who speak the same language.

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Annex

"أثناء المنافسة / اللعبة، راودتني أفكار..."	"During the competition/game I had thoughts..."
مخاوف الأداء	Performance Worries
- عن الأخطاء السابقة التي قمت بها	-about previous mistakes I have made
-أنتي أمر بيوم سيء	-that I'm having a bad day
- أن الظروف (الطقس، درجة الحرارة، الملعب، الجو) ليست جيدة	-that the conditions (weather, temperature, pitch, atmosphere) are no good
-أنتي لن أحقق أهدافي اليوم	-that I am not going to achieve my goals today
-أنتي لن أفوز بهذه المسابقة	-that I am not going to win this competition
- أن المنافسين الآخرين أفضل مني	that other competitors are better than me
-الموقف- أفكار لا صلة لها بالموضوع	-Situation- Irrelevant Thoughts
-عن الأنشطة الأخرى (مثل التسوق وتناول الشاي والتلفزيون	-about other activities (e.g. shopping, having tea, TV
-سأفعله ما حول لاحقاً اليوم	-about what I'm going to do later in the day
حول القلق الشخصي (مثلاً المدرسة والعمل والعلاقات)	-about personnel worries (e.g. school, work, relations)
-عن الأصدقاء	-about friends
حول ما سأفعله عندما أصل إلى المنزل	-about what I'm going to do when I get home
-أفكار الهروب	-Thoughts of Escape
-أنتي أريد الاستقالة	-That I want to quit
-لم أعد أرغب في المشاركة في هذه المسابقة بعد الآن	-that I do not want to take part in this competition any more
-أريد الخروج من هنا للتوقف	-That I want to get out of here about stopping
-أنتي سئمت منها	-that I am fed-up with it
-لا أستطيع تحملها بعد الآن	-that I cannot stand it any more