ABSTRACT

The aim of this study was to examine the factorial validity of the Test of Performance Strategies 2-Competition Scale (TOPS 2-CS) in Greek athletic population, using confirmatory factor analysis. TOPS 2-CS is consisting of the same eight subscales as the initial Test of Performance Strategies-Competition Scale (TOPS-CS) – activation, self-talk, automaticity, emotional control, goal-setting, imagery, negative thinking, relaxation – with the addition of a new subscale, distractibility. International and national level athletes (n = 536) aged 17-42 years, completed the 36-item competition subscale of the inventory during training sessions. Fit indices supported the structural validity of the nine factor model (comparative fit index = 0.88, Tucker-Lewis index = 0.85, root mean square error of approximation = 0.05). Moreover, eight of the nine subscales showed adequate internal consistency. The subscale of automaticity demonstrated poor factor loadings and inadequate internal consistency. It is concluded that TOPS 2-CS can be used in Greek athletic population however, the psychometric properties of the automaticity subscale are questionable at present and further research is required.

Key Words: questionnaire, psychological skills, athletes, psychometric properties.
INTRODUCTION

Numerous previous studies have examined the role of psychological skills' use in athletic performance (7, 25). Knowledge of the psychological strategies that elite and non-elite athletes adopt and develop is of important value for the implementation of psychological skills training and intervention (24). Psychological skills are learned behaviours that are theorized to serve athletes in the pursuit of sport excellence (20). Previous research focused primarily on the differences in personality characteristics between more versus less successful athletes, while more recently, investigators examined those differences in terms of the psychological skills which athletes have practiced and used (15, 24, 14). Indeed, several studies have indicated that effective application of psychological skills and strategies is related to superior sport performance (23, 13, 30).

Psychological inventories have been widely used as a traditional method of measuring athletes’ psychological skills and sport-related behaviors. Over the last years, several psychological skill inventories have been proposed, like the Psychological Skills Inventory for Sports; PSIS (23), the Athletic Coping Skills Inventory-28; ACSI-28 (25) and the Ottawa Mental Skills Assessment Tool (11). However, the most commonly used measure of performance strategies is Thomas, Murphy and Hardy’s (28) Test of Performance Strategies (TOPS). TOPS was designed to measure a comprehensive range of psychological skills and techniques, and their use by athletes both in competition and practice (16). Thomas, Murphy and Hardy (28) assumed that it was important to distinguish strategies used in competition from those used during practice as considered like two different contexts of the athlete’s life. TOPS is a 64 items self-report instrument consisting of two scales, competition and practice scale and each one of them of eight subscales. Seven subscales were common to both competition and practice scales; self-talk, emotional control, automaticity, goal-setting, imagery, activation, relaxation. The eighth subscale, negative thinking, replaced attentional control in the competition scale as a competition specific factor (21).

Subsequent research has provided further evidence of the psychometric properties of the TOPS subscales (12, 17) and several investigators have recommended the use of TOPS to examine the relationships between psychological skills and top performance (14, 27), flow (17), competitive anxiety (12, 24), mental toughness (18), and emotions (8). The factorial structure of the TOPS has also been proved to be adequate for use in non English speaking adult athletic populations (10).

While developing the inventory, Thomas et al., (28) used a sample of a large age range athletes, from different sports and performance levels. However, it appeared that the use of TOPS for adolescent and young adolescent athletes was doubtful: a confirmatory factor analysis by Lane, Harwood, Terry,
& Karageorghis (21) provided only mixed support for the factorial validity of the inventory for athletes younger than 18 years of age and the authors questioned whether the language in some items was appropriate for adolescent athletes. In another study Katsikas, Donti and Psychountaki (19) found that the Competition Scale of TOPS demonstrated inadequate psychometric properties in a sample of young adolescent athletes (12-15 years old); the items of goal setting loaded in the factor of activation and the authors assumed that the ability of setting goals in competition may develop after considerable competing experience and young athletes in some sports probably cannot set goals and pursue them independently from their coaches' and/or parents' influence.

Thomas et al. (28) used exploratory factor analysis as a preliminary step in the inventory development and validation. In order to improve the psychometric properties of TOPS, Hardy et al., (16) undertook two studies using confirmatory factor analysis: in the first study, the authors modified the items of the activation subscale to better reflect athletes' readiness to perform. Further items were created, in order to purify the emotional control and the automaticity subscale in the competition scale and last, the authors considered that a new factor, distractibility, reflecting resistance to disruption, might be a more appropriate way to measure athletes' attentional control in competition. In the second study, the authors, used a sample of Australian athletes. Results demonstrated that TOPS 2-CS was an improvement over the TOPS, consisting of the same eight, slightly modified subscales as the initial inventory (activation, self-talk, automaticity, emotional control, goal-setting, imagery, negative thinking, relaxation) with the addition of a new subscale, distractibility.

However, Hardy et al. (16) pointed out that a need remains to confirm their results and further develop the TOPS 2, using data from athletes ranging in age and ability and representing different cultures. Furthermore, coaches and sport specialists could benefit from the use of a valid and reliable instrument measuring athletes’ psychological skills in developing and implementing intervention programs designed to enhance performance. Thus, the purpose of this study was to examine the psychometric properties of the Test of Performance Strategies 2-Competition Scale (16) in Greek athletic population.

METHODS

Participants

A total of 536 national and international level athletes (306 males, 220 females), aged 17-42 years (19.80 ± 2.62 years) with mean competitive experience of 10.4 ± 4 years participated in this study. The athletes were training in sport clubs and national teams affiliated with the Greek Sports Federations, from 27 individual and team sports. From the 536 athletes that took
part in the research, 123 were active members of national teams, 133 were former members of national teams and 265 were club level athletes. As a condition of participation in the research, all athletes had to have at least two years of competitive experience.

**Measurement instrument**

The Competition Scale of the Test of Performance Strategies 2 is developed to measure athletes’ use of psychological skills and strategies during competition (28). It is consisting of 36 items that are constructing nine factors: *self-talk* (maintaining a positive internal dialogue), *emotional control* (controlling emotions under pressure), *automaticity* (performing with little conscious effort), *goal-setting* (setting personal goals), *imagery* (visualizing sport performance), *activation* (maintaining an optimal level of arousal), *relaxation* (practicing to remain calm under pressure), *negative thinking* (thoughts of failure), and *distractibility* (resistance to disruption). Each factor is consisting of four items. Answers are given on a 5-point Likert scale ranging from 1 (never) to 5 (always). Cronbach’s $\alpha$ coefficients in the initial edition of the inventory ranged from .62 to .87 with the exception of *distractibility* which demonstrated low values of reliability (0.44).

**Translation**

For the translation of the TOPS 2-CS into Greek language, 5 interpreters specialized in sport psychology conducted a back and forth translation. Furthermore, 20 athletes participated in a pilot study in order to examine the content validity of the inventory and shape its final form.

**Administration of the Test**

Adult athletes provided informed consent and volunteered to take part in this study. For adolescent athletes, written parental consent for participation in the study was provided. Instructions to the participants included a reminder to respond to all items and a statement that there were no right or wrong answers. The participants filled in the inventory before or after their training sessions.

**Statistical analysis**

The responses for the 36 items of the Test of Performance Strategies 2-Competition Scale questionnaire (TOPS 2-CS) were tested against the stan-
standard nine-factor model. The model fit for the nine-factor structure was tested with confirmatory factor analysis (CFA), while the internal consistency of the factors was computed with Cronbach's alpha reliability coefficient. The confirmatory factor analysis was conducted with computer program Analysis of Moment Structures; AMOS, (1).

The primary index used for model fit was the "root mean square error of approximation" (RMSEA) (26), which is a measure of the mean discrepancy between the observed covariances and those implied by the model per degree of freedom. Values less than 0.05 are indicators of a good fit. Certain investigators consider 0.08 as an acceptable cut-off value, but certainly an RMSEA value above 0.1 indicates a poor model fit (6). The 90% confidence intervals (CI) of RMSEA are also reported. Two additional incremental fit indices are reported: Tucker-Lewis index-TLI (29) and comparative fit index (CFI). Tucker-Lewis index belongs to the family of indices that compare the discrepancy of the specified model in comparison to the baseline model (4). The typical range for TLI lies between zero and one, but it is not limited to that range; TLI values close to 1 indicate a very good fit. As a rule of thumb the value of TLI = 0.9 is considered a cut-off value, above which there is an indication of a good model fit. The same criteria apply for the CFI (3).

In addition, the results of the chi-square analysis are reported; p-values less than 0.05 rejecting the null hypothesis indicate that the model fit is not satisfactory.

Separate confirmatory factor analyses were performed independently for each factor, which were also tested for their internal consistency with Cronbach’s alpha coefficients.

RESULTS

The confirmatory factor analysis for the overall model gave an RMSEA value of 0.054 (90% CI 0.051-0.058), with TLI = 0.854 and CFI = 0.878, providing acceptance for the nine-factor structure of TOPS 2-CS. For the competition items, confirmatory factor analysis provided strong support for the subscales of self-talk, relaxation and distractibility. Scope of improvement was indicated for emotional control, negative thinking, goal-setting, activation and negative thinking and no support was found for the fit of the automaticity scale.

Independent analyses of each factor are shown in Table 1.

Cronbach’s α values for competition subscales ranged from .61 to .83 with the exception of the automaticity subscale which demonstrated low Cronbach’s alpha value (α = 0.44) (Table 1). The criterion that is commonly used for internal consistency is an alpha of 0.70. However, Loewenthal (22) has suggested that an alpha of 0.60 is acceptable for subscales consisting of only four items.
Rerunning confirmatory factor analysis without automaticity yields a slightly better model fit with an RMSEA value of 0.053 (90% CI 0.050-0.057), TLI = 0.877 and CFI = 0.898 indicating that the eight-structure model of TOPS after excluding the subscale of automaticity is slightly better.

Table 1. Results of the CFA and reliability analysis of TOPS 2-CS.

<table>
<thead>
<tr>
<th>Subscale</th>
<th>$x^2$ (df = 2)</th>
<th>TLI</th>
<th>CFI</th>
<th>RMSEA (90% CI)</th>
<th>Cronbach’s alpha (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-talk</td>
<td>2.1</td>
<td>1.008</td>
<td>1.000</td>
<td>0.012</td>
<td>0.818</td>
</tr>
<tr>
<td>Emotional control</td>
<td>17.1 &lt;0.001</td>
<td>0.882</td>
<td>0.976</td>
<td>0.119</td>
<td>0.799</td>
</tr>
<tr>
<td>Automaticity</td>
<td>33.5 &lt;0.001</td>
<td>-0.049</td>
<td>0.790</td>
<td>0.170</td>
<td>0.446</td>
</tr>
<tr>
<td>Goal setting</td>
<td>38.4 &lt;0.001</td>
<td>0.695</td>
<td>0.939</td>
<td>0.184</td>
<td>0.787</td>
</tr>
<tr>
<td>Imagery</td>
<td>24.8 &lt;0.001</td>
<td>0.871</td>
<td>0.974</td>
<td>0.146</td>
<td>0.829</td>
</tr>
<tr>
<td>Activation</td>
<td>40.3 &lt;0.001</td>
<td>0.727</td>
<td>0.945</td>
<td>0.189</td>
<td>0.808</td>
</tr>
<tr>
<td>Relaxation</td>
<td>2.2</td>
<td>0.998</td>
<td>1.000</td>
<td>0.015</td>
<td>0.818</td>
</tr>
<tr>
<td>Negative thinking</td>
<td>20.0 &lt;0.001</td>
<td>0.895</td>
<td>0.979</td>
<td>0.130</td>
<td>0.773</td>
</tr>
<tr>
<td>Distractibility</td>
<td>10.3 &lt;0.001</td>
<td>0.829</td>
<td>0.964</td>
<td>0.088</td>
<td>0.612</td>
</tr>
</tbody>
</table>

DISCUSSION

This study examined the psychometric properties of the TOPS 2-Competition Scale in Greek athletic population using confirmatory techniques. Confirmatory factor analysis supported the initial structure of the inventory for the
overall model. At the subscale level, for the competition items, self-talk, relaxation and distractibility showed good fit whereas activation, emotional control, imagery, negative thinking and goal setting scales, less so. Cronbach’s alpha values for the eight subscales provided adequate evidence for the internal consistency of the scale. Nevertheless, the subscale of automaticity demonstrated poor factor loadings and reliability (Cronbach $\alpha = 0.45$). It is concluded, that TOPS 2-CS can be used in Greek athletic population however, the factorial validity of the automaticity subscale is questionable at present and further research is required.

Although the fit statistics reported in the study are good, results indicated that the automaticity subscale clearly requires re-examination as previously identified also by Hardy et al. (16). For the purpose of this investigation, the last item of the subscale was rephrased in the Greek version of the inventory because the double-negative expression in the initial item wording ("Unable to perform skills without consciously thinking") perhaps confused the respondents in interpreting the item (16). Consequently, in the Greek language, the item was positively rephrased ("In order to perform skills, I have to consciously think of them"). However, Cronbach’s $\alpha$ value for the subscale was not adequate (.45). Similarly, two automaticity items, "allow whole skill to happen naturally without concentrating on each part" and "sufficiently prepared to perform on automatic pilot" apart from the conceptual overlap, cannot have the same response from all athletes. Psychological skills training is often conducted to help athletes attain automaticity (28) however, different sports require different amounts and level of "automatically" executed technical skills. It is possible that some athletes might be able to perform on "automatic pilot" during competition (e.g distance runners) while others do not experience automatic execution and need to consciously focus on some technical aspects in order to perform well; in sports like artistic gymnastics, diving, figure skating, e.t.c., athletes have to constantly learn new skills and combinations of the skills in order to compete on international level. Consequently, although in the present research, the nine-factor model of the TOPS 2- CS has an acceptable model fit, the fits of the eight-factor model –with automaticity removed– are also acceptable and slightly better. Probably, a reduced length questionnaire might be more appropriate for athletes, given that athletes, competing under stressful conditions, are known to dislike lengthy paperwork (2).

In the study of Hardy et al. (16) the subscale of distractibility demonstrated very low Cronbach’s alpha value ($\alpha = 0.44$), so the authors proposed that practitioners could use an eight factor model –with distractibility removed– choosing the version of the inventory that is most appropriate for their needs. However, in that paper, the eight-factor model did not demonstrate better psychometric properties than the nine factor model. In the present study, the subscale of distractibility demonstrated adequate psychomet-
ric properties. A possible explanation of this result might be the considerable competing experience of the participants (10.4 ± 4 years) and their familiarization with the concept of resistance to disruption/distraction. Indeed, in the present study, 256 athletes were active or former members of national teams, hence an athletic population with a remarkable capacity to resist to distractions during competition and a long competing experience under stressful conditions.

In summary, with the possible exception of the subscale of automaticity, the TOPS 2-CS has quite good psychometric properties so practitioners can choose the nine-factor or eight-factor (with automaticity removed) version that is most appropriate for the needs of their athletes. TOPS-2 CS seems to be an appropriate research tool to examine research questions concerning the practice and use of psychological skills in competition. It can also be useful in profiling athlete's psychological parameters and in evaluating the effectiveness of interventions to improve psychological skills.

REFERENCES


Address for correspondence:
Olyvia Donti
Department of Physical Education & Sport Science
41, Ethnikis Antistasis Str, Daphne
17237, Athens
Greece
e-mail: odonti@phed.uoa.gr