



Development and preliminary validation of the Sport Situation Attentional Questionnaire

Maxime Mastagli, Jean-Philippe Hainaut, Aurélie van Hoyer, Benoît Bolmont

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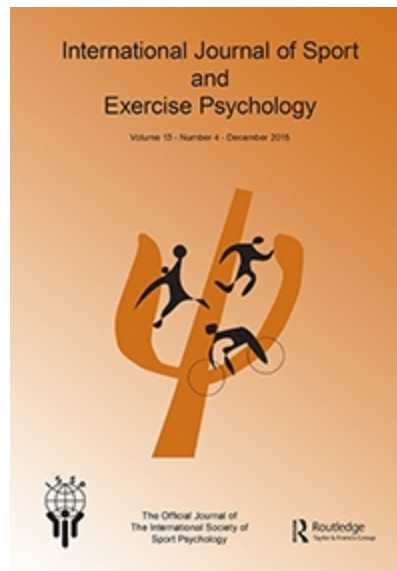
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Development and Preliminary Validation of the Sport Situation Attentional Questionnaire

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Maxime Mastagli (1)
Jean-Philippe Hainaut (1) *
Aurélien Van-Hoye (2)
Benoit Bolmont (1)

(1) 2LPN : Laboratoire Lorrain de Psychologie et de Neurosciences de la dynamique des comportements, Université de Lorraine
(2) APEMAC : Adaptation, Mesure et Evaluation en Santé. Approches Interdisciplinaires, Université de Lorraine

* Corresponding Author

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1 **Development and Preliminary Validation of the Sport Situation Attentional**
2 **Questionnaire**
3 **Abstract**

4 Sport participants’ ability to be concentrated and ignore distractors has been recognized
5 as a crucial cognitive skill for optimizing cognitive and motor learning. To date, no
6 instrument enables to assess concentration and distraction during a sport situation. This
7 paper aimed at developing and validating the Sport Situation Attentional Questionnaire
8 (SSAQ) among French sport participants. Study 1 developed items measuring the level
9 of concentration and distraction. Content validity was assessed with a panel of experts,
10 and by using cognitive interview with ten sport sciences students. Study 2 included 164
11 sport sciences students, and explored the factor structure of the questionnaire.
12 Exploratory factor analysis refined the scale to 18 items and supported a four-factor
13 model: concentration on the task, concentration due to the teacher, distraction away
14 from the task, and distraction toward the teacher. Study 3 included 216 sports sciences
15 students and confirmed the factor structure. Results showed satisfactory internal
16 consistency, convergent and divergent validity, as well as gender invariance. The
17 relationships between SSAQ factors and state anxiety subscales supported concurrent
18 validity. Study 4 included 481 high school students and supported a four-factor model,
19 using confirmatory factor analysis. Results also supported the convergent, divergent
20 validity and reliability of the SSAQ. Combined, these studies provided preliminary
21 evidence to support the psychometric properties of the SSAQ, a questionnaire that could
22 be used to assess sport participants’ perceived concentration and distraction during a
23 sport situation.

24 Keywords: Attention, concentration, distraction, sport, physical education,
25 psychometric scale

27 Introduction

28 The ability to be attentive has been widely regarded as a major prerequisite in motor learning
29 (Wulf & Lewthwaite, 2016), whether in a sport (Moran, 2016) or an educational context
30 where physical activities are taught (Standage et al., 2005). However, sport participants can
31 experience difficulties in turning their attention on sport situation (Maldonado et al., 2019;
32 Moran, 2016). Less is known on how to optimize attention during a sport situation. To our
33 knowledge, in comparison to the flourishing literature in cognitive and clinical psychology on
34 attention, research evidences, especially on the measurement of attention during a sport
35 situation, are sparse. Researchers have analyzed attentional processes through three kinds of
36 measures (Calmels et al., 2004): (1) behavioral (e.g. time reaction; Posner, 1980), (2)
37 physiological (e.g. pupil dilatation; van der Wel & van Steenbergen, 2018), or (3) self-
38 reported measurement (Calmels et al., 2004). These methods have been applied to laboratory
39 situations. However, behavioral and physiological measurement can hardly be implemented in
40 ecological situations such as a sport situation. Thus, the purpose of the present paper was to
41 develop and validate a self-reported scale, to measure attention during a sport situation.

42 The concept of attention entails a variety of interconnected processes (Ocasio, 2010). At least
43 three distinct forms of attention have been identified: attentional vigilance, selective attention,
44 and executive attention (Ocasio, 2010). Based on these three forms, the concept of attention in
45 sport has been used loosely to express performer's concentration (Calmels et al., 2004).

46 Concentration was defined as the ability to focus on one source of relevant information while
47 ignoring distracting stimuli as irrelevant information (Moran, 2016). Concentration has been
48 used as a relevant cognitive ability for purposes of optimizing learning in sport (e.g. Moran,
49 2016) and physical education (PE; e.g. Maldonado et al., 2019). In contrast, distraction was
50 defined as a diversion of attention from some intended targets (Moran, 2016). Distraction

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51 could refer to inward (e.g. daydreams), outward (e.g. scenery), involuntary (e.g. when
52 environment captures attention), and active distraction (e.g. sending SMS during classroom
53 activities; Brick et al., 2014).

54 In the sport context, Moran (2016) suggested that an attentive performer have to continually
55 take relevant cues on the task into account, and ignore numerous distractors to achieve
56 success during motor action. In educational context, Leconte (2005) provided a similar
57 definition underlying the importance of being attentive to relevant information, and to ignore
58 distractors. In PE, Maldonado et al. (2019) defined concentration as the act of focusing on a
59 major event, that would be difficult, because the mind may be easily distracted. The need to
60 identify potential distractors, as non-relevant information and thoughts during a lesson, has
61 also been underlined by Ntoumanis (2005). Content regarding particular movement-relevant
62 cues, the relationships with others (either partners or opponents) and the environment noises
63 are some non-exhaustive examples of relevant and irrelevant cues (Moran, 2016; Wulf &
64 Lewthwaite, 2016).

65 In regard to the relationship with others, the supervisor (e.g. coach or teacher) could be
66 considered as a source of relevant information for cognitive (Cohen et al., 2003; Leconte,
67 2005) and motor learning (Wulf & Lewthwaite, 2016), by playing a role in creating and
68 maintaining an appropriate learning space during the task (French, 1997). Supervisor also
69 frequently give tailored and supporting instructions and feedbacks during the task
70 performance, which evolve according to the goal and the understanding of this task (Cohen et
71 al., 2003; Grobe & Pettibone, 1975; Rowe et al., 2014). However, these instructions could
72 also be irrelevant. For example, it has been demonstrated that an inaccuracy in one or two
73 words can lead to a differential effect on learning (Wulf & Lewthwaite, 2016). Instructions
74 could also be perceived as unnecessary, and thus irrelevant, especially when the supervisor

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3 75 interacts with other sport participants. Supervisor could also provide unclear and stressful
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5 76 feedbacks/instructions (Rowe et al., 2014), inducing an irrelevant cue hard to process. In
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8 77 sport, critical or punitive feedback can evoke high level of state anxiety that, in turn,
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10 78 contributes to a threatening environment and constitutes an irrelevant source of information
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12 79 for learning (Smith et al., 2007). In PE, it has also been demonstrated that, through what the
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14 80 teacher says and does, he/she could foster one student's state anxiety (Liukkonen et al., 2010)
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17 81 and becomes a distractor for the task at hand.
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20 82 State anxiety could be defined as a situational concept, referring to how the participant feels a
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22 83 situation, in response to possible actual or non-actual threats (Spielberger, 1983). State
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24 84 anxiety could be cognitive (i.e. tension, apprehension) and somatic (i.e. activation of the
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26 85 autonomic nervous system; Spielberger, 1972). Previous research has shown that state anxiety
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28 86 was one of the most important predictor of distractibility (Eysenck et al., 2007) and harmed
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30 87 processing efficiency (Eysenck & Calvo, 1992). State anxiety has also been linked to
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32 88 ruminating about irrelevant things, subsequently distracting athletes (McCarthy et al., 2013).
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34 89 The Attentional Control Theory (Eysenck et al. 2007), based on the Processing Efficiency
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36 90 Theory (Eysenck and Calvo 1992) and validated in the sport anxiety literature (Wilson et al.
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38 91 2009), postulates that state anxiety interferes with the goal-oriented system of attention and
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40 92 fosters fixation on threatening or irrelevant stimuli in the environment (e.g. Wilson et al.
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42 93 2009).
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49 94 To our knowledge, measurement of attention and distraction in sport situations has been given
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51 95 little attention. In sport psychology, some psychometric scales measuring attention were
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53 96 interesting (e.g. Test of Attentional and Interpersonal Style, Attentional Focus Questionnaire,
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55 97 Flow State Scale; Nideffer, 1976; Brewer et al., 1996; Fournier et al., 2007), but limited in
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57 98 regard to the definitions of attention, because they used different concepts than
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3 99 concentration/distraction processes. In PE context, previous studies (Maldonado et al., 2019;
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5 100 Zhang et al., 2012) measured students' concentration using the six items (e.g. "*I really*
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7 101 *concentrate in PE*") developed by Standage et al. (2005). In the same vein, Ntoumanis (2005)
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9 102 measured students' concentration using three items (e.g. "*In PE, I concentrate on the*
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11 103 *skills/tasks I have to do*"). Although some items of both scales were interesting, none allowed
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13 104 to capture the sport participants' distraction, which has been identified as a major limitation
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15 105 by Ntoumanis (2005). While these studies have reported a suitable internal consistency, both
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17 106 scales were not published nor validated through an extensive validation process. Otherwise,
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19 107 the Cognitive Processes Questionnaire in Physical Education (Solmon & Lee, 1997) assessed
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21 108 cognitive variables intervening in the achievement among elementary and middle schools
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23 109 students. This scale was composed of 33 items divided in five subscales: self-regulation,
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25 110 confidence-efficacy, attention-concentration, willingness to engage, and strategies. Attention-
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27 111 concentration included six items and aimed at assessing the level of concentration by using
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29 112 task-references (e.g. "*When I practice, I try to think only about the skill I am working on*")
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31 113 and teacher-references (e.g. "*I miss important things the PE teacher says because I am not*
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33 114 *paying attention*"). This scale was interesting because it took into account the task and the
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35 115 teacher as relevant cues. However, the role played by the teacher as a potential distractor
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37 116 during the task at hand was not considered. Therefore, while these scales included specific
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39 117 and interesting items about the task and the supervisor, it may not be well suited to the
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41 118 definition of an attentive sport participant, mainly because the supervisor contribution on the
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43 119 distraction process during the task should be considered.
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52 120 Therefore, our aim by developing and validating the Sport Situation Attentional Questionnaire
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54 121 (SSAQ) was to provide a much-needed measure to comprehensively assess sport participants'
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56 122 attention. The scale that we tried to develop would allow researchers to better understand the
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58 123 complex attentional processes involved during a sport situation. Moreover, sport supervisors
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could use this type of scale in order to analyse the **impact** of their pedagogical strategies on sport participants' attention. In that respect, **to develop and perform an initial validation** of the SSAQ, we have followed the validation steps proposed by Messick (1995) and Boateng et al. (2018). **Taking into account the similarities between organized and academic sport practice, in regard to sport situation, such as (1) the implication in cognitive or motor task (e.g. Müller et al., 2018; Wulf & Lewthwaite, 2016), (2) the definition of attention towards the task (e.g. Maldonado et al., 2019; Moran, 2016), (3) the role played by the supervisor (e.g. Camiré, 2015; Wulf & Lewthwaite, 2016), we conducted the present study in high school and college PE classes. Both of these sport environment offered an important application of the constructs outlined in the introduction, and targeted sport participants of all skill levels, and in many and various sport activities. In Study 1, we aimed at developing an initial pool of items. First, we provide a clear definition of what is an attentive student in sport situations, and then we present the process by which we identified and created relevant items and assessed their content validity. In Study 2, we explored the **factor** structure of the questionnaire, to determine the optimal number of factors that **would** fit the pool of items, and reduce their numbers. In Study 3, we confirmed the **factor** structure and its reliability with sports sciences students. Study 3 examined the concurrent validity of the scale with Pearson's correlations between the SSAQ **factor** dimensions and **state** anxiety subscales. Measurement invariance across gender groups was also investigated in Study 3. In Study 4, we confirmed the **factor** structure and its reliability with high school students in PE.**

Ethical Requirements

All participants gave informed consent to their participation. According to the declaration of Helsinki and the French current legislation, participants were informed that they could withdraw from the study at any time without any consequences. They were clearly informed

that anonymity was retained and **that** their personal information **would** remain confidential and intended only for research purposes. These provisions were applied for all subsequent studies. Each study has been **formally notified** to the French National Commission of Informatics and Liberty (N°2017-261; N°2017-266).

Study 1

Following the steps of scale development and validation (Boateng et al., 2018; Messick, 1995), **Study 1** aimed to develop a preliminary version of the SSAQ. The first step was to provide a clear definition of attentive **sport participant**. Secondly, **an** item generation was conducted, identifying appropriate questions that fitted the previous definition (Boateng et al., 2018). Third, items content validity was examined by **the** evaluation of a panel **of** experts, and cognitive interviews were conducted (Boateng et al., 2018; Messick, 1995). The panel **of** experts' evaluation and cognitive interview focused on the discrimination and the reliability of the scale to control the risks of deviation of personal interpretations and decision-making due to unclear items (Cohen et al., 2013).

Study 1: Domain identification

The first step in **our** scale development was to provide a clear definition of **an** attentive **sport participant**, to ensure that the measurement tool adequately captured the concept of attentive **sport participant**, eliminating extraneous content (Boateng et al., 2018). From existing definitions in the sport (**Moran, 2016; Wulf & Lewthwaite, 2016**) and PE literature (**Maldonado et al., 2019; Ntoumanis, 2005**), we identified how **an** attentive **sport participant** has been defined, what **does** imply a good concentration, and which distractors could occur during a sport situation. The first part of the definition of **an** attentive **sport participant** was to consider the concentration on the task and the distraction away from the task because **a sport**

174 participant should adopt an external focus on the relevant informations on the task, and ignore
175 irrelevant informations and distractors (Moran, 2016; Wulf & Lewthwaite, 2016). The second
176 part of the definition of an attentive sport participant was to consider the supervisor as an
177 exogenous cue about the task, which could be relevant when he/she supports the sport
178 participant's cognitive processes (e.g. Wulf & Lewthwaite, 2016), or irrelevant when he/she
179 interferes in the sport participant's cognitive processes (e.g. Liukkonen et al., 2010). In that
180 respect, the definition of an attentive sport participant was the following: a sport participant
181 would be attentive when he/she is able to focus on the relevant cues (e.g. the task, the
182 supervisor's instructions) by not being distracted by irrelevant cues (e.g. distractors linked to
183 the task, distraction linked to the supervisor). From this definition, the research team could
184 not identify a suitable questionnaire to measure concentration and distraction during a sport
185 situation, because distraction, as well as the supervisor contribution on the
186 concentration/distraction process, were not considered.

188 *Study 1: Item Generation*

189 The item generation of the initial version of the SSAQ was established, using the deductive
190 method, through an analysis of existing instruments (Boateng et al., 2018; Clark & Watson,
191 2016), by a panel of four experts. These experts had a previous applied and experimental
192 background in sport practice, PE, cognitive sciences, and psychometric questionnaire
193 development. The item inclusion criteria were: (1) being related to concentration and
194 distraction processes, and (2) being relevant to the context of a sport situation. Some items
195 from the Cognitive Processes Questionnaire in Physical Education (Solmon & Lee, 1997) and
196 the scales developed by Standage et al. (2005) and Ntoumanis (2005) were selected and new
197 ones were created, based on the inclusion criteria and the definition of an attentive sport
198 participant. English items were translated into French by two independent researchers, then

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the expert panel compared the two propositions to choose the most relevant item. As recommended (Boateng et al., 2018), initial item generation have been broader and more comprehensive than the theoretical view of an attentive sport participant, entailing 50 items at the end of the process.

Study 1: Providing Content Validity Evidence

The 50 items were again submitted to the panel of experts for evaluation to take into account the redundancies, the form and the wording of the items, in order to conserve items simply and unambiguously worded (Boateng et al., 2018). To reach a consensus, the item formulation problems were discussed within the expert panel. In case of disagreement among the panel and after discussion, the item was eliminated. This evaluation had 30 items deleted because they were redundant, tangential or did not perfectly fit the definition of an attentive sport participant during a sport situation (Boateng et al., 2018). Following this process, the pool of items included 20 items (Table 1). After the review process, a content validity assessment was conducted to establish the intelligibility of the questionnaire items, and to identify any potential difficulties in its administration. The approach used a self-reported questionnaire, and was completed by cognitive interviews.

Participants and Procedure

Seven and three women sport sciences students ($M_{age} = 18.60$ years; $SD_{age} = .70$) took part in this study. The first author distributed the surveys and conducted cognitive interviews. It took place after a sport lesson, in a quiet place of the University campus. Each student had to answer each item on a Likert scale of six points ranging from one “absolutely not clear” to six “absolutely clear.” The six-point scale was used in order to avoid middle option meaning “cannot say” (Clark & Watson, 2016). The inventory took approximately five minutes to complete.

224 When the score was not maximal (i.e. below six), cognitive interviews were conducted to
225 identify the difficulty and to ensure that participants interpreted questions as intended
226 (Boateng et al., 2018). During the cognitive interview, the participant verbalized the mental
227 process used to answer (Boateng et al., 2018), then indicated the part of the item that **could**
228 not **be properly understood**. Each cognitive interview took approximately five minutes.

229 *Results and Discussion*

230 This study demonstrated an excellent item **understanding** ($M = 5.93$; $SD = .25$; data are
231 described in detail in **Supplementary file 1**). No item was assessed below 5.50. Among items
232 not achieving the maximal score, **the** cognitive interviews revealed that participants were not
233 completely sure of the meaning of some terms (e.g. “*distracted*”, “*I felt*”, and “*I happened*”).
234 After the cognitive interview, **the** first author concluded systematically that participants
235 interpreted questions as intended, and **an** agreement on the meaning proposed by the first
236 author was **reached**. These outcomes attested the clarity and proper understanding **of the 20**
237 **items** by **the** teenagers (Clark & Watson, 2016). Due to **the** high scores **obtained** in regard to
238 **the** item clarity and understanding, no item modification has been undertaken after this first
239 round of interviews (during which few new insights have emerged; Boateng et al., 2018). The
240 pool of **the 20** selected items were validated as such by **the panel of experts**. **Our following**
241 **studies have tested their psychometric properties**.

243 **Study 2**

244 This second study aimed **at assessing** the structural aspect (Messick, 1995) of the SSAQ **by**
245 exploring its **factor** structure. This step determined the optimal number of factors that **could** fit
246 the pool of items, by examining the covariance that existed between all the scale items. This
247 step may also reduce the number of items (Boateng et al., 2018).

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Study 2: Methods

Participants and Procedure

The participants consisted in 164 sport sciences students ($M_{age} = 19.63$ years; $SD_{age} = 2.10$), including 43 women and 121 men. The survey was administered during a regular weekly sport practice that took place at the university’s sports department. The first author distributed the surveys immediately after a sport situation. The teacher was present but did not interact with the students. The inventory took approximately five minutes to complete. Sports practice included athletics ($n = 35$), baseball ($n = 27$), basketball ($n = 47$), and American football ($n = 55$).

Measures

Demographic information. Participants indicated their age, gender (i.e. men, women, or other), and sports experience (i.e. no practice, and regular practice).

SSAQ. Answers were collected on a seven-point Likert scale ranging from one “absolutely not agree” to seven “absolutely agree” to increase the usability of the collected data. This ranging scale seemed the most appropriate (Boateng et al., 2018), as a five-point scale seemed too restrictive in regard to extreme values (i.e. one and five) and more than seven points on the scale could lead to problems of interpretation (Cohen et al. 2013).

Data Analysis

Data analysis were conducted using SPSS 22. Missing values were analyzed and univariate normality distribution was examined. The factorability of the data was tested using Bartlett’s test of sphericity, which should be significant ($p < .05$; Dziuban & Shirkey, 1974). The

sampling adequacy was tested using the Kaiser-Meyer-Olkin's test (KMO), which should be higher than .80 (Dziuban & Shirkey, 1974). Based on the theoretical definition of an attentive sport participant, we had an a priori understanding of the number of factors to retain, expecting two (e.g. concentration/distraction) or four-factor (e.g. concentration related to the task, concentration related to the teacher, distraction related to the task, distraction related to the teacher). However, the extraction method used in SPSS software had not previously specified the number of factor to retain. Scree plot inspection method (Cattell, 1966) conjointly with Minimum Average Partial method (MAP; Velicer, 1976) were used to decide how many factors to retain (Costello & Osborne, 2005; Izquierdo et al., 2014). Exploratory Factor Analysis (EFA) with maximum likelihood factors extraction were conducted (Gaskin & Happell, 2014). Oblimin rotation was chosen because of the likelihood that the factors might be correlated. The following indicators were used and their satisfactory cut points are mentioned in brackets: factor loading ($> .40$; Costello & Osborne, 2005), no salient cross-loading (i.e. item loading at .32 or higher on two or more factors; Costello & Osborne, 2005) and total variance explained ($> 50\%$; Tinsley & Tinsley, 1987). Internal consistency of factor dimensions was evaluated with Cronbach's alpha ($\alpha > .80$ = excellent, $.80 > \alpha > .70$ = satisfactory, $.70 > \alpha > .60$ = lower limits; Hair et al., 2010) and inter-correlations were inspected.

Study 2: Results and discussion

Preliminary Analysis

Ten items presented missing data without exceeding 2.4%. Therefore, a list-wise deletion was applied (Garson, 2015). A scoring distribution analysis showed that univariate normality (scoring distribution of each item are available in Supplementary file 2) was not achieved for eight items (skewness range: -4.37 to 12.14; kurtosis range: -3.48 to 14.36). Despite the fact

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3 296 that the assumption of normality was not met, the EFA with maximum likelihood method was
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5 297 fairly robust, justifying its use (Gaskin & Happell, 2014).
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10 299 *Exploratory factor analysis of the 20-SSAQ*
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12 300 The sampling was adequate (KMO = .86). Bartlett’s test showed no problem of sphericity (χ^2
13 301 (190) = 1426.55, $p < .01$). An examination of the scree plot of the initial eigenvalues and the
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15 302 MAP method indicated that a four-factor structure should be retained. The percentage of total
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17 303 variance explained by the extracted four factors was 63.43%. EFA with maximum likelihood
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19 304 method and Oblimin rotation was generated with a four-factor structure (Table 1). The items
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21 305 were clustered into the following four categories, which the previously mentioned expert
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23 306 panel had labeled as: (I) concentration on the task, (II) concentration due to the teacher, (III)
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25 307 distraction away from the task, and (IV) distraction toward the teacher. No cross loading was
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27 308 observed and items loaded highly, excepted item 3 (i.e. “*I made mistakes of inattention*”) and
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29 309 item 20 (i.e. “*I directed more my attention to the teacher than to the exercise*”). Item 3 loaded
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31 310 below the cut point of .40 on the category labelled distraction away from the task and item 20
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33 311 loaded weakly on the category labelled concentration due to the teacher, whereas the expert
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35 312 panel formulated item 20 in reference to the distraction toward the teacher (Table 1). Internal
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37 313 consistency of each factor dimensions was satisfactory, and inter-item correlations within
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39 314 factor dimensions varied between .44 and .68 for the factor I ($\alpha = .88$), between .52 and .64
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41 315 for the factor II ($\alpha = .87$). The factor III ($\alpha = .75$) showed inter-item correlations between .42
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43 316 and .57, except item 3 (between .04 and .32). The factor IV ($\alpha = .75$) showed inter-item
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45 317 correlations between .39 and .53, except item 20 (between .18 and .35). Considering the weak
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47 318 factor loading of item 3 and item 20 and their low inter-correlations, a second analysis was
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49 319 conducted without them (Little et al., 1999).
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321 *Exploratory factor analysis of the 18-SSAQ*

322 The sampling was adequate (KMO = .87). Bartlett's test showed no problem of sphericity (χ^2
323 (153) = 1369.28, $p < .01$). Examination of the scree plot of the initial eigenvalues and the
324 MAP method again indicated that a four-factor structure should be retained. The total
325 percentage of variance explained by extracted four factors was improved to 67.49%. EFA
326 with maximum likelihood method and Oblimin rotation was generated with a four-factor
327 structure. The items were clustered into the same four categories as labelled above. No cross
328 loading was observed and all item loaded highly on its intended factor (Table 1). Internal
329 consistency improved for the factor dimensions III ($\alpha = .77$) and IV ($\alpha = .79$), as well as their
330 inter-item correlations (between .39 and .53 for the factor dimension III and between .42 and
331 .57 for the factor dimension IV). To summarize, EFA on the 18-SSAQ version was more
332 adequate, showing better sampling adequacy, better four-factor structure with all items
333 loading highly on only one factor, and higher total explained variance. Reliability analysis
334 showed better internal consistency and inter-correlations. Each factor entailed the minimum
335 of four items, which is a key aspect in scale development because it ensures an adequate
336 internal consistency reliability (Clark & Watson, 2016). Consequently, the version with 18
337 items entailing four factors has been retained: concentration on the task (CTASK),
338 concentration due to the teacher (CTEACHER), distraction away from the task (DISTASK),
339 and distraction toward the teacher (DSTEACHER). These four factors were in line with the
340 definition of an attentive sport participant. The factors concentration on the task and
341 concentration due to the teacher referred to "focus on the relevant cues (e.g. the task, the
342 supervisor's instructions)." The factors distraction away from the task and distraction toward
343 the teacher referred to "being not distracted by irrelevant cues (e.g. distractors linked to the
344 task, distraction linked to the supervisor)."

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[Table 1 near here]

Study 3

The third study aimed at assessing the structural aspect and the external aspect of the SSAQ validity (Messick, 1995) with sport sciences students, confirming the factor structure of the SSAQ and testing the concurrent validity of the scale on state anxiety. The second goal of this study was to assess the generalizability aspect of the SSAQ validity (Messick, 1995). Therefore, social desirability was controlled because of the human tendency to present oneself in the best possible way could significantly distort the information obtained through self-assessments (Van de Mortel, 2008). Finally, measurement invariance was examined to determine if the four-factor structure of the SSAQ was the same across gender groups. Then, differences in score according to the gender were examined, because this consideration is commonplace in the sport group dynamics literature, frequently identifying gender as moderation variable (Benson & Eys, 2017), and because gender differences has been shown to influence cognitive ability (Alavi et al., 2019). Differences in score according to the sport experience were also examined because attentional behaviors could differ between an expert practicing with more automatic attention and a novice practicing with more controlled attention (Abernethy et al., 2007).

Study 3: Methods

Participants and Procedure

As the data collection in Study 2 and Study 3 were on different campuses or sports premises, no participants had the opportunity to take part in both data collections. In Study 3, the participants were 216 sports sciences students ($M_{age} = 18.91$ years; $SD_{age} = 1.30$), including 96 women and 120 men. The first author distributed the surveys immediately after a sport

370 situation during a regular weekly sport practice at the university's sports department. The
371 teacher was present but did not interact with the students. The inventory took approximately
372 ten minutes to complete. Sports practices were swimming ($n = 19$), floor gymnastics ($n = 15$),
373 French boxing ($n = 28$), volleyball ($n = 109$), badminton ($n = 20$), and tennis ($n = 25$).

374

375 *Measures*

376 **Demographic information.** Participants indicated their age, gender (i.e. men, women, or
377 other), and sports experience (i.e. no practice, and regular practice).

378 **SSAQ.** Answers to 18 items were on a Likert scale of seven points ranging from one
379 “absolutely not agree” to seven “absolutely agree.”

380 **State anxiety.** The French version of the Competitive State Anxiety Inventory-2 (CSAI-2;
381 Cury et al., 1999) is a global measure of state anxiety adapted to sport competition and
382 includes three subscales: self-confidence (nine items; e.g. “I was confident.”), cognitive state
383 anxiety (seven items; e.g. “I was afraid of failing.”), and somatic state anxiety (seven items;
384 e.g. “I felt my stomach tighten.”). Answers were on a Likert scale of four points ranging from
385 one “not at all” to four “much.” This French version of the CSAI-2 has been validated in a
386 sport context with middle school and high school students, sport science students and elite
387 athletes (Cury et al., 1999). This scale has been previously used by Arous et al. (2013) with a
388 population of 320 practitioners of individual and team sports ($M_{age} = 19.37$ years; $SD_{age} =$
389 1.26), including 160 women and 160 men. This study reported satisfactory internal
390 consistency for self-confidence ($\alpha = .93$), cognitive state anxiety ($\alpha = .89$), and somatic state
391 anxiety ($\alpha = .82$). In a PE context, this scale has been used by Isoard-Gauthier et al. (2010)
392 with 461 middle school and high school students ($M_{age} = 15.68$; $SD_{age} = 1.17$), including 213

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women and 248 men. Isoard-Gauthier et al. (2010) reported satisfactory internal consistency for self-confidence ($\alpha = .79$), cognitive **state** anxiety ($\alpha = .79$), and somatic **state** anxiety ($\alpha = .74$).

Social desirability. The Marlowe-Crowne Social Desirability scale form C (Reynolds, 1982) evaluates social desirability with 13 items. Participants rated “*true*” or “*false*” to answers concerning **their** personal attitudes (e.g. “*I am always courteous, even to people who are disagreeable*”). The present study used a French adaptation, which have been administered by Verardi et al. (2010) with 697 participants ($M_{age} = 32.14$; $SD_{age} = 13.76$), including 370 women and 327 men. **The authors reported a** satisfactory internal consistency ($\alpha = .63$).

Data Analysis

Data analysis were performed using SPSS Amos 22. Missing values were inspected and univariate normality distribution was tested. A confirmatory **factor** analysis (CFA) with maximum likelihood robust estimator was applied on the SSAQ to confirm the structure of the scale. **A CFA were also conducted with the CSAI-2 and the social desirability scale.** Following adjustments indices were used and their satisfactory cut-off points are mentioned in brackets (Hu & Bentler, 1999): the chi-square fit index (χ^2), Comparative Fit Index and Tucker-Lewis Index (CFI and TLI $> .90$ were satisfactory and $> .95$ were excellent), Root Mean Square Error of Approximation (RMSEA $< .08$ indicated adequate model, $< .06$ excellent fit), and RMSEA 90% confidence intervals. To test the measurement model’s reliability, the composite reliability (CR $> .70$; Hair et al., 2016) was examined in addition to the internal consistency using Cronbach’s alpha. To complete the structure analysis, convergent validity was assessed using the Average Variance Extracted (AVE $> .5$) and divergent validity was assessed using the Average Shared Variance (ASV $< AVE$; Hair et al.,

2016). External aspect of the SSAQ validity was inspected, testing the concurrent validity of the scale with Pearson's correlations between the SSAQ **factor** dimensions and the CSAI subscales (coefficients r ranging between .10 – .30 = small effect, .30 – .50 = medium effect, and $\geq .50$ = large effect; Cohen, 2013). To test the bias of social desirability, Person's correlations and a one-way ANOVAs were conducted. To determine if the four-factor structure of the SSAQ was the same across gender groups (i.e. women and men), configural invariance (i.e. same **factor** structure across groups), metric invariance (i.e. same factor loadings across groups), and scalar invariance (i.e. same item intercepts across groups) were examined, using multiple groups CFA. Metric invariance was tested once configural invariance was established, and scalar invariance was tested once metric invariance was established. We compared models by examining χ^2 , CFI, TLI, and RMSEA differences. There was no invariance when changes in CFI and TLI were $< .01$ and increases in RMSEA were $< .015$ (Chen, 2007). Strong measurement invariance was demonstrated when all three tests showed invariance. Then, to examine the scale sensitivity to gender and sport experience, one-way ANOVAs were conducted. For all statistical tests, the significance level was set at $p < .05$.

Study 3: Results and discussion

Preliminary analysis

Between 0% and 1.9% of missing data per variable were observed. Since the missing data were considered as missing completely at random (MCAR; $p > .05$; Little, 1988), data were estimated using full information Maximum Likelihood estimation (ML; Garson, 2015). Scoring distribution analysis showed that univariate normality (scoring distribution of each item are available in **Supplementary file 2**) was not achieved for nine items (skewness range: -7.18 to 16.07; kurtosis range: -4.18 to 23.56). **CFA with the social desirability scale supported**

adequate model fit (Supplementary file 3). CFA with CSAI-2 indicated that the item 4 (i.e. “*I am agitated*”) loaded negatively in its intended factor (i.e. somatic state anxiety). We therefore applied a CFA with the CSAI-2 excluding item 4, which presented an acceptable model fit (Supplementary file 3). Item 4 was excluded from the following analysis. The Cronbach’s alpha of CSAI-2 subscales and social desirability scale were satisfactory (ranging from .64 to .91; Table 3).

Confirmation of the Factor Structure

The model fit was adequate ($\chi^2 = 297.6$, $df = 129$, $p < .001$, TLI = .90, CFI = .91, RMSEA = .08, LO 90% = .07, HI 90% = .09) and the standardized factor loadings were between .55 and .89 (model data are described in detail in Supplementary file 4). Modification indices (MI) indicated the model fit could be improved, if the error covariance between two items from the concentration due to the teacher (i.e. item 6 “*I felt that the teacher was helping me to be concentrated on the exercise*”, and 18 “*I felt that the teacher was helping me focus better*”) was free to co-vary (MI = 22.27). Because these items were theoretically close, the final model included these specifications. The new model (Figure 1) showed a better fit to the data: $\chi^2 = 255.89$, $df = 128$, $p < .001$, TLI = .92, CFI = .93, RMSEA = .07, LO 90% = .06, HI 90% = .08. The standardized factor loadings were between .55 and .89.

[Figure 1 near here]

Validity, Reliability, Outcomes Correlations, Measurement Invariance and Sensitivity

Cronbach’s alphas, factor correlations, CR, AVE, ASV, means and standard deviations are presented in Table 2. AVE were above .05 and ASV below their respective AVE, meeting the requirements for convergent validity and divergent validity. All factor dimensions presented a

satisfactory reliability with all CR above .70. Correlations between each **factor** dimensions were almost all significant. Concentration **factor** dimensions had significant and negative relationships with distraction away from the task. Concentration **factor** dimensions were positively related to each other as well as distraction **factor** dimensions. All Cronbach's alpha were above .70, meeting the requirements for internal consistency.

[Table 2 near here]

Correlations with the CSAI-2 confirmed the concurrent validity of the SSAQ (Table 3). Low positive correlations between distraction away from the task and somatic **state** anxiety, and between distraction toward the teacher and cognitive **state** anxiety and somatic **state** anxiety were found. Low negative correlations between distraction away from the task and self-confidence were also observed. These results were in line with previous studies showing that **state** anxiety was related to distractibility, but especially when stimuli was threat related (Eysenck et al., 2007). This could explain why the correlations with the distraction **factor** dimensions were low, because the teacher was considered as a factor of **state** anxiety, but probably not as a threat. Usually, **state** anxiety is related to distraction (Eysenck & Wilson, 2016; Grossbard et al., 2009), and interacts less with the willingness of focusing on the task or the teacher. Another explanation of the weak correlations with SSAQ factors could be related to the calculation of Pearson's correlations, relying on the covariance of two variables divided by the product of their standard deviation (Bishara & Hittner, 2015). The high skewness and high kurtosis, due to floor and ceiling effects (Supplementary file 2), could have limited the correlation effect (Bishara & Hittner, 2015).

[Table 3 near here]

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5 493 Concerning the measurement invariance models of the SSAQ, the $\Delta\chi^2$ (Δdf) was not
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8 494 significant for both models. CFI, TLI and RMSEA changes were $< .01$ (Table 4). We have
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10 495 concluded that factor structure, factor loadings, and item intercepts remained invariant across
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12 496 gender. Then, SSAQ sensibility was tested using one-way ANOVAs. Levene statistic
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14 497 indicated that assumption of variance homogeneity was not violated ($p > .05$). Results
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16 498 showed a significant difference on concentration due to the teacher ($F(1,215) = 5.57, \eta^2 = .03,$
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18 499 $p = .02$), with women ($n = 96; M = 5.08; SD = 1.33$) more concentrated due to the teacher
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20 500 than men ($n = 120; M = 4.62; SD = 1.49$). Similar results were found among elementary
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22 501 students, showing that girls demonstrated higher level of attention than boys (Alavi et al.,
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24 502 2019; Grossbard et al., 2009). In addition, women may have been more concentrated because
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26 503 they tend to be more learning goal oriented (Anderman & Young, 1994), whereas men tend to
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28 504 be less self-disciplined (Zimmerman & Martinez-Pons, 1990). Therefore, future research
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30 505 using the SSAQ should consider the influence of gender.
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37 507 [Table 4 near here]

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42 509 Concerning the influence of social desirability, one-way ANOVAs were conducted based on
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44 510 the median value which separated the sample into two groups. Students with a score of social
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46 511 desirability under seven (median value) were included in the fewest desirable ones' group.
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48 512 Inversely, students with a score of social desirability above seven were included in the most
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50 513 desirables ones' group. Levene statistic indicated that assumption of variance homogeneity
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52 514 was not violated ($p > .05$). A significant difference was found on distraction away from the
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54 515 task ($F(1,215) = 6.84, \eta^2 = .03, p = .01$), with the most desirable ones ($n = 104; M = 2.95; SD$
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56 516 $= 1.48$) having a lower distraction scores than the fewest desirable ones ($n = 112; M = 3.51;$
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517 $SD = 1.64$). Results also showed low negative correlations with distraction away from the task
518 and distraction toward the teacher. Students' distraction would be related to social desirability
519 because students' indicators such as attention, interest and task execution have been
520 considered as relevant for teachers (Durand, 1996) yielding items as socially sensitive (Van
521 de Mortel, 2008). Students with high social desirability may have modified their answer in
522 order to appear less distracted and therefore to build a good reputation with their teacher.
523 Although this bias could be low, some precautions should be taken. During the instructions
524 given to sport participants, investigators should emphasize that the data will be collected and
525 held anonymously (Randall & Fernandes, 1991). Participants could fill out a social
526 desirability scale allowing to control the characteristics of the study sample. It may be
527 envisaged as well that the supervisor will be absent when the sport participants answer the
528 questionnaire.

529 Finally, one-way ANOVAs were conducted with sport experience outside school as a group
530 variable. Two groups were distinguished: no practice ($n = 40$) and regular practice ($n = 176$).
531 Levene statistic indicated that assumption of variance homogeneity was not violated ($p >$
532 $.05$). There was no significant difference between the two groups ($p > .05$). Despite this result,
533 future studies should consider the influence of sport experience because the sample was small
534 and subsequent studies may find differences.

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536 **Study 4**

537 This fourth study aimed at confirming the factor structure of the SSAQ and assessing its
538 reliability with high school students in a PE context. This study completed the assessment of
539 the structural aspect of the SSAQ (Messick, 1995), examining its validity in another relevant
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Study 4: Methods

Participants and Procedure

The participants consisted in 481 high school students ($M_{age} = 15.40$ years; $SD_{age} = .87$), including 317 girls and 161 boys (3 did not specify their gender), from 23 different high schools. A single class from each school took part in the study, based on the PE teachers' approval. The first author distributed the surveys immediately after a sport situation (after a warm-up) during a regular PE lesson. The teacher was present but did not interact with the students. Participants answered the SSAQ on a Likert scale of seven points ranging from one “absolutely not agree” to seven “absolutely agree.” The inventory took approximately five minutes to complete. Sports practices were athletics ($n = 33$), climbing ($n = 23$), rugby ($n = 21$), volleyball ($n = 27$), basketball ($n = 55$), team handball ($n = 30$), table tennis ($n = 15$), artistic gymnastics ($n = 54$), badminton ($n = 64$), step ($n = 46$), and strength training ($n = 113$).

Data Analysis

Data analysis were conducted using the statistics software SPSS Amos 22. Missing values were examined and univariate normality distribution was analyzed. A CFA with maximum likelihood robust estimator was applied on the SSAQ to confirm the structure of the scale, using the same criteria described in Study 3. The measurement model's reliability was tested by examining the composite reliability, the internal consistency of each factor dimension, the convergent validity, and the divergent validity, with the same criteria described in Study 3.

564 ***Study 4: Results and discussion***

565 *Preliminary analysis*

566 Between 0% and 1.9% of missing data per variable were observed. Since the missing data
567 were considered as MCAR ($p > .05$; Little, 1988), data were estimated using full information
568 ML estimation (Garson, 2015). Scoring distribution analysis showed that univariate normality
569 (scoring distribution of each item are available in Supplementary file 2) was not achieved for
570 14 items (skewness range: -10.39 to 19.75; kurtosis range: -6.44 to 18.14).

572 *Confirmation of the **Factor Structure***

573 The model fit was adequate ($\chi^2 = 321.55$, $df = 129$, $p < .001$, $TLI = .94$, $CFI = .95$, $RMSEA =$
574 $.06$, $LO\ 90\% = .05$, $HI\ 90\% = .06$) and the standardized factor loadings were between $.44$ and
575 $.82$ (model data are described in detail in Supplementary file 4) **in a sport situation**. As was
576 the case in the CFA of Study 3, MI indicated the model fit could be improved if the error
577 covariance between two items from the concentration due to the teacher (i.e. item 6 “*I felt*
578 *that the teacher was helping me to be concentrated on the exercise*”, and 18 “*I felt that the*
579 *teacher was helping me focus better*”) was free to co-vary ($MI = 22.34$). Because these items
580 were theoretically close and in line with the CFA of Study 3, these specifications were
581 accepted. The new model (Figure 2) showed a better fit to the data: $\chi^2 = 285.38$, $df = 128$, $p <$
582 $.001$, $TLI = .95$, $CFI = .96$, $RMSEA = .05$, $LO\ 90\% = .04$, $HI\ 90\% = .06$). The standardized
583 factor loadings were between $.44$ and $.83$.

585 **[Figure 2 near here]**

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Validity and Reliability

Cronbach’s alphas, factor correlations, CR, AVE, ASV, means and standard deviations are presented in Table 5. AVE were above .05 and ASV below their respective AVE, meeting the requirements for convergent validity and divergent validity. All factor dimensions presented a satisfactory reliability with all CR above .70. All factor correlations were significant. Concentration factor dimensions showed significant and negative relationships with distraction factor dimensions. Concentration factor dimensions were positively related to each other as well as distraction factor dimensions. All Cronbach’s alpha scored above .70, and showed a correct internal consistency.

[Table 5 near here]

General Discussion

The purpose of the present work was to develop a self-reported measurement of sport participants’ concentration/distraction. In the current set of studies, we offered a definition of an attentive sport participant, which could be useful to better understand how to maximize sport participants’ concentration and reduce distraction. We then developed a self-reported measurement to capture the sport participants’ level of concentration/ distraction.

Four separate studies provided evidence for the construct validity of the SSAQ. Study 1 provided a definition of attentive sport participant, and developed 50 items. Based on the definition, the panel of experts’ evaluations refined the initial pool of items to 20 items. Cognitive interviews with sport sciences students ensured the content validity of this initial pool of 20 items. Study 2 provided evidence for the four-factor structure of the SSAQ subscales (i.e. concentration on the task, concentration due to the teacher, distraction away from the task, and distraction toward the teacher). Refining the scale to 18 items, by

considering factor loading in EFA and inter-correlations, the SSAQ respected the minimum of four items for each factor (Clark & Watson, 2016). Study 3 provided evidence for the **factor**, convergent and divergent validity of the subscales, and found support for measurement invariance according to the gender. Study 3 also supported concurrent validity, as **state anxiety** was correlated with **the** distraction subscales. Study 4 demonstrated a consistently good factor structure of the SSAQ **across a sample of high school students during a PE sport situation**. Finally, studies 2, 3 and 4 demonstrated satisfactory internal consistency reliability of the SSAQ.

A noteworthy feature of the SSAQ is its adaptability to several sport situations context. This adaptability results from the wordings of the items that are easily tailored to academic or organized sport situation (e.g. using “coach” instead of “teacher”; Riou et al., 2012). As a result, the SSAQ is a somewhat short instrument (18 items) that can be easily used to measure sport participants’ concentration and distraction during different sport situations, such as PE course, sport lesson in higher education, sport training in club and sport programs for health and well-being (Riou et al., 2012).

Another important strength of the SSAQ is that this questionnaire considers the concentration/distraction with the task and the **supervisor**, **as** an aspect which has never been considered **before**, when capturing **sport participants’** concentration with self-reported measures (Maldonado et al., 2019; Ntoumanis, 2005; Solmon & Lee, 1997; Standage et al., 2005; Zhang et al., 2012). From a theoretical standpoint, the SSAQ will allow researchers to test various theories and pedagogical practices **that can improve sport participants’** concentration and reduce **sport participants’** distraction. For example, using self-determination theory (Ryan & Deci, 2017), the following sequence could be investigated: motivational climate – basic psychological need satisfaction/frustration – self-determined motivation – concentration/distraction. Similar causal sequences have been previously tested

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3 637 with concentration (Maldonado et al., 2019; Ntoumanis, 2005; Standage et al., 2005).
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5 638 However, **none of these authors** have considered **sport participants'** distraction. **Besides**, few
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7 639 studies have focused on how self-determined behaviours influence cognitive variables
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9 640 (Vasconcellos et al., 2020). The SSAQ and self-determination theory combined offer
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11 641 possibilities to begin inspecting the effects of motivational climate in sport participants'
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13 642 concentration/distraction. **By** developing and validating the SSAQ **as well**, we have attempted
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15 643 to fill a theoretical gap and a lack of psychometric scale in sport situations.
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17 644 However, although all studies in this paper provided evidence for the validity and reliability
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19 645 of the SSAQ, **our work also have some** limitations. Items asymmetry and kurtosis are high in
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21 646 all **of** the studies. The **factor** dimension distraction toward the teacher also presented high
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23 647 skewness and kurtosis in all the studies. In accordance with these results (Terwee et al.,
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25 648 2007), the response frequencies for each item in each study (presented in **Supplementary file**
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27 649 **2**), have underlined floor and ceiling effects (i.e. when more than 15% of participants
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29 650 achieved the lowest or highest possible score; Terwee et al., 2007). This result could be
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31 651 explained because **the supervisor** did not adopted distracting behaviors. It would be
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33 652 interesting **to examine the concurrent validity of the SSAQ during anxiety-inducing situations**
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35 653 **in sport**, fostering **sport participant's state** anxiety that may increase distraction (Eysenck &
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37 654 Wilson, 2016) and may disrupt concentration (Smith et al., 2006). In the same vein,
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39 655 concurrent validity should be also tested with **other** variables **such** as reaction time or other
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41 656 psychological variables, in order to improve evidence of the SSAQ validity. Furthermore,
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43 657 although validity and reliability of the SSAQ were also investigated among high school
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45 658 students ($M_{age} = 15.40$ years; $SD_{age} = .87$), the content validity of the SSAQ was established
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47 659 with university students aged around 18 to 19 years. The SSAQ questionnaire interpretation
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49 660 may be different across age groups. Future **research** should run invariance analysis to examine
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51 661 the role of age gap in the measurements of these four **factor** dimensions. Another limitation of
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the present research is that the SSAQ relies on students' perceptions of whether they felt concentrated and distracted during the sport situation. With any self-reported measure, there are always concerns with memory recall, social desirability and the truthfulness of responses (Brenner & DeLamater, 2014). For example, Study 3 found that the distraction factor dimensions were slightly affected by the social desirability response bias.

In conclusion, the present studies provided evidence for the validity and reliability of the SSAQ. The SSAQ could be used to conduct research with individuals during a sport situation implying a supervisor, aiming at assessing the predictors and consequences of sport participants' concentration and distraction on various variables such as emotion, motivation, learning, and performance. The SSAQ fosters initiatives such as exploring the role of pedagogical strategies during sport situations on sport participants' concentration and distraction. The SSAQ could also be used by supervisors to evaluate the level of concentration and distraction of individuals during a sport situation.

Disclosure statement

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References

- Abernethy, B., Maxwell, J. P., Masters, R. S. W., Van der Kamp, J., & Jackson, R. C. (2007). Attention processes in skill learning and expert performance. In G. Tenenbaum & R. C. Eklund (Éds.), *Handbook of Sport Psychology, 3rd Ed.* Wiley.
- Alavi, M., Seng, J. H., Mustaffa, M. S., Ninggal, M. T., Amini, M., & Latif, A. A. (2019). Attention, impulsiveness, and gender in academic achievement among typically developing children. *Perceptual and Motor Skills, 126*(1), 5-24.
<https://doi.org/10.1177/0031512518809163>

- 1
2
3 688 Anderman, E. M., & Young, A. J. (1994). Motivation and strategy use in science : Individual
4 689 differences and classroom effects. *Journal of Research in Science Teaching*, 31(8),
5 690 811-831. <https://doi.org/10.1002/tea.3660310805>
6
7 691 Arous, I., Baccouche, M. A., Trabelsi, K., Masmoudi, L., & Elloumi, A. (2013). Effect of
8 692 gender and type of sport on anxiety and self-esteem. *International Journal of*
9 693 *Humanities and Social Science Invention*, 2(3), 55-61.
10
11 694 Benson, A. J., & Eys, M. (2017). Understanding the consequences of newcomer integration
12 695 processes : The sport team socialization tactics questionnaire. *Journal of Sport and*
13 696 *Exercise Psychology*, 39(1), 13-28. <https://doi.org/10.1123/jsep.2016-0182>
14
15 697 Bishara, A. J., & Hittner, J. B. (2015). Reducing Bias and Error in the Correlation Coefficient
16 698 Due to Nonnormality. *Educational and Psychological Measurement*, 75(5), 785-804.
17 699 <https://doi.org/10.1177/0013164414557639>
18
19 700 Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quinonez, H. R., & Young, S. L.
20 701 (2018). Best practices for developing and validating scales for health, social, and
21 702 behavioral research : A primer. *Frontiers in Public Health*, 6, 149.
22 703 <https://doi.org/10.3389/fpubh.2018.00149>
23
24 704 Brenner, P., & DeLamater, J. (2014). Social desirability bias in self-reports of physical
25 705 activity : Is an exercise identity the culprit? *Social Indicators Research: An*
26 706 *International and Interdisciplinary Journal for Quality-of-Life Measurement*, 117(2),
27 707 489-504. <https://doi.org/10.1007/s11205-013-0359-y>
28
29 708 Brewer, B. W., Van Raalte, J. L., & Linder, D. E. (1996). Attentional focus and endurance
30 709 performance. *Applied Research in Coaching and Athletics Annual*, 11, 1-14.
31
32 710 Brick, N., MacIntyre, T., & Campbell, M. (2014). Attentional focus in endurance activity :
33 711 New paradigms and future directions. *International Review of Sport and Exercise*
34 712 *Psychology*, 7(1), 106-134. <https://doi.org/10.1080/1750984X.2014.885554>
35
36 713 Calmels, C., Berthoumieux, C., & d'Arripe-Longueville, F. F. (2004). Effects of an imagery
37 714 training program on selective attention of national softball players. *The Sport*
38 715 *Psychologist*, 18(3), 272-296. <https://doi.org/10.1123/tsp.18.3.272>
39
40 716 Camiré, M. (2015). Examining High School Teacher-Coaches' Perspective on Relationship
41 717 Building With Student-Athletes. *International Sport Coaching Journal*, 2(2), 125-136.
42 718 <https://doi.org/10.1123/iscj.2014-0098>
43
44 719 Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral*
45 720 *Research*, 1(2), 245-276. https://doi.org/10.1207/s15327906mbr0102_10
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 721 Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance.
 722 *Structural Equation Modeling: A Multidisciplinary Journal*, 14(3), 464-504.
 723 <https://doi.org/10.1080/10705510701301834>
- 724 Clark, L. A., & Watson, D. (2016). Constructing validity : Basic issues in objective scale
 725 development. In A. E. Kazdin (Éd.), *Methodological issues and strategies in clinical*
 726 *research* (p. 187-203). American Psychological Association.
 727 <https://doi.org/10.1037/14805-012>
- 728 Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, instruction, and research.
 729 *Educational Evaluation and Policy Analysis*, 25(2), 119-142.
 730 <https://doi.org/10.3102/01623737025002119>
- 731 Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic Press.
- 732 Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education*. Routledge.
- 733 Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis : Four
 734 recommendations for getting the most from your analysis. *Practical Assessment,*
 735 *Research, and Evaluation*, 10(7), 86-99. <https://doi.org/10.4135/9781412995627.d8>
- 736 Cury, F., Sarrazin, P., Pérès, C., & Famose, J. P. (1999). Mesurer l'anxiété du sportif en
 737 compétition : Présentation de l'Echelle d'Etat d'Anxiété en Compétition (EEAC)
 738 [Measuring the athlete's anxiety in competition : Presentation of the Competitive State
 739 Anxiety Inventory-2 (CSAI-2)]. In C. Le Scanff & J. P. Famose (Éds.), *La gestion du*
 740 *stress : Entraînement et compétition* (p. 47-53). Dossier EPS.
- 741 Durand, M. (1996). *L'enseignement en milieu scolaire [Teaching in school context]*. Presses
 742 universitaires de France.
- 743 Dziuban, C. D., & Shirkey, E. C. (1974). When is a correlation matrix appropriate for factor
 744 analysis? Some decision rules. *Psychological Bulletin*, 81(6), 358-361.
 745 <https://doi.org/10.1037/h0036316>
- 746 Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance : The processing
 747 efficiency theory. *Cognition and Emotion*, 6(6), 409-434.
 748 <https://doi.org/10.1080/02699939208409696>
- 749 Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive
 750 performance : Attentional control theory. *Emotion*, 7(2), 336-353.
 751 <https://doi.org/10.1037/1528-3542.7.2.336>

- 752 Eysenck, M. W., & Wilson, M. R. (2016). Sporting performance, pressure and cognition. In
 753 D. Groome & M. Eysenck (Éds.), *An Introduction to applied cognitive psychology* (p.
 754 329-350). Routledge.
- 755 Fournier, J., Gaudreau, P., Demontrond-Behr, P., Visioli, J., Forest, J., & Jackson, S. (2007).
 756 French translation of the Flow State Scale-2 : Factor structure, cross-cultural
 757 invariance, and associations with goal attainment. *Psychology of Sport and Exercise*,
 758 8(6), 897-916. <https://doi.org/10.1016/j.psychsport.2006.07.007>
- 759 French, R. B. (1997). The teacher as container of anxiety : Psychoanalysis and the role of
 760 teacher. *Journal of Management Education*, 21(4), 483-495.
 761 <https://doi.org/10.1177/105256299702100404>
- 762 Garson, G. D. (2015). *Missing values analysis & data imputation*. Statistical Associates
 763 Publishers.
- 764 Gaskin, C. J., & Happell, B. (2014). On exploratory factor analysis : A review of recent
 765 evidence, an assessment of current practice, and recommendations for future use.
 766 *International Journal of Nursing Studies*, 51(3), 511-521.
 767 <https://doi.org/10.1016/j.ijnurstu.2013.10.005>
- 768 Grobe, R. P., & Pettibone, T. J. (1975). Effect of instructional pace on student attentiveness.
 769 *The Journal of Educational Research*, 69(4), 131-134.
 770 <https://doi.org/10.1080/00220671.1975.10884855>
- 771 Grossbard, J. R., Smith, R. E., Smoll, F. L., & Cumming, S. P. (2009). Competitive anxiety in
 772 young athletes : Differentiating somatic anxiety, worry, and concentration disruption.
 773 *Anxiety, Stress, & Coping*, 22(2), 153-166.
 774 <https://doi.org/10.1080/10615800802020643>
- 775 Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). *Multivariate data analysis :
 776 A global perspective*. Upper Saddle River.
- 777 Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least
 778 squares structural equation modeling (PLS-SEM)*. SAGE Publications.
- 779 Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure
 780 analysis : Conventional criteria versus new alternatives. *Structural Equation
 781 Modeling: A Multidisciplinary Journal*, 6(1), 1-55.
 782 <https://doi.org/10.1080/10705519909540118>
- 783 Isoard-Gauthier, S., Oger, M., Guillet, E., & Martin-Krumm, C. (2010). Validation of a
 784 French version of the athlete burnout questionnaire (ABQ). *European Journal of*

- 785 *Psychological Assessment*, 26(3), 203-211. [https://doi.org/10.1027/1015-](https://doi.org/10.1027/1015-5759/a000027)
 786 [5759/a000027](https://doi.org/10.1027/1015-5759/a000027)
- 787 Izquierdo, I., Olea, J., & Abad, F. J. (2014). Exploratory factor analysis in validation studies :
 788 Uses and recommendations. *Psicothema*, 26(3), 395-400.
 789 <https://doi.org/10.7334/psicothema2013.349>
- 790 Leconte, C. (2005). L'attention est-elle éduicable? [Is it possible to teach attention?]. *A.N.A.E.*
 791 *Approche Neuropsychologique des Apprentissages chez l'Enfant*, 17(2[82]), 108-112.
- 792 Little, R. J. A. (1988). A test of missing completely at random for multivariate data with
 793 missing values. *Journal of the American Statistical Association*, 83(404), 1198-1202.
 794 <https://doi.org/10.1080/01621459.1988.10478722>
- 795 Little, T. D., Lindenberger, U., & Nesselroade, J. R. (1999). On selecting indicators for
 796 multivariate measurement and modeling with latent variables : When « good »
 797 indicators are bad and « bad » indicators are good. *Psychological Methods*, 4(2),
 798 192-211. <https://doi.org/10.1037/1082-989X.4.2.192>
- 799 Liukkonen, J., Barkoukis, V., Watt, A., & Jaakkola, T. (2010). Motivational climate and
 800 students' emotional experiences and effort in physical education. *The Journal of*
 801 *Educational Research*, 103(5), 295-308. <https://doi.org/10.1080/00220670903383044>
- 802 Maldonado, E., Zamarripa, J., Ruiz-Juan, F., Pacheco, R., & Delgado, M. (2019). Teacher
 803 autonomy support in physical education classes as a predictor of motivation and
 804 concentration in Mexican students. *Frontiers in Psychology*, 10, 2834.
 805 <https://doi.org/10.3389/fpsyg.2019.02834>
- 806 McCarthy, P. J., Allen, M. S., & Jones, M. V. (2013). Emotions, cognitive interference, and
 807 concentration disruption in youth sport. *Journal of Sports Sciences*, 31(5), 505-515.
 808 <https://doi.org/10.1080/02640414.2012.738303>
- 809 Messick, S. (1995). Validity of psychological assessment : Validation of inferences from
 810 persons' responses and performances as scientific inquiry into score meaning.
 811 *American Psychologist*, 50(9), 741-749. <https://doi.org/10.1037/0003-066X.50.9.741>
- 812 Moran, A. P. (2016). *The psychology of concentration in sport performers : A cognitive*
 813 *analysis*. Psychology Press.
- 814 Müller, S., Vallence, A.-M., & Winstein, C. (2018). Investigation of Perceptual-Motor
 815 Behavior Across the Expert Athlete to Disabled Patient Skill Continuum can Advance
 816 Theory and Practical Application. *Journal of Motor Behavior*, 50(6), 697-707.
 817 <https://doi.org/10.1080/00222895.2017.1408557>

- 1
- 2
- 3 818 Nideffer, R. M. (1976). Test of attentional and interpersonal style. *Journal of Personality and*
- 4 819 *Social Psychology*, 34(3), 394-404. <https://doi.org/10.1037/0022-3514.34.3.394>
- 5 820 Ntoumanis, N. (2005). A prospective study of participation in optional school physical
- 6 821 education using a self-determination theory framework. *Journal of Educational*
- 7 822 *Psychology*, 97(3), 444-453. <https://doi.org/10.1037/0022-0663.97.3.444>
- 8 823 Ocasio, W. (2010). Attention to attention. *Organization Science*, 22(5), 1286-1296.
- 9 824 <https://doi.org/10.1287/orsc.1100.0602>
- 10 825 Posner, M. I. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology*,
- 11 826 32(1), 3-25. <https://doi.org/10.1080/00335558008248231>
- 12 827 Randall, D. M., & Fernandes, M. F. (1991). The social desirability response bias in ethics
- 13 828 research. *Journal of Business Ethics*, 10(11), 805-817.
- 14 829 <https://doi.org/10.1007/BF00383696>
- 15 830 Reynolds, W. M. (1982). Development of reliable and valid short forms of the Marlowe-
- 16 831 Crowne social desirability scale. *Journal of Clinical Psychology*, 38(1), 119-125.
- 17 832 [https://doi.org/10.1002/1097-4679\(198201\)38:1<119::AID-](https://doi.org/10.1002/1097-4679(198201)38:1<119::AID-JCLP2270380118>3.0.CO;2-I)
- 18 833 [JCLP2270380118>3.0.CO;2-I](https://doi.org/10.1002/1097-4679(198201)38:1<119::AID-JCLP2270380118>3.0.CO;2-I)
- 19 834 Riou, F., Boiché, J., Doron, J., Romain, A.-J., Corrion, K., Ninot, G., d'Arripe-Longueville,
- 20 835 F., & Gernigon, C. (2012). Development and validation of the French Achievement
- 21 836 Goals Questionnaire for Sport and Exercise (FAGQSE). *European Journal of*
- 22 837 *Psychological Assessment*, 28(4), 313-320. [https://doi.org/10.1027/1015-](https://doi.org/10.1027/1015-5759/a000112)
- 23 838 [5759/a000112](https://doi.org/10.1027/1015-5759/a000112)
- 24 839 Rowe, A. D., Fitness, J., & Wood, L. N. (2014). The role and functionality of emotions in
- 25 840 feedback at university : A qualitative study. *The Australian Educational Researcher*,
- 26 841 41(3), 283-309. <https://doi.org/10.1007/s13384-013-0135-7>
- 27 842 Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory : Basic psychological needs in*
- 28 843 *motivation, development, and wellness*. Guilford Publications.
- 29 844 Smith, R. E., Smoll, F. L., & Cumming, S. P. (2007). Effects of a motivational climate
- 30 845 intervention for coaches on young athletes' sport performance anxiety. *Journal of*
- 31 846 *Sport and Exercise Psychology*, 29(1), 39-59. <https://doi.org/10.1123/jsep.29.1.39>
- 32 847 Smith, R. E., Smoll, F. L., Cumming, S. P., & Grossbard, J. R. (2006). Measurement of
- 33 848 multidimensional sport performance anxiety in children and adults : The Sport
- 34 849 Anxiety Scale-2. *Journal of Sport and Exercise Psychology*, 28(4), 479-501.
- 35 850 <https://doi.org/10.1123/jsep.28.4.479>
- 36
- 37
- 38
- 39
- 40
- 41
- 42
- 43
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- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 851 Solmon, M. A., & Lee, A. M. (1997). Development of an instrument to assess cognitive
852 processes in physical education classes. *Research Quarterly for Exercise and Sport*,
853 68(2), 152-160. <https://doi.org/10.1080/02701367.1997.10607991>
- 854 Spielberger, C. D. (1972). Anxiety as an emotional state. *Anxiety-current trends and theory*,
855 3-20.
- 856 Spielberger, C. D. (1983). *Manual for the State-Trait Anxiety Inventory STAI (form Y) ('self-*
857 *evaluation questionnaire')*.
- 858 Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in
859 school physical education. *British Journal of Educational Psychology*, 75(3), 411-433.
860 <https://doi.org/10.1348/000709904X22359>
- 861 Terwee, C. B., Bot, S. D. M., de Boer, M. R., Van der Windt, D. A. W. M., Knol, D. L.,
862 Dekker, J., Bouter, L. M., & de Vet, H. C. W. (2007). Quality criteria were proposed
863 for measurement properties of health status questionnaires. *Journal of Clinical*
864 *Epidemiology*, 60(1), 34-42. <https://doi.org/10.1016/j.jclinepi.2006.03.012>
- 865 Tinsley, H. E. A., & Tinsley, D. J. (1987). Uses of factor analysis in counseling psychology
866 research. *Journal of Counseling Psychology*, 34(4), 414-424.
867 <https://doi.org/10.1037/0022-0167.34.4.414>
- 868 Van de Mortel, T. F. (2008). Faking it : Social desirability response bias in self-report
869 research. *Australian Journal of Advanced Nursing*, 25(4), 40-48.
- 870 van der Wel, P., & van Steenbergen, H. (2018). Pupil dilation as an index of effort in
871 cognitive control tasks : A review. *Psychonomic Bulletin & Review*, 25(6), 2005-2015.
872 <https://doi.org/10.3758/s13423-018-1432-y>
- 873 Vasconcellos, D., Parker, P. D., Hilland, T., Cinelli, R., Owen, K. B., Kapsal, N., Lee, J.,
874 Antczak, D., Ntoumanis, N., Ryan, R. M., & Lonsdale, C. (2020). Self-determination
875 theory applied to physical education : A systematic review and meta-analysis. *Journal*
876 *of Educational Psychology*, 112(7), 1444-1469. <https://doi.org/10.1037/edu0000420>
- 877 Velicer, W. F. (1976). Determining the number of components from the matrix of partial
878 correlations. *Psychometrika*, 41(3), 321-327. <https://doi.org/10.1007/BF02293557>
- 879 Verardi, S., Dahourou, D., Ah-Kion, J., Bhowon, U., Tseung, C. N., Amoussou-Yeye, D.,
880 Adjahouisso, M., Bouatta, C., Dougoumalé Cissé, D., Mbodji, M., Barry, O., Minga,
881 D. M., Ondongo, F., Tsokini, D., Rigozzi, C., Meyer de Stadelhofen, F., & Rossier, J.
882 (2010). Psychometric properties of the Marlowe-Crowne social desirability scale in

1
2
3 883 eight African countries and Switzerland. *Journal of Cross-Cultural Psychology*, 41(1),
4 884 19-34. <https://doi.org/10.1177/0022022109348918>
5
6 885 Wilson, M. R., Wood, G., & Vine, S. J. (2009). Anxiety, attentional control, and performance
7 886 impairment in penalty kicks. *Journal of Sport and Exercise Psychology*, 31(6),
8 887 761-775. <https://doi.org/10.1123/jsep.31.6.761>
9
10 888 Wulf, G., & Lewthwaite, R. (2016). Optimizing performance through intrinsic motivation and
11 889 attention for learning : The OPTIMAL theory of motor learning. *Psychonomic Bulletin*
12 890 *& Review*, 23(5), 1382-1414. <https://doi.org/10.3758/s13423-015-0999-9>
13
14 891 Zhang, T., Solmon, M. A., & Gu, X. (2012). The role of teachers' support in predicting
15 892 students' motivation and achievement outcomes in physical education. *Journal of*
16 893 *Teaching in Physical Education*, 31(4), 329-343. <https://doi.org/10.1123/jtpe.31.4.329>
17
18 894 Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated
19 895 learning : Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal*
20 896 *of Educational Psychology*, 82(1), 51-59. <https://doi.org/10.1037/0022-0663.82.1.51>
21
22 897
23
24
25
26
27
28
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Table 1. Exploratory factor analysis with maximum likelihood method and internal consistency (Study 2)

	20-SSAQ Factor				18-SSAQ Factor			
	I	II	III	IV	I	II	III	IV
[I] Concentration on the task	$\alpha = .88^a$				$\alpha = .88^b$			
Item-1. I was concentrated to success the exercise	.78				.76			
Item-5. I was focused on the exercise	.67				.60			
Item-9. I was devoted to realize the exercise	.78				.81			
Item-13. I kept attentive throughout the exercise	.66				.53			
Item-17. I was concentrated to get the exercise done	.79				.73			
[II] Concentration due to the teacher	$\alpha = .87^a$				$\alpha = .87^b$			
Item-2. The teacher directed my attention on what needed to be done	.56				.57			
Item-6. I felt that the teacher was helping me to be concentrated on the exercise	.79				.79			
Item-10. I felt that the teacher knew what to be done in order for me to be concentrated on the exercise	.83				.87			
Item-14. The teacher was able to capture my attention in order to get me involved in the exercise	.67				.68			
Item-18. I felt that the teacher was helping me focus better	.73				.76			
[III] Distraction away from the task	$\alpha = .75^a$				$\alpha = .77^b$			
Item-3 ^C . I made mistakes of inattention	.38							
Item-7. I happened to have my head in the clouds	.55				.60			
Item-11. I happened to be distracted	.76				.77			
Item-15. I happened to think about something else rather than the exercise	.53				.58			
Item-19. I was distracted by external events	.58				.73			
[IV] Distraction toward the teacher	$\alpha = .75^a$				$\alpha = .79^b$			
Item-4. During the exercise, I was distracted by the teacher	.71				.72			
Item-8. I happened to be distracted by what the teacher was doing	.73				.70			
Item-12. Some teacher's explanations distracted me during the exercise	.69				.66			
Item-16. I happened to be distracted by what the teacher was talking about	.67				.67			
Item-20 ^C . I directed more my attention to the teacher than to the exercise	.32							

Note. a = Cronbach's alpha of 20-SSAQ; b = Cronbach's alpha of 18-SSAQ; c = items excluded from 18-SSAQ; To facilitate the reading, all values < .32 were not reported; English items have not been validated; French validated items are available in Supplementary file 1.

Table 2. Factor correlations, variances, means, standard deviations and internal consistencies (Study 3)

	1	2	3	4	CR	AVE	ASV	M	SD
1. Concentration on the task	.87	.41***	-.55***	n.s	.88	.59	.16	5.28	1.08
2. Concentration due to the teacher		.90	-.18**	n.s	.89	.62	.07	4.82	1.44
3. Distraction away from the task			.80	.23**	.81	.51	.13	3.24	1.59
4. Distraction toward the teacher				.76	.77	.47	.02	1.75	.98

Note. α = diagonals; CR = Composite Reliability; AVE = Average Variance Extracted; ASV = Average Shared Variance; M. = Mean; SD = Standard Deviation; n.s = no significant; ** = $p < .01$; *** = $p < .001$

Table 3. Outcomes correlations, descriptive statistics and internal consistencies (Study 3)

	SC	CSA	SSA	Soc Des
Concentration on the task	n.s	n.s	n.s	n.s
Concentration due to the teacher	n.s	n.s	n.s	n.s
Distraction away from the task	-.19**	n.s	.20***	-.21**
Distraction toward the teacher	n.s	.15*	.14*	-.15*
Mean	3.02	1.71	1.48	7.08
Standard Deviation	.68	.78	.49	2.77
Cronbach's alpha	.89	.91	.66	.64

Note. SC = Self-Confidence; CSA = Cognitive State Anxiety; SSA = Somatic State Anxiety excluding the item 4; Soc Des = Social Desirability; n.s = no significant; * = $p < .05$; ** = $p < .01$; *** = $p < .001$

Table 4. Measurement invariance testing across gender groups (Study 3)

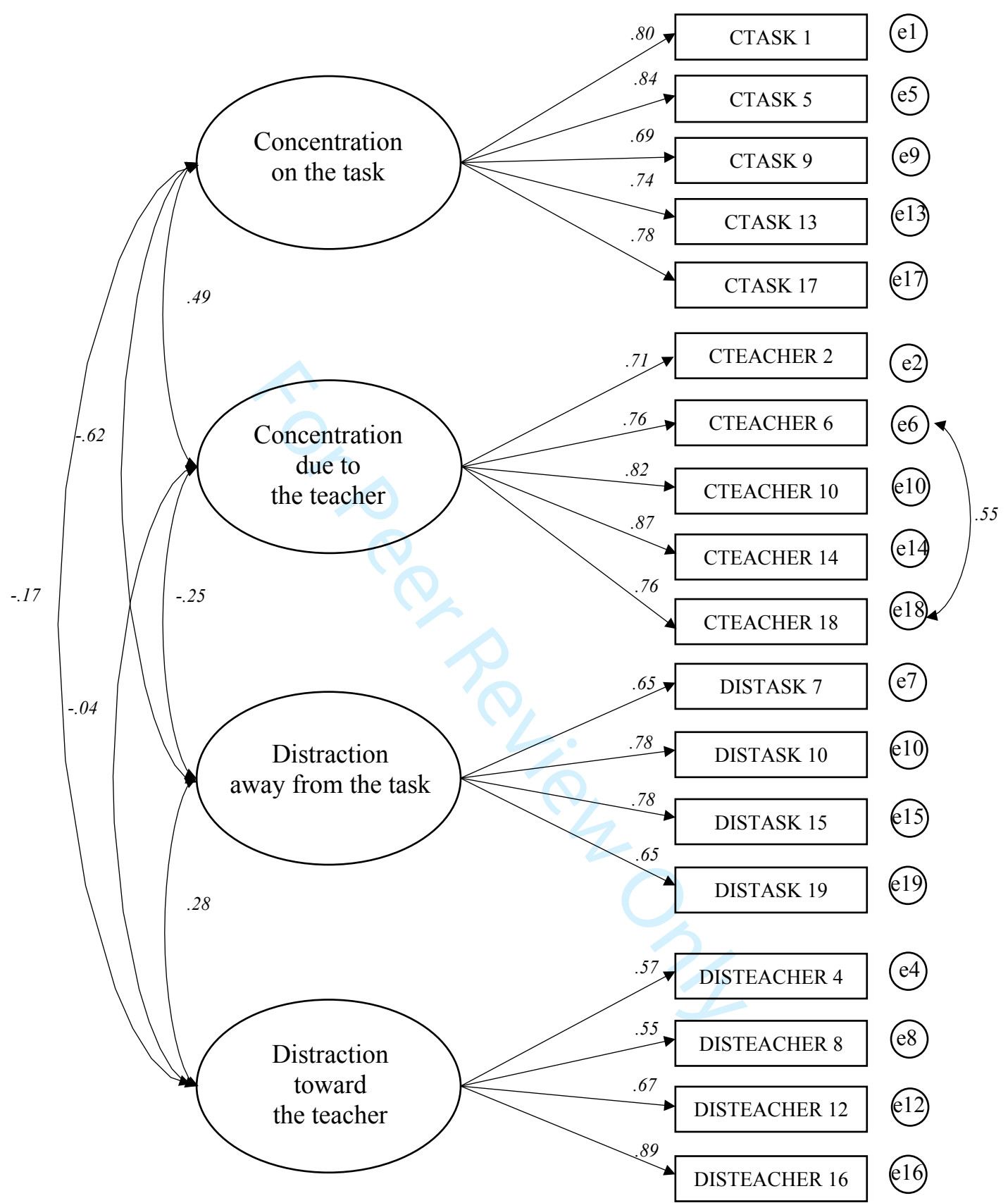
Model	$\chi^2(df)$	RMSEA (90% CI)	CFI	TLI	CM	$\Delta \chi^2$ (Δdf)	Δ RMSEA	Δ CFI	Δ TLI
a: Configural	417.170 (256)***	.054 (.045 - .064)	0.917	0.900	-	-	-	-	-
b: Metric	432.080 (270)***	.053 (.044 - .062)	0.916	0.905	a	14.910 (14)	-.001	-.001	.005
c: Scalar	457.969 (288)***	.053 (.043 - .061)	0.912	0.906	b	25.889 (18)	.000	-.004	.001

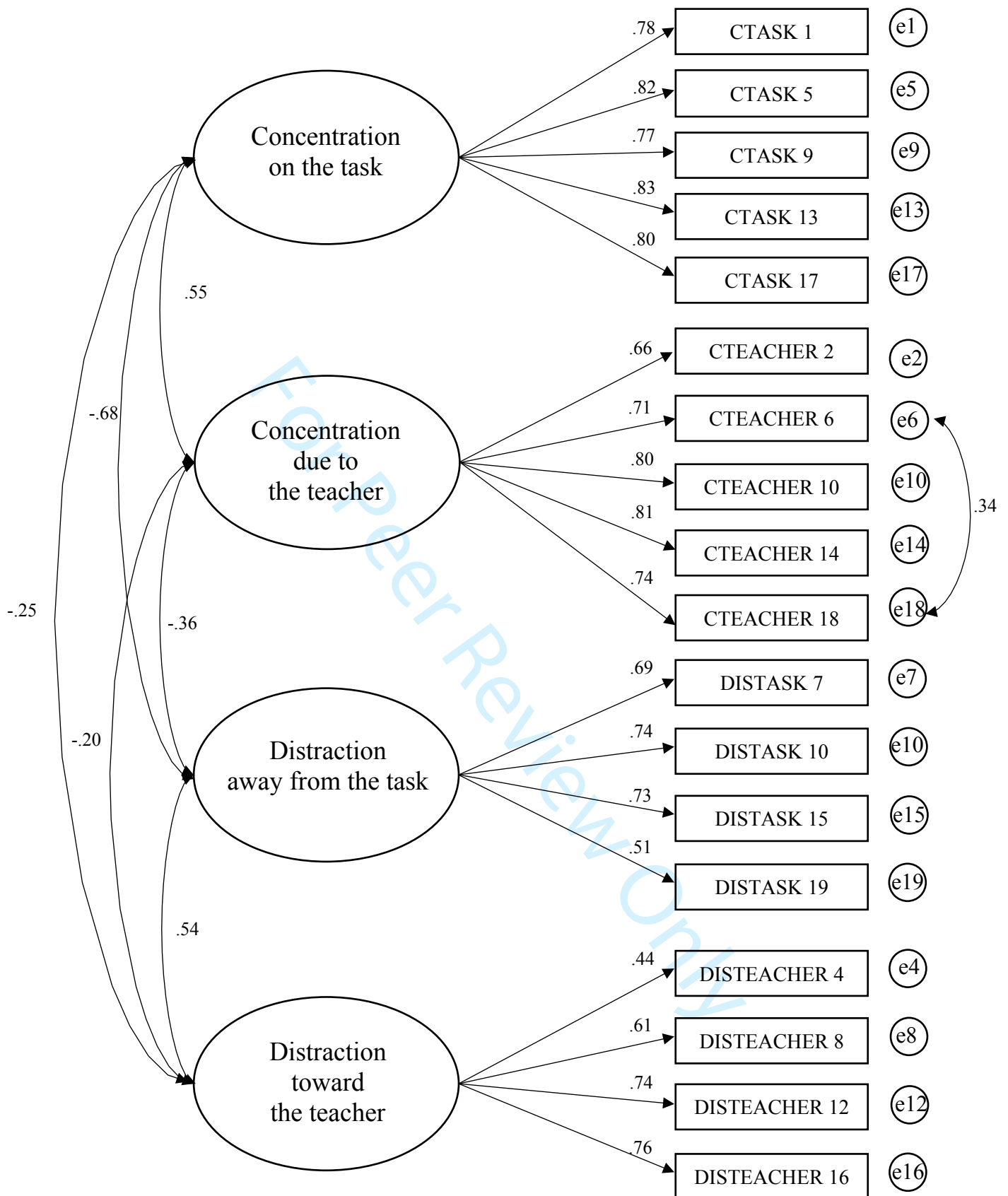
Note. The subsamples for the different measurement invariance analyses were women ($n = 96$), and men ($n = 120$); df = degrees of freedom; RMSEA = Root Mean Square Error of Approximation; CI = Confidence Interval; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; CM = comparison model; *** = $p < .001$.

Table 5. Factor correlations, variances, means, standard deviations and internal consistencies (Study 4)

	1	2	3	4	CR	AVE	ASV	M	SD
1. Concentration on the task	.90	.47***	-.55***	-.19***	.90	.64	.19	5.28	1.27
2. Concentration due to the teacher		.87	-.26***	-.15**	.86	.56	.10	4.69	1.46
3. Distraction away from the task			.76	.42***	.76	.45	.18	3.47	1.62
4. Distraction toward the teacher				.73	.74	.42	.08	2.06	1.21

Note. α = diagonals; CR = Composite Reliability; AVE = Average Variance Extracted; ASV = Average Shared Variance; M. = Mean; SD = Standard Deviation; n.s = no significant; ** = $p < .01$; *** = $p < .001$





Supplementary file 1. Item comprehension of the pool of 20 items in Study 1

Items	M	SD	Problem mentioned during the interview
CTASK1. J'étais concentré(e) pour réussir l'exercice.	6.00	.00	
CTEACHER2. J'ai eu l'impression que l'enseignant savait quoi faire pour que je me concentre sur l'exercice.	5.80	.63	"SAVAIT QUOI FAIRE"
DISTASK3. Il m'est arrivé(e) d'être déconcentré(e).	6.00	.00	
DISTEACHER4. Pendant l'exercice, j'ai été déconcentré(e) par l'enseignant.	6.00	.00	
CTASK5. J'étais focalisé(e) sur l'exercice.	6.00	.00	
CTEACHER6. J'ai senti que l'enseignant m'aidait à me concentrer sur l'exercice	5.90	.32	"J'AI SENTI"
DISTASK7. Il m'est arrivé(e) d'être dans la lune	5.90	.32	"EST ARRIVE"
DISTEACHER8. Il m'est arrivé(e) d'être déconcentré(e) parce que faisait l'enseignant.	6.00	.00	
CTASK9. Je me suis appliqué(e) à réaliser l'exercice	6.00	.00	
CTEACHER10. L'enseignant a su diriger mon attention sur ce qu'il fallait faire.	6.00	.00	
DISTASK11. J'ai commis des erreurs d'inattention.	6.00	.00	
DISTEACHER12. Certaines explications de l'enseignant m'ont distrait pendant l'exercice	5.80	.42	"DISTRAIT"
CTASK13. Je suis resté(e) attentif(ve) tout le long de l'exercice	6.00	.00	
CTEACHER14. L'enseignant a su capter mon attention pour que je m'implique dans l'exercice.	6.00	.00	
DISTASK15. Il m'est arrivé(e) de penser à autre chose plutôt qu'à l'exercice.	5.90	.32	SAISI MAL LE SENS GENERAL
DISTEACHER16. Il m'est arrivé(e) d'être déconcentré(e) parce que disait l'enseignant.	6.00	.00	
CTASK17. J'étais concentré(e) pour réaliser l'exercice.	6.00	.00	
CTEACHER18. J'ai eu l'impression que l'enseignant m'aidait à mieux me concentrer.	5.90	.32	SAISI MAL LE SENS GENERAL
DISTASK19. J'ai été distrait(e) par des événements extérieurs	5.80	.42	"EVENEMENTS EXTERIEURS"
DISTEACHER20. J'étais davantage concentré(e) sur l'enseignant que sur l'exercice.	5.50	.85	SAISI MAL LE SENS GENERAL

Note. n = 10 sport sciences students

Supplementary file 2. Scoring distribution of the SSAQ in Study 2, 3 and 4

Items	Study 2			Study 3			Study 4		
	M (SD)	Skew	Kurt	M (SD)	Skew	Kurt	M (SD)	Skew	Kurt
CTASK1	4.65 (1.35)	-1.65	-1.17	5.12 (1.30)	-2.30	-1.64	5.34 (1.63)	-5.02	-.81
CTEACHER2	4.81 (1.50)	-1.85	-1.61	5.61 (1.43)	-7.18	3.63	5.50 (1.60)	-9.87	2.19
DISTASK3	3.09 (1.72)	1.61	-2.96	-	-	-	-	-	-
DISTEACHER4	1.68 (1.32)	12.14	14.36	1.45 (.97)	16.07	23.56	1.72 (1.41)	19.75	18.14
CTASK5	4.94 (1.45)	-1.85	-1.47	5.19 (1.32)	-3.32	-1.26	5.12 (1.53)	-5.44	-1.26
CTEACHER6	4.09 (1.56)	-.34	-1.83	4.48 (1.86)	-2.38	-2.72	4.49 (1.85)	-3.51	-3.74
DISTASK7	2.74 (1.92)	4.37	-1.53	2.73 (2.03)	5.13	-2.18	3.17 (2.16)	4.38	-5.47
DISTEACHER8	1.91 (1.50)	10.08	7.48	1.64 (1.25)	13.49	13.99	1.96 (1.63)	15.84	9.32
CTASK9	5.52 (1.22)	-4.19	1.03	5.73 (1.21)	-6.34	3.19	5.61 (1.41)	-10.39	4.58
CTEACHER10	4.27 (1.60)	-1.02	-1.76	4.74 (1.69)	-3.80	-1.12	4.48 (1.88)	-2.79	-4.32
DISTASK11	3.77 (1.89)	.87	-3.29	3.61 (2.02)	.99	-3.95	3.87 (2.11)	.34	-6.04
DISTEACHER12	2.13 (1.41)	7.53	4.20	1.94 (1.53)	9.93	4.86	2.33 (1.78)	10.68	.79
CTASK13	4.64 (1.54)	-2.34	-1.48	5.01 (1.50)	-3.33	-.80	4.99 (1.68)	-5.54	-1.97
CTEACHER14	4.50 (1.43)	-.92	-1.46	4.94 (1.67)	-4.08	-.69	4.80 (1.73)	-5.27	-1.89
DISTASK15	3.94 (2.06)	-.13	-3.48	3.72 (2.06)	.48	-4.18	3.88 (2.16)	.24	-6.44
DISTEACHER16	2.22 (1.49)	7.70	4.88	1.94 (1.37)	9.24	4.75	2.25 (1.67)	11.35	2.71
CTASK17	5.04 (1.46)	-4.35	1.13	5.34 (1.28)	-4.42	.80	5.36 (1.52)	-8.61	2.02
CTEACHER18	3.95 (1.51)	-.64	-1.43	4.33 (1.83)	-2.25	-2.77	4.19 (1.91)	-2.00	-4.48
DISTASK19	3.20 (1.94)	2.25	-2.77	2.92 (1.90)	3.53	-2.89	2.95 (2.08)	5.69	-4.51
DISTEACHER20	2.16 (1.43)	7.23	4.06	-	-	-	-	-	-
CTASK	4.95 (1.18)	-2.22	-0.64	5.28 (1.08)	-3.56	-0.06	5.28 (1.27)	-6.59	0.33
CTEACHER	4.32 (1.24)	-0.72	-1.33	4.82 (1.44)	-3.39	-1.38	4.69 (1.46)	-3.52	-2.57
DISTASK	3.42 ^a (1.53)	2.22 ^a	-1.46 ^a	3.24 (1.59)	2.08	-2.86	3.47 (1.62)	2.42	-3.98
DISTEACHER	1.99 ^b (1.11)	8.32 ^b	8.12 ^b	1.75 (.99)	10.67	10.74	2.06 (1.21)	11.58	5.42

Note. Study 2: n = 164 sport sciences students; Study 3: n = 216 sport sciences students; Study 4: n = 481 high school students; M = Mean; SD = Standard Deviation; Skew. = Skewness value; Kurt. = Kurtosis value; CTASK = Concentration on the task. CTEACHER = Concentration due to the teacher. DISTASK = Distraction away from the task. DISTEACHER = Distraction toward the teacher; a = DISTASK skewness and kurtosis scores were calculated without DISTASK3; b = DISTEACHER skewness and kurtosis scores were calculated without DISTEACHER20

Supplementary file 2. Frequency tables of the answers to items of the SSAQ in **Study 2**, **Study 3** and **Study 4**

Study 2	1	2	3	4	5	6	7
CTASK1	1	5	13	26	23	26	6
CTEACHER2	2	5	13	23	18	26	13
DISTASK3	24	21	11	18	15	9	1
DISTEACHER4	68	13	6	7	0	2	2
CTASK5	1	5	10	21	24	22	16
CTEACHER6	5	13	18	23	23	13	6
DISTASK7	40	18	12	9	10	7	5
DISTEACHER8	58	24	2	5	3	4	2
CTASK9	1	1	5	15	19	37	22
CTEACHER10	5	9	15	27	16	20	7
DISTASK11	11	24	12	15	13	16	9
DISTEACHER12	44	29	10	10	3	3	1
CTASK13	3	7	14	19	21	27	9
CTEACHER14	1	9	14	25	26	18	8
DISTASK15	16	17	7	15	17	13	14
DISTEACHER16	43	26	15	9	3	2	3
CTASK17	4	2	7	20	20	33	13
CTEACHER18	7	12	17	28	20	12	4
DISTASK19	28	17	12	15	13	9	7
DISTEACHER20	45	26	12	12	3	2	2

Note. n = 164; values are expressed in percentage.

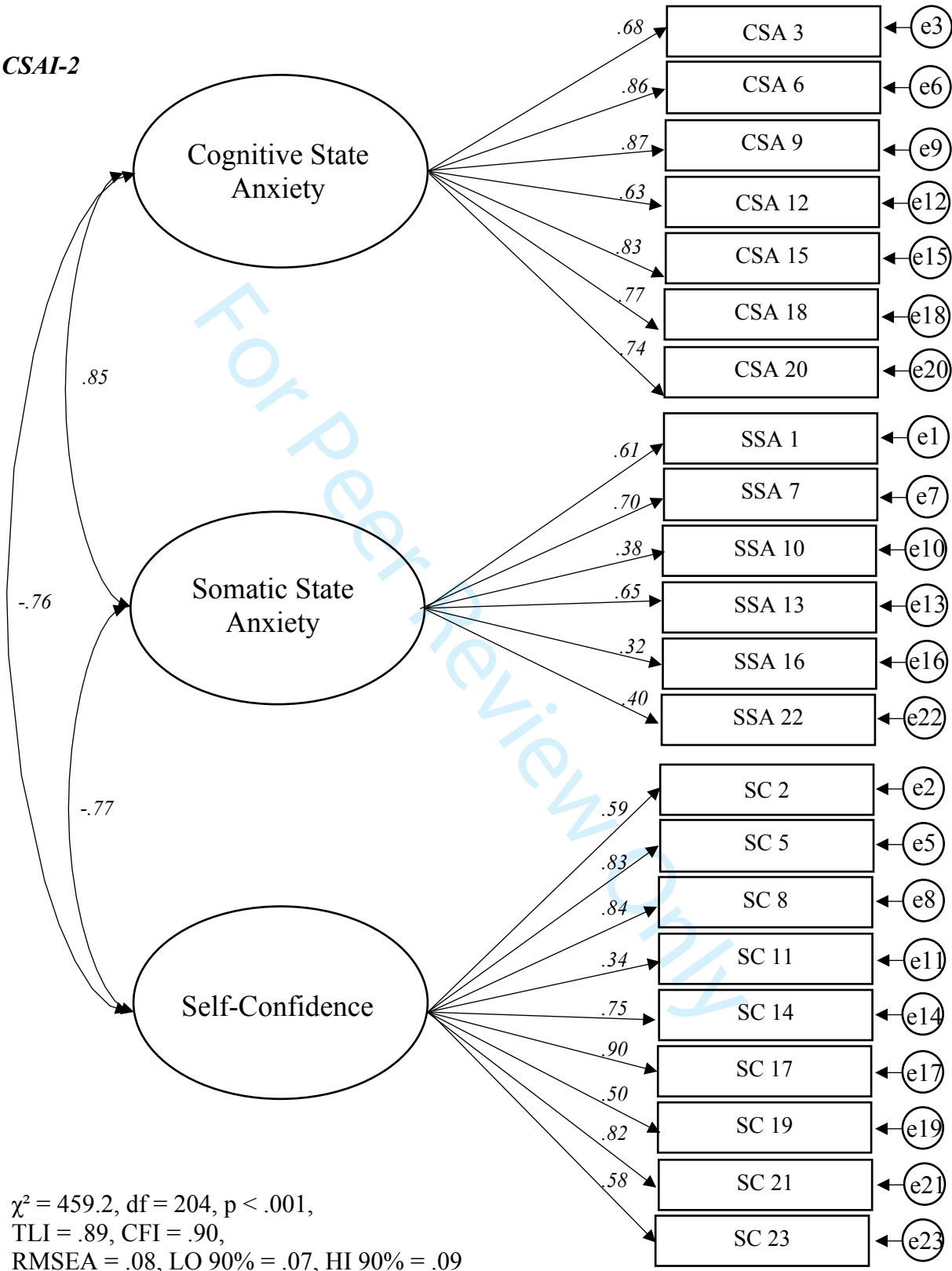
Study 3	1	2	3	4	5	6	7
CTASK1	0	3	9	19	26	28	15
CTEACHER2	2	1	6	9	19	29	33
DISTASK3	75	14	4	4	2	0	0
CTASK5	0	3	9	16	24	33	15
CTEACHER6	10	8	11	19	14	23	15
DISTASK7	44	19	4	9	10	7	2
DISTEACHER8	70	13	7	3	5	1	1
CTASK9	0	1	3	10	19	35	31
CTEACHER10	6	8	4	23	19	25	14
DISTASK11	21	19	8	13	18	11	10
DISTEACHER12	61	17	5	6	5	5	1
CTASK13	2	3	11	19	21	26	17
CTEACHER14	6	3	10	19	19	25	19
DISTASK15	21	16	11	9	18	14	10
DISTEACHER16	56	19	11	6	6	2	0
CTASK17	0	3	5	15	25	33	19
CTEACHER18	11	9	11	18	19	22	11
DISTASK19	35	18	9	13	12	8	4

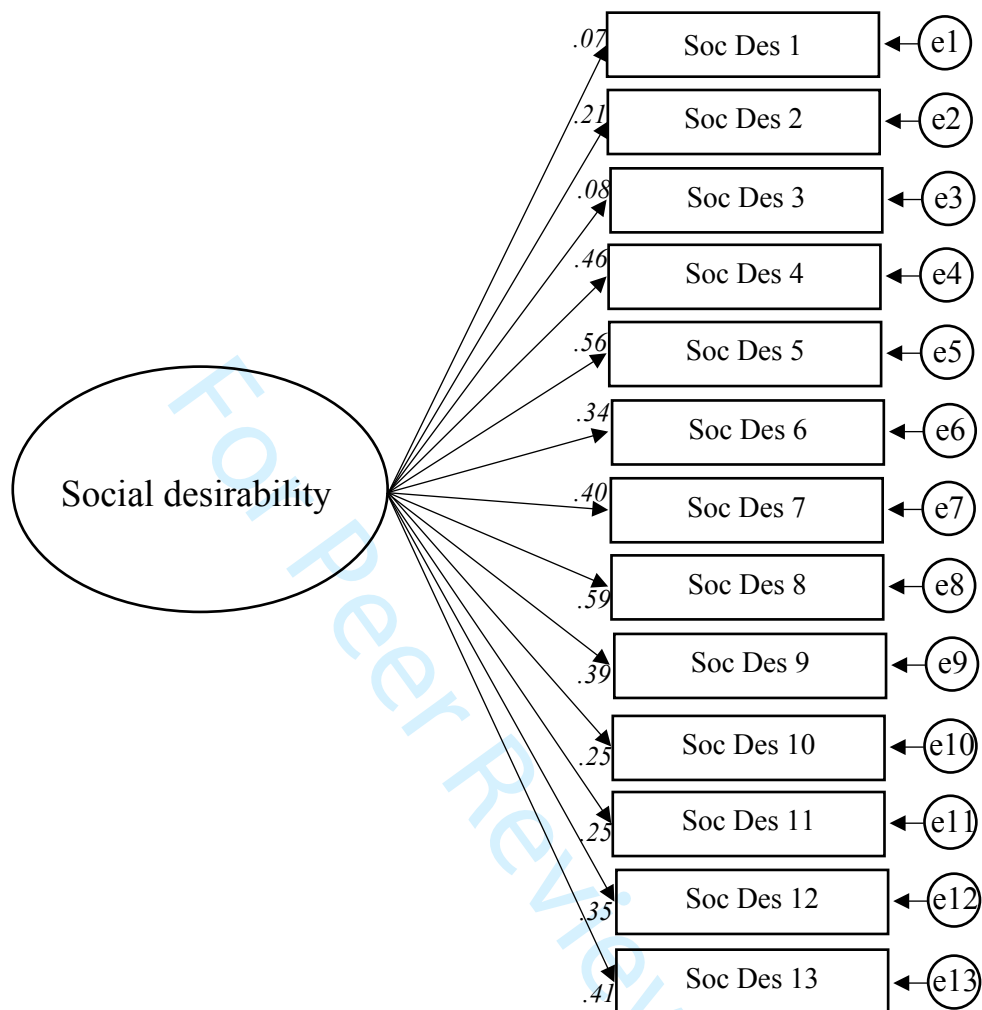
Note. n = 216; values are expressed in percentage.

Study 4	1	2	3	4	5	6	7
CTASK1	1	1	8	16	27	23	25
CTEACHER2	3	4	5	10	17	26	35
DISTASK3	70	15	4	5	3	3	1
CTASK5	2	4	10	16	22	24	22
CTEACHER6	10	7	11	19	18	19	16
DISTASK7	36	14	7	11	13	7	11
DISTEACHER8	63	15	5	6	5	3	4
CTASK9	2	2	6	9	19	31	32
CTEACHER10	9	10	11	19	17	16	18
DISTASK11	20	15	8	16	15	11	16
DISTEACHER12	51	17	7	8	7	6	3
CTASK13	4	5	10	16	19	23	22
CTEACHER14	7	6	7	22	19	21	19
DISTASK15	21	15	9	10	16	13	16
DISTEACHER16	51	17	9	10	6	3	3
CTASK17	3	3	6	14	19	29	26
CTEACHER18	14	8	12	21	16	16	13
DISTASK19	40	14	9	11	12	7	9

Note. n = 481; values are expressed in percentage.

Supplementary file 3. Confirmatory factor analysis with the CSAI-2 and the social desirability scale (Study 3)



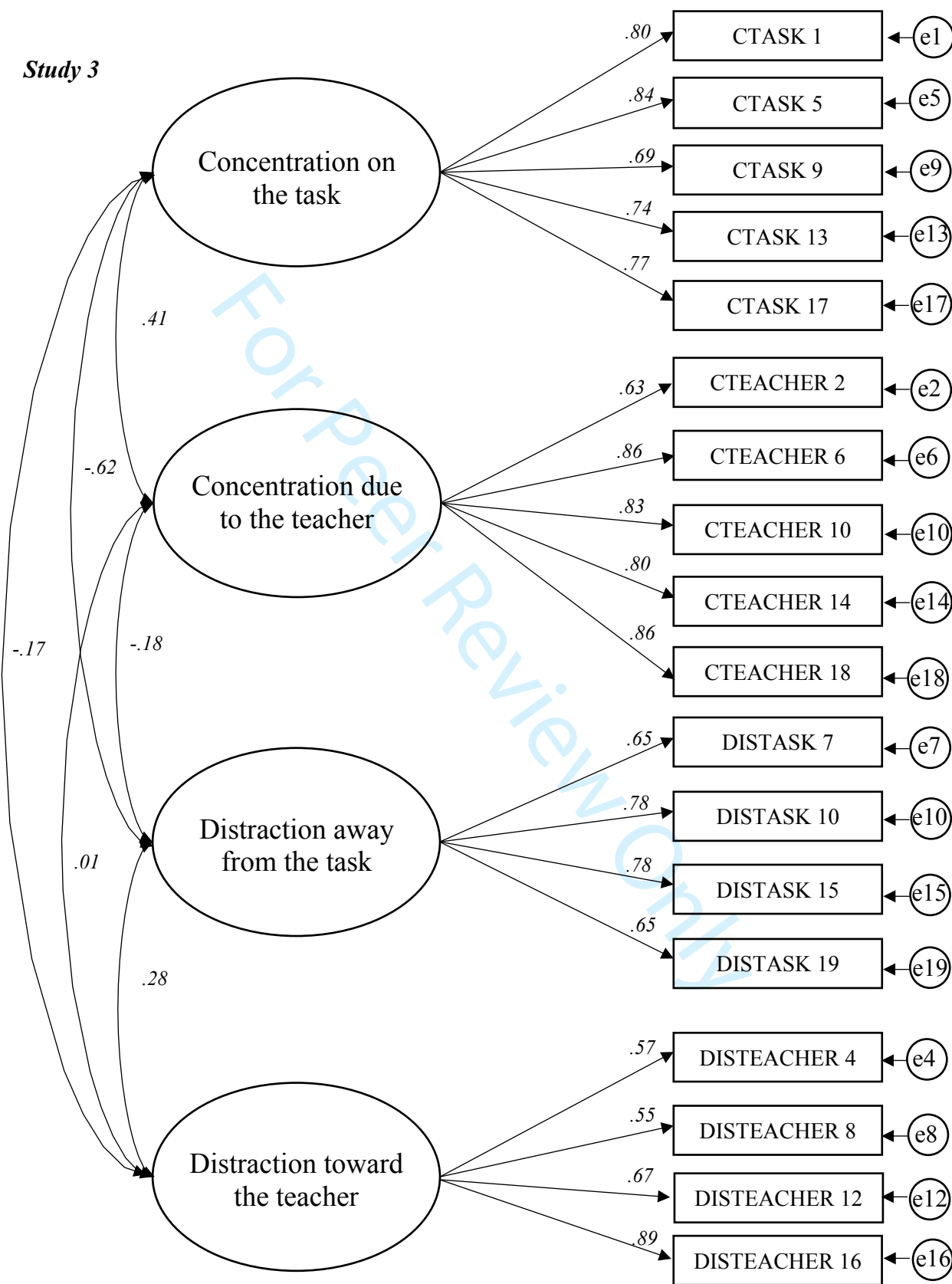
Social desirability scale

$\chi^2 = 84$, $df = 63$, $p = .035$,
 TLI = .86, CFI = .89,
 RMSEA = .04, LO 90% = .01, HI 90% = .06

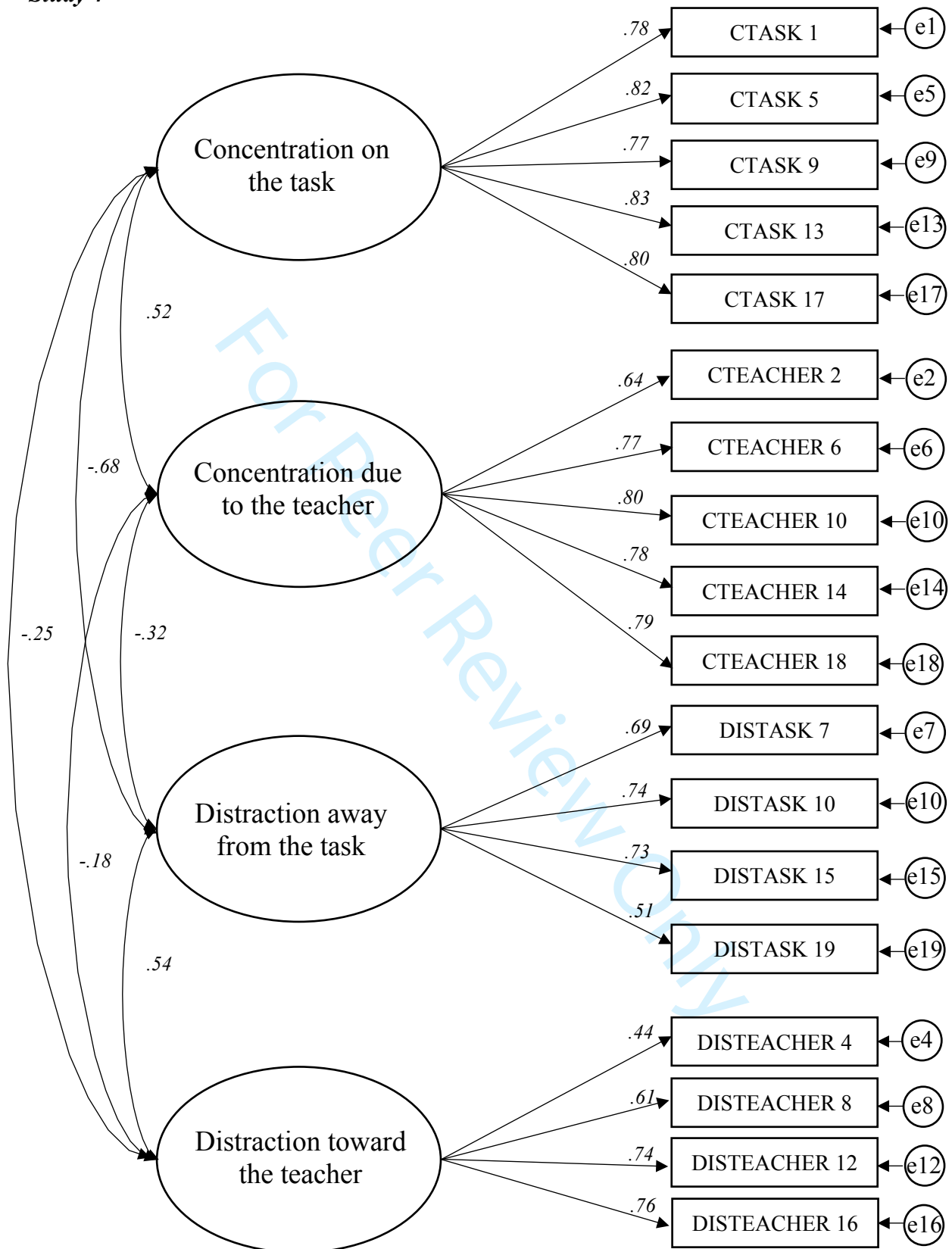
Note. Soc Des = Social Desirability

Supplementary file 4. Initial confirmatory factor analysis (without error covariance between item 6 and item 18) in Study 3 and 4

Study 3



Note. Study 3: n = 216 sport sciences students. CTASK = Concentration on the task. CTEACHER = Concentration due to the teacher. DISTASK = Distraction away from the task. DISTEACHER = Distraction toward the teacher

Study 4

Note. Study 4: $n = 481$ high school students. CTASK = Concentration on the task. CTEACHER = Concentration due to the teacher. DISTASK = Distraction away from the task. DISTEACHER = Distraction toward the teacher