



Cross-validation of the short form of the physical self-inventory (PSI-S) using exploratory structural equation modeling (ESEM)

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ABSTRACT

Objectives: In a review of physical self-concept instruments Marsh and Cheng (in press) noted that the short version (18 item) of the physical self-inventory (PSI-S) represents an important contribution to applied research but that further research was needed to investigate the robustness of its psychometric properties in new and diversified samples and to investigate the reasons for the elevated correlations observed between the six PSI-S subscales.

Design and Method: A sample of sample 2029 French adolescents completed the PSI-S and their answers were analyzed with exploratory structural equation modeling (ESEM).

Results: The results show that the PSI-S ESEM measurement model is robust and fully invariant across subgroups of students formed on the basis of gender, weight categories, age categories, and ethnicity. The results also confirm the convergent validity and reliability of the PSI-S subscales. Most importantly, the ESEM model results in importantly deflated latent factor correlations and suggest that the previously reported inflated correlations may have been due to the fact that traditional confirmatory factor analytic (CFA) models arbitrarily constrain all cross-loadings to zero. In addition, the ESEM model reveals that the negatively worded items from the PSI-S may be suboptimal, a result that was not obvious from the CFA results.

Conclusion: The obtained results clearly confirm the robustness of the psychometric properties of the PSI-S and the usefulness of ESEM for more detailed analyses of measurement scale psychometric properties. Reformulations for the negatively worded items are proposed and directions for future studies of the PSI-S are noted.

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In their classic review of self-concept research Shavelson, Hubner, and Stanton (1976) represented self-concept as a pyramid, with global self-esteem at the apex and more specific constructs at the next-lower level, such as the academic self, the social self and the physical self. Specificity increases downward with the most situation-specific self-perceptions at the base. With the recognition of the multi-dimensionality of the self-concept (Marsh, 1997), came more refined conceptualizations and studies of its sub-components (Fox, 2000). Following Sonstroem's (1976, 1978) work, Fox and Corbin (1989) developed a multidimensional

and hierarchical model of the physical self-concept of particular interest to sport psychologists. In this model, the upper level is occupied by a generic construct representing global self-worth (GSW). GSW refers to the positive or negative way people feel about themselves as a whole, which is also often called global self-esteem (e.g. Brown, Dutton, & Cook, 2001). The next level (the domain level) is occupied by a global construct representing physical self-worth (PSW; general feelings of happiness, satisfaction and pride in the physical self). Finally, the lower level (the subdomain level) is occupied by four constructs: sport competence (SC: athletic ability, ability to learn sports, etc.), physical condition (PC: stamina, fitness, etc.), physical attractiveness (PA: physical attractiveness, ability to maintain an attractive body over time, etc.) and physical strength (PS: perceived strength, muscle development, etc.).

From this model, Fox and Corbin (1989) developed the *Physical Self-Perception Profile* (PSP) and validated it among North

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American college students.² This model and instrument were successfully cross-validated in adults English-speaking samples (Hagger, Asçi, & Lindwall, 2004; Page, Ashford, Fox, & Biddle, 1993; Sonstroem, Speliotis, & Fava, 1992) and cross-culturally adapted and validated in non-English European countries, such as Belgium and the Netherlands (Van de Vliet et al., 2002), Portugal (Fonseca & Fox, 2002), Spain (Atzienga, Balaguer, Moreno, & Fox, 2004), Sweden (Hagger et al., 2004), and Turkey (Hagger et al., 2004; Marsh et al., 2002).

Nevertheless, concerns have been expressed about PSPP, particularly about its non-standard structured alternative format (i.e. paired forced-choice with a 4-point answer scale) which has been found to be confusing for respondents and associated with substantial method effects (Eiser, Eiser, & Havermans, 1995; Marsh et al., 1994, 2002, 2006; Wichstrøm, 1995; Wylie, 1989). In addition, the PSPP assess GSW with items from the Rosenberg Self-Esteem Inventory (RSEI; Rosenberg, 1965), which is also associated with substantial method effects (Marsh, Scalas, & Nagengast, 2010; Tomás & Oliver, 1999). Finally, and importantly, many have expressed concerns regarding the appropriateness of this instrument for children and adolescents (Biddle et al., 1993; Marsh et al., 1994). Indeed, because youths' cognitive abilities are more limited than those of adults, it might be harder for them to distinguish their own physical self-evaluations across a variety of specific sub-domains and to fully comprehend the items' abstract formulations (which are made worse by the non-standard answering scale). Fortunately, some of these concerns were addressed (i.e. sport competence items were replaced and age-appropriate terminology was used) with the development of a version of the PSPP for North American children and adolescents (Eklund, Whitehead, & Welk, 1997; Whitehead, 1995). This instrument has since been similarly validated for youths from non-English-speaking European countries (e.g. Asçi, Eklund, Whitehead, Kirazci, & Koca, 2005; Bernardo & Matos, 2003; Hagger, Ashford, & Stambulova, 1997; Moreno, Cervelló, Vear, & Ruiz, 2007). However, this instrument still relies on a structured alternative format answer scale.

In France, Ninot, Delignières, and Fortes (2000) developed, for adults, the *physical self-inventory* (PSI). The PSI is based on the PSPP and provides a promising way of circumventing the problems typically associated with the PSPP: (i) the original response format was replaced by a 6-point Likert scale (1: *not at all*, 2: *very little*, 3: *some*, 4: *enough*, 5: *a lot*, 6: *entirely*); (ii) GSW was assessed with 5 items from the school version of the Coppersmith's (1967, 1984) Self-Esteem Inventory, rather than with items from the RSEI; (iii) following initial analyses, the items from the original PSW scale were replaced with five items taken from Marsh and O'Neill's (1984) Self-Description Questionnaire-III. Maïano et al. (2008) adapted the PSI for use with adolescents and developed short form of this instrument (PSI-S; 18 items, with 3 items per dimension). The factor validity and reliability of this instrument was tested with a sample 1018 French adolescents (541 boys and 477 girls), aged between 11 and 16 years. Maïano et al. (2008) conducted a series of confirmatory factor analyses (CFA) to test the original six-factor measurement model. Results from analyses performed in two independent subsamples provided support for the: (i) factorial validity of the measurement model of the PSI-S;

(ii) invariance of the PSI-S intercepts across gender; and (iii) a lack of latent mean invariance, showing that girls presented a lower level on most PSI-S dimensions (GSW, PSW, SC, PA and PS), confirming the results from previous studies conducted with similar instruments (e.g. Asçi, 2002; Hagger, Biddle, & Wang, 2005; Marsh et al., 2006; Marsh, Hau, Sung, & Yu, 2007). Subsequent analyses also confirmed that the PSI-S was characterized by: (i) satisfactory internal consistency coefficients ranging from .73 to .75; (ii) acceptable test–retest correlations, ranging from .74 to .84, and (iii) elevated latent factor correlations that still provided evidence of discriminant validity ($r = .50-.91$; $M = .71$; $SD = .12$). With the sole exception of a subsequent study in which Maïano, Bégarie, Morin, and Ninot (2009) validated another adaptation of the PSI for use among adolescents with intellectual disability ($n = 362$) and replicated the results from their original study, no other attempt was made to replicate these results on new samples of “normal” adolescents. This is worrying since it is a known fact that a single study is insufficient to reach clear conclusions regarding the psychometric properties of an instrument. This is especially true given the fact that Maïano et al. (2008) developed the PSI-S from the 25-item adult version of the PSI in order to obtain a reasonable fit from an initially suboptimal measurement model and never really cross-validated it on a new independent sample of adolescents. Moreover, the methodological limitations mentioned by Maïano et al. (2008) remain unresolved and stress the need for additional cross-validation efforts.

First, Maïano et al.'s (2008) study was based on a sample of normal-weight adolescents. It is thus uncertain whether the observed psychometric properties could generalize to youth with different weight statuses. However, current research evidence reveal that overweight and obesity represent a highly prevalent phenomenon in multiple countries around the world (e.g. Lissau et al., 2004) with prevalence rates sometimes reaching over 30% for overweight and 15% for obesity in some subpopulations. As overweight adolescents (or very skinny ones for that matter) present a higher risk of being discriminated against on the basis of their weight, the resulting stigmatization may strongly influence their individual self-concepts, particularly in the physical domain and sub-domains (e.g. Puhl & Latner, 2007; Wardle & Cooke, 2005). Thus, when overweight and obese adolescents are compared to normal-weight peers they tend to present significantly different relations to their bodies and lower level of GSW and physical self-perceptions (e.g. French, Story, & Perry, 1995; Griffiths, Parsons, & Hill, 2010; Hau, Sung, Yu, Marsh, & Lau, 2005; Marsh et al., 2007; Sung, Yu, So, Lam, & Hau, 2005). However, the validity of this conclusion relies on the often untested assumption that the measurement model used to assess physical self-concept is invariant across weight categories; whereas it is highly possible that overweight or obesity may completely modify the way the physical self-concept is organized. To our knowledge, this assumption was only verified once among a sample of Chinese children (Hau et al., 2005), using the Chinese version of the *Physical Self-Description Questionnaire* (PSDQ), and never amongst Western populations or using PSPP-based instruments.

Similarly, although Maïano et al. (2008) did confirm the gender-based invariance of the PSI-S, these results also need to be replicated. In addition, they did not examine the measurement invariance of the PSI-S across age categories (i.e. early and late adolescence) and ethnicity. Adolescence is a period of multiple social and physical transformations in which youths implicitly and explicitly learn about themselves psychologically and physically and these transformations exert a determining impact on how they perceive themselves and even on how they organize their self-perceptions (Cicchetti & Rogosch, 2002; Eccles et al., 1993;

² Marsh and Redmayne's (1994) also developed and validated a multidimensional and hierarchical instrument: the *Physical Self-Description Questionnaire* (PSDQ). For details on the psychometric properties of this instrument and differences with the PSPP in various samples differing in age, culture or language, see Marsh et al. (Marsh, Asçi, & Marco, 2002; Marsh, Bar-Eli, Zach, & Richards, 2006; Marsh, Richards, Johnson, Roche, & Tremayne, 1994). In addition, for a recent review of the various instruments that may be used to assess the physical self-concept, see Marsh and Cheng (in press).

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