J Autism Dev Disord (2009) 39:775–787
DOI 10.1007/s10803-008-0686-z

ORIGINAL PAPER

Assessment of Physical Self-Concept in Adolescents with Intellectual Disability: Content and Factor Validity of the Very Short Form of the Physical Self-Inventory

Christophe Maïano · Jérôme Bégarie · Alexandre J. S. Morin · Grégory Ninot

Published online: 9 January 2009

Abstract The purpose of this study was to test the factor validity and reliability of the Very Short Form of the Physical Self-Inventory- (PSI-VSF) within a sample of adolescents with mild to moderate Intellectual Disability (ID). A total of 362 ID adolescents were involved in two studies. In Study 1, the content and format scale response of the PSI-VSF were adapted for adolescents with ID. This instrument was thus renamed PSI-VSF-ID and two versions with two alternative responses scales format, were developed: Likert and graphical. In Study 2, results provided support for: (1) the factorial validity and reliability; and (2) factorial invariance across gender, age, type of school placement and ID level of the PSI-VSF-ID associated with a graphical response scale format.

Keywords French · Graphical response format · Gender · Age · School placement · Intellectual disability level · Invariance

C. Maïano (✉)
UMR 6233 "Institute of Movement Sciences, Etienne-Jules Marey", CNRS-University of Aix-Marseille II, 163 Avenue de Luminy, CP 910, 13288 Marseille Cedex 9, France
e-mail: christophe.maiano@univmed.fr

J. Bégarie · G. Ninot
EA 4206 "Addictive, Performance and Health Behaviors", University of Montpellier I, Montpellier, France

A. J. S. Morin
Department of Psychology, University of Sherbrooke, Sherbrooke, QC, Canada

Introduction

Self-concept is a multidimensional construct encompassing many characteristics, competencies and roles possessed or played by individuals (Fox 2000). In social sciences, many terms are often used interchangeably to refer to the self-concept: self-esteem, self-worth, self-perception and perceived competence (Ulrich and Collier 1990). This construct is commonly viewed as the perception, evaluation, beliefs and feelings that a person holds in regard to himself or herself (Harter 1999). The self concept includes many sub-selves or domains (Fox 2000), such as the social self, the academic self, the emotional self, the family self, the physical self, etc. Shavelson et al. (1976) hypothesized that these various domains are organized hierarchically: the self-concept being like a pyramid, with Global Self-Concept (GSC)[1] at the apex and general constructs at the next-lower level (Shavelson et al. 1976). Specificity increases downward, with the most situation-specific self-perceptions at the base (Shavelson et al. 1976). Harter (1978, 1999) conception of perceived competence also follows this general multidimensional framework. Additionally, research indicates that the numbers of domains are sensitive to cognitive-developmental shifts (Yun and Ulrich 1997): with development, individuals become able to differentiate more keenly among various self-concepts' domains (e.g. cognitive, social, physical, academic, maths, family, work, etc.). This means that the content of the scales used to measure this construct should use age-appropriate items and domains. For instance, Harter and her colleagues (Harter 1982, 1988; Harter and Kreinik

[1] In the present investigation, global self-concept and global self-esteem are considered as synonyms since their distinction has not yet been clearly established (Byrne 1996).

1998; Harter and Pike 1984; Messer and Harter 1986; J. Neemann and S. Harter, 1987, Unpublished manuscript) developed appropriate questionnaires for six developmental levels, measuring between 4 and 13 domains of perceived competence.

A handful of studies have examined the effects of the participation in various forms of adapted physical activities (i.e. integrated, segregated and alternated programs) on the self-concept, and more specifically on the perceived physical competence (i.e. athletic competence and physical appearance), of adolescents with Intellectual Disability (ID) (Castagno 2001; Dykens and Cohen 1996; Gibbons and Bushakra 1989; Maïano et al. 2001, 2002; Ninot and Maïano 2007; Ninot et al. 2000b, c, 2005; Weiss et al. 2003; Wright and Cowden 1986). The rationale behind these studies is that a balanced and realistic level of self concept, in general and physical self-concept in particular, represents an important condition for the success of ID adolescents reinsertion into mainstream society (Bear et al. 1991; Butler and Marinov-Glassman 1994; Kistner et al. 1987; Maïano et al. 2003; Ninot et al. 2000a; Pierrehumbert et al. 1988; Renick and Harter 1989). Sports and adapted physical activities represent one form of activities that may help educators to reach this objective.

Notwithstanding their interest, most of the aforementioned studies relied on Harter's (1982) Self-Perception Profile for Children (SPP-C), which presents multiple limitations in this specific context, to evaluate ID adolescents' self-concept. First, although Harter herself failed to replicate the proposed factor structure of the SPP-C with a sample of ID youths (Silon and Harter 1985), the aforementioned studies still rely on the original factor structure and did not attempt to verify it in their samples. Thus, these studies may rely on an instrument that is psychometrically inadequate for ID youths who may not be able to make the fine domain-specific distinctions that underlie the SPP-C. Second, the SPP-C is relatively lengthy and hard to understand for ID youths (i.e. 30-items and a question format with two groups of questions for each item, see Wichstrøm 1995). Thus, about a third of ID adolescents tend to complete the SPP-C incorrectly or incompletely (Marsh and Holmes 1990). This problem gets even more serious when the SPP-C has to be completed in conjunction with additional instruments in the context of in-depth idiographic, epidemiologic or longitudinal studies. Finally, the SPP-C assesses youths physical self-concept with only two short subscales (i.e. perceived physical appearance and perceived athletic competence), which is insufficient for studies specifically designed to study the effects of adapted physical activities on ID youths physical self concept. Indeed, according to Fox and Corbin (1989; see also Marsh and Redmayne 1994), the physical domain of the self-concept is itself best represented as a multidimensional and hierarchical construct. In the Fox and Corbin's (1989) model (see Fig. 1), the upper level is occupied by a generic construct representing GSC. The GSC is then subdivided into a Physical Self-Worth domain (i.e. PSW: general feelings of happiness, satisfaction and pride in the physical self), which itself is subdivided into four more specific subdomains: Sport Competence (i.e. SC: athletic ability, ability to learn sports, etc.), Physical Condition (i.e. PC: stamina, fitness, etc.), Physical Attractiveness (i.e. PA: ability to maintain an attractive body over time, etc.) and Physical Strength (i.e. PS: perceived strength, muscle development, etc.). The measurement of these numerous physical self-perceptions has the potential to provide a fuller description of the physical self-concept of ID individuals.

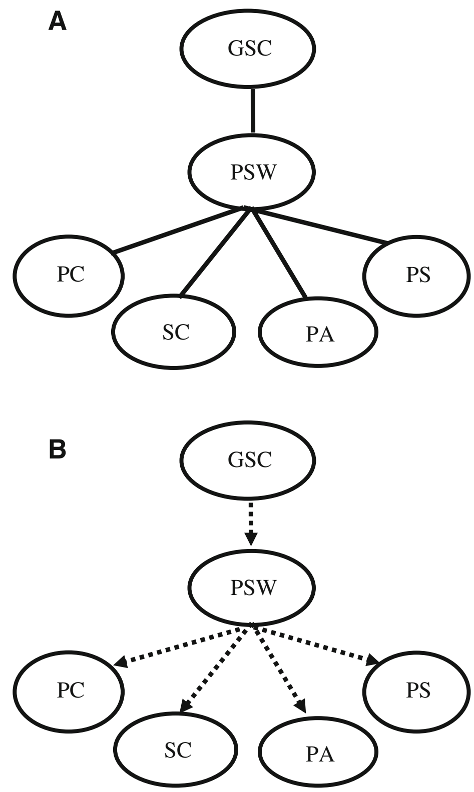

Fig. 1 Fox and Corbin's (1989) multidimensional and hierarchical conceptualization of the physical self-concept. *Note*: *GSC*, Global self-concept; *PSW*, Physical self-worth; *PC*, Physical condition; *SC*, Sport competence; *PA*, Physical attractiveness; *PS*, Physical strength. **a** Multidimensional and hierarchical conceptualization of the physical self-concept; **b** Structural equation model suggested by Fox and Corbin (1989), showing relations between the four physical self-perceptions subdomain factors, the physical self-worth factor and the global self-concept factor

Two prominent instruments were developed to measure this multidimensional and hierarchical model of the physical self-concept: Fox and Corbin's (1989) Physical Self-Perception Profile (PSPP) and Marsh and Redmayne's (1994) Physical Self-Description Questionnaire (PSDQ). Differences between these instruments are numerous and include the number of measured subdomains (the PSDQ has 11 subscales and 70 items, while the PSPP has 6 subscales and 30 items) and the item-response format (the PSDQ relies on Likert-type scales, while the PSPP relies on a structured alternative format). Given its reduced length, only the characteristics of Fox and Corbin's (1989) PSPP will be presented in details for the present investigation. The PSPP comprises 6 items for each of the five dimensions: PSW, PC, SC, PA and PS. In addition, 6 items from the Rosenberg Self-Esteem Inventory (RSEI; Rosenberg 1965) are often used in conjunction with the PSPP to assess GSC. The PSPP utilizes a structured alternative format (i.e. paired forced-choice with a 4-point scale to rate the chosen alternative) providing a possible range of 1–4 for each scale. The RSEI rely on a 4-point Likert scale, also providing a possible range of 1–4 for the GSC. This instrument has been cross-culturally adapted and validated in Belgium (Van de Vliet et al. 2002), Israel (Marsh et al. 2006), Portugal (Fonseca and Fox 2002), Spain (Atzienga et al. 2004), Sweden (Hagger et al. 2004), Turkey (Marsh et al. 2002) and France (Ninot et al. 2000d).

Recently, in a series of two studies, Maïano et al. (2008) developed and validated a Very Short Form (VSF) of the Physical Self Inventory (PSI; Ninot et al. 2000d), which is the French adaptation of the PSPP-RSEI in a sample of French adolescents. The PSI-VSF has specifically been developed for the measurement of adolescents' physical self-concept at a minimal cost in the context of in-depth longitudinal or idiographic studies. The PSI-VSF comprises 12 items and measure the six aforementioned dimensions with 2-item per dimension. Participants answer each item on a 6-point Likert scale (*That's just like me* (1) *not at all*, (2) *very little*, (3) *some*, (4) *enough*, (5) *a lot*, (6) *entirely*), and its completion generally takes between 4 and 5 min (Maïano et al. 2008). The reduced length and greater simplicity of this instrument (Likert-type answer scale rather than the original structured alternative formats), make it a particularly promising tool for the assessment of ID adolescents physical self-concept. The main objective of the present series of studies is thus to investigate the factor validity and reliability of the PSI-VSF within a population of adolescents with ID.

Because the PSI-VSF was not originally designed for adolescents with ID, the appropriateness of the items content and answer scale in this population remains unknown. In this context, Study 1 was designed to verify the clarity of the PSI-VSF's items within a sample of adolescents with ID, and to develop two alternative versions of the PSI-VSF that would be tested in the second study: one using the original Likert-type answer scale and one using a more graphical answer scale (smiling and unsmiling faces). The purpose of the second Study was to test the multidimensional and hierarchical structure and the reliability (i.e. internal consistency and test–retest reliability) of both forms of the PSI-VSF for ID adolescents (PSI-VSF-ID). To assess the generalizability of these results, their measurement invariance across gender, age categories, type of school placement and ID level will also be verified. These variables were selected because ID adolescents are often compared and contrasted along these variables in adapted physical activity research (Sherrill 1997) and because measurement invariance represents a prerequisite to multiple group comparisons (Cheung and Rensvold 2002; Vandenberg and Lance 2000).

Method

Participants and Procedures

Study 1

Participants were 20 adolescents (10 boys, $M_{age} = 14.56$ years, $SD_{age} = 2.13$; 10 girls, $M_{age} = 14.60$ years, $SD_{age} = 2.12$), aged between 12 and 18 years ($M_{age} = 14.58$ years, $SD_{age} = 2.06$) and identified as having mild to moderate ID level by the Departmental Commission for the Right of Self-sufficiency of People with Disabilities (DCRSPD). All of these adolescents had an Intellectual Quotient (IQ) within the range of 70–35, were limited in their adaptive behavioral skills (Luckasson 2002), attended full time one of two specialized school for ID adolescents, and were enrolled in Adapted Physical Education (APE) classes. All participants have given written informed consent (none of the adolescents either decline to participate or dropped out of the study), and the study protocol was approved by the local Ethical Committee. Items from the original version of the PSI-VSF were read aloud by the interviewer and the adolescents were then asked whether they understood the sentence, the format of delivery and the response alternatives. The suitability of the format and the content were then more directly probed with open-ended questions (i.e. What is very little, some, enough, a lot or entirely? What is running for a long time?).

Study 2

Participants were 342 adolescents (212 boys, $M_{age} = 15.07$ years, $SD_{age} = 1.89$; 130 girls, $M_{age} = 15.10$ years, $SD_{age} = 1.88$), aged between 12 and 18 years ($M_{age} = 15.01$ years, $SD_{age} = 1.91$) and identified as having mild to moderate ID level by the DCRSPD (IQ between 70 and 35 and limited adaptive behavioral skills). This overall sample comprised 201 adolescents with mild ID (IQ between 50 and 70) and 141 with moderate ID (IQ between 35 and 49). On the basis of the adolescents' current educational placement, two separate were also identified: (1) adolescents schooled full time in a regular school but within a self-contained class with other adolescents with ID ($n = 147$); and (2) adolescents enrolled full time in a specialized school with other adolescents with ID ($n = 195$). All of these students were involved in APE classes. This sample was drawn from seven schools and thirteen specialized establishments that agreed to participate in the study. All participants gave written informed consent and none declined to participate or dropped out of the study.

The two versions (i.e. Likert and graphical rating scales) of the PSI-VSF-ID developed in Study 1 were administered in the same day, with a 1 h of interval, to all participants in quiet classroom conditions in classes of up to 12 adolescents. As in Study 1, items were read aloud by the interviewer and the adolescents were then asked to answer. The questionnaires were presented in a counterbalanced order in the different classes. Additionally, 17 adolescents ($M_{age} = 15.24$ years, $SD_{age} = 1.75$), comprising 10 boys (58.82%, $M_{age} = 14.80$ years, $SD_{age} = 1.81$) and 7 girls (41.18%, $M_{age} = 15.86$ years, $SD_{age} = 1.57$) were retested after a 2-week period.

Materials

Three version of the PSI-VSF were used in these studies. In the first study, the original version was used. This instrument, which has been previously described, comprise 12 items (items for each of the six scales: GSC, PSW, PC, SC, PA, PS) that are rated on a six-point Likert scale (*That's just like me* (1) *not at all*, (2) *very little*, (3) *some*, (4) *enough*, (5) *a lot*, (6) *entirely*). In the second study, two adaptations of the PSI-VSF (i.e. items wording was simplified whilst retaining the original meaning) for ID adolescents were used (PSI-VSF-ID): one with a Likert-type answer scale and the other with a graphical answer-scale. The graphical rating scale, illustrated in Fig. 2, was developed on the basis of the Wong–Baker facial pain rating scale (Wong and Baker 1988).

Data Analysis

In the second study, analyses were conducted in several stages. Because of the significant multivariate non-normality of the data (normalized coefficients values for skewness and kurtosis: 49.77 and 25.11), the analyses were performed using Bootstrapped Maximum Likelihood estimation with AMOS 7.0 program (Arbuckle 2006). Thus, all fit values provided in this series of studies were based upon AMOS 7.0 Bollen–Stine bootstrap p-value and bootstrap adjusted chi-square and goodness of fit indexes (Yuan and Hayashi 2003).

In the first stage, two Confirmatory Factor Analyses (CFA) models were tested on both PSI-VSF-ID versions. The first model a priori hypothesized that the answers to the PSI-VSF-ID could be explained by one factor, and that the measurement error terms would be uncorrelated. The second model a priori hypothesized that the answers to the PSI-VSF-ID could be explained by six factors, that each item would have a non-zero loading on the PSI-VSF-ID factor it was designed to measure and zero loadings on all other factors, that the six factors would be correlated, and that the measurement error terms would be uncorrelated. Finally, the temporal stability of the two versions was also estimated using test–retest reliability correlation for scale scores uncorrected for measurement errors on the data from the 17 adolescents who were re-tested over a 2-week period. In the second stage, the best version (i.e. Likert or graphical rating scale) of the PSI-VSF-ID generated in the first stage was used to test the hypothesized hierarchical relationships among the six factors (Fig. 1) with Structural Equation Modeling (SEM) techniques.

In the four following stages, the best version of the PSI-VSF-ID was used to test the invariance of the six-factor CFA model across age category (Stage 3), gender (Stage 4), type of school placement (Stage 5) and level of ID (Stage 6). Regarding the reduced number of participants in several of the ages categories, this variable was dichotomized into 12–14 ($n = 159$) and 15–18 ($n = 183$) years olds. The models were first estimated separately in the various subsamples and then measurement invariance tests were directly conducted across age categories, gender groups, types of school placement and levels of ID in the sequential order recommended by Byrne (2004). In these analyses, each model was compared to the preceding one that served as a reference model (Vandenberg and Lance 2000).

Assessment of fit for the CFA and SEM models was based on multiple indicators (Byrne 2005; Hu and Bentler

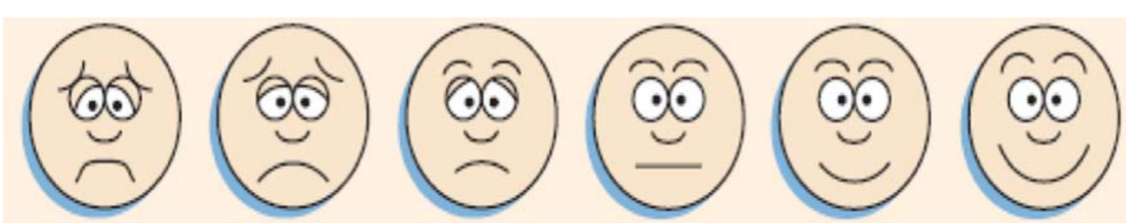

Fig. 2 Graphical "facial" rating scale

1999; Vandenberg and Lance 2000): the Chi-square statistic (χ^2), the Goodness of Fit Index (GFI), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), the Standardized Root Mean square Residual (SRMR), the Root Mean Square Error of Approximation (RMSEA), and the 90% confidence interval of the RMSEA. Values greater than .90 for CFI and TLI are considered to be indicative of adequate model fit (Byrne 2005; Hu and Bentler 1999; Vandenberg and Lance 2000), although values approaching .95 are preferable. Values smaller than .08 or .05 for the RMSEA and smaller than .10 and .08 for the SRMR support, respectively, acceptable and good model fit (Hu and Bentler 1999; Vandenberg and Lance 2000). Concerning the RMSEA 90% CI, values less than .05 for the lower bound (left side) and less than .08 for the upper bounds (right side) or containing 0 for the lower bound and less .05 for the upper bounds (right side) indicate, respectively, acceptable and good model fit (MacCallum et al. 1996). The factor loadings, square multiple correlations, standard errors and *t* values were inspected for appropriate sign and/or magnitude. Critical values for the tests of multi-group invariance in CFAs models were evaluated by the examination of several criterions: χ^2 difference tests and changes in CFI and RMSEA (Chen 2007; Cheung and Rensvold 2002; Vandenberg and Lance 2000). A CFI difference of .01 or less and a RMSEA difference of .015 or less between a reference model and the following model indicate that the measurement invariance hypothesis should not be rejected. Vandenberg and Lance (2000) also indicate that CFI differences of .02 or more would be needed to clearly reject the measurement invariance hypothesis. Analysis of the discriminant validity of the PSI-VSF-ID was also realized using latent factor correlations, according to Bagozzi and Kimmel's (1995) criteria. These criteria state that the validity of two distinct constructs is supported when the result of the multiplication of the standard errors of the factor correlation by 1.96 is less than unity. Finally, the reliability was computed from the model's standardized parameters, using the formula (Bagozzi and Kimmel 1995): $\rho = (\Sigma\lambda i)^2/([\Sigma\lambda i]^2 + \Sigma\delta ii)$ where λi are the factor loading and δii the error variances.

Results

Study 1: Format and Content Evaluation of the PSI-VSF

Items from the French and English original version of the PSI-VSF are reported in parentheses and italics in Table 1. Analysis of the items' content with the ID adolescents from the sample reveal that many words were not understood (e.g. item 1: *good opinion of myself*; item 2: *Globally, I'm proud*; item 4: *nice body to look at*; etc.). In all of these cases the wording of the problematic items was simplified whilst retaining their original meaning. This adapted French version is reproduced in Table 1 outside of the parentheses, along with their English equivalents. The format of the Likert-type answering scale appeared adequate. All participants from this sample were then gathered again 1 week later and presented the adapted version of the questionnaire (the PSI-VSF-ID). This time, all adolescents clearly understood the items and both versions (Likert and graphical answer scales).

Study 2: Factor Validity of the Likert and Graphical Versions of the PSI-VSF-ID

Stage 1

The goodness-of-fit statistics and factor loadings-uniquenesses of the series of CFA measurement models for both versions of the PSI-VSF-ID are displayed in Tables 2 and 3. First, the results showed that the one-factor CFA model for both versions of the PSI-VSF-ID showed (Table 2): (1) significant bootstrapped χ^2 values, (2) GFI, CFI and TLI under .90, and (3) RMSEA and SRMR exceeding .08. Conversely, the results from the six-correlated factors model revealed (Table 2), for both versions: (1) significant bootstrapped χ^2 values; (2) GFI, CFI and TLI exceeding .90 (with the exception of the TLI for the Likert version, which was under .90); and (3) RMSEA and SRMR lower than .08. All loadings and uniquenesses for both versions were significant (Table 3). These results supported factor validity of both versions of the PSI-VSF-ID, but show the superiority of the graphical version when compared to the Likert version.

Descriptive statistics for the PSI-VSF-ID are provided in Table 4. The graphical version is characterized by satisfactory internal consistency coefficients (i.e. ranging from .70 to .74; see Table 4), especially given the fact that it comprises only two items per domain,[2] whereas the Likert version was characterized by weaker internal consistency coefficients (i.e. ranging from .65 to .67). Latent variables intercorrelations are provided in Table 5. In both versions, all of these correlations are statistically significant and quite elevated (i.e. ranging from .418 to .990). These results are highly similar for both versions and consistent to the results from previous studies of the PSI-VSF (Maïano et al. 2008) and of the PSPP-RSEI combination (Atzienga et al. 2004; Fox and Corbin 1989; Hagger et al. 2004;

[2] Indeed, according to Streiner (2003), these coefficients increase and decrease as a function of the number of items included in the scale and consequently this acceptability levels must be adjusted to this very short form scale.

Table 1 Items of the very short form of the physical self-inventory adapted for intellectual disability participants

1. Je m'aime bien—I like myself	GSC
(*J'ai une bonne opinion de moi-même—I have a good opinion of myself*)	
2. Je suis content(e) de toutes les choses que j'arrive à faire avec mon corps—I am glad of all the things I manage to do with my body	PSW
(*Globalement, je suis satisfait de mes capacités physiques—Globally, I'm proud of what I can do physically)*	
3. J'ai plus de force que les autres—I am stronger than others	PS
(*Je pense être plus fort que la moyenne—I'm physically stronger than most people*)	
4. Mon corps est beau à regarder—My body is nice to look at	PA
(*J'ai un corps agréable à regarder—I have a nice body to look at*)	
5. J'arrive à porter quelque chose de lourd—I can carry heavy things	PS
(*Je serais bon dans une épreuve de force—I would be good at exercise that depends on strength*)	
6. Je peux courir beaucoup sans être fatigué—I can run a long time without tiring	PC
(*Je pense pouvoir courir longtemps sans être fatigué—I think I could run for a long time without tiring*)	
7. Je suis bon(ne) dans tous les sports—I am good in all sports	SC
(*Je me débrouille bien dans tous les sports—I can find a way out of difficulties in all sports*)	
8. Tout le monde me trouve beau—Everybody find me good-looking	PA
(*Personne ne me trouve beau—Nobody find me good-looking*)	
9. Je suis content(e) de moi et de ce que je peux faire avec mon corps—I'am happy of myself and what I can do with my body	PSW
(*Je suis content de ce que je suis et de ce que je peux faire physiquement—I'm happy with who I am and what I can do physically*)	
10. Je peux faire 10 tours de terrain de basket-ball sans m'arrêter—I can run ten times around the basketball course without stopping	PC
(*Je serais bon dans une épreuve d'endurance—I would be good at aerobic exercise*)	
11. Je réussis bien à faire les choses en sport—I do things well in sports	SC
(*Je réussis bien en sport—I do well in sports*)	
12. Je veux rester comme je suis—I want to stay as I am	GSC
(*Je voudrais rester comme je suis—I would like to stay as I am*)	

Original French and English items from the PSI-VSF are in parentheses

Note: GSC, global self-concept; PSW, physical self-worth; PC, physical condition; SC, sport competence; PA, physical attractiveness; PS, physical strength

Marsh et al. 2006). Additionally, all latent factor correlations provide evidence for the discriminant validity of the PSI-VSF-ID, according to Bagozzi and Kimmel's (1995) criteria. In contrast with previous results (Fox and Corbin 1989; Maïano et al. 2008), these results revealed that for both versions, the GSC scale exhibited a stronger relationship with PA rather than with PSW, and all of the subscales were significantly and positively correlated with the PSW scale and exhibited stronger relationships with PSW than with GSC (with the exception of PA). Additionally, as displayed in Table 4, the test–retest reliability correlation coefficients of the PSI-VSF-ID were satisfactory in all cases and for both versions of the questionnaire, although the results for the graphical versions were superior to those from the Likert version. Given the superior psychometric properties (model fit and reliability coefficients) of the graphical PSI-VSF-ID, this version was retained for the following steeps of the analyses.

Stage 2

The results from the SEM hierarchical model of the graphical version of the PSI-VSF-ID showed a significant bootstrapped χ^2 values, a GFI, a CFI and aTLI under .90, a SRMR higher than .08, and a RMSEA higher than .10 (see Table 2). All loadings and uniquenesses[3] in this SEM model were significant (i.e. loadings ranging from .791 to .950; uniqueness ranging from .244 to .656). Structural parameters (see footnote 3) estimates among the latent variables for the SEM analyses were all large and significant (i.e. ranging from .494 to .810). An analysis of the modification indices did not provided any acceptable suggestion regarding the improvement of the goodness-of-fit indices of this SEM model. These analyses failed thus to support the proposed hierarchical structure of the graphical PSI-VSF-ID.

Stage 3

The results from the measurement invariance tests are reported in Table 2. The initial analyses performed separately within both age groups revealed acceptable fit indices in both groups with the exception of the TLI and

[3] Details about the analyses are available upon request from the first author.

Table 2 Goodness-of-fit statistics of PSI-VSF-ID models

Stages	Version	Model	Description	χ^2 (B–S)	*df*	GFI	CFI	TLI	SRMR	RMSEA	RMSEA 90% CI	$\Delta\chi^2$	Δdf	|ΔCFI|	|ΔRMSEA|
Stage 1	Likert[a]	CFA	1-factor	270.890*	54	.868	.766	.714	.087	.109	.096–.122	–	–	–	–
		CFA	6-factor correlated	48.240*	39	.947	.916	.857	.055	.077	.061–.093	–	–	–	–
	Graphical[a]	CFA	1-factor	348.206*	54	.832	.783	.734	.089	.126	.114–.139	–	–	–	–
		CFA	6-factor correlated	49.812*	39	.953	.949	.914	.049	.072	.056–.088	–	–	–	–
Stage 2	Graphical[a]	SEM	Hierarchical model	64.994*	50	.895	.873	.832	.077	.100	.087–.114	–	–	–	–
Stage 3	Graphical[a]	CFA	12–14 ($n = 159$)	50.723*	39	.918	.923	.871	.059	.084	.045–.094	–	–	–	–
		CFA	15–18 ($n = 183$)	50.290*	39	.937	.957	.927	.054	.070	.059–.109	–	–	–	–
		CFA, age invariance tests	A—No invariance	101.784*	78	.928	.943	.903	.061	.054	.042–.067	–	–	–	–
			B—λs invariant	109.354*	84	.926	.943	.911	.063	.052	.040–.064	7.57	6	.000	.002
			C—λs, δs invariant	128.287*	96	.921	.941	.919	.065	.050	.038–.061	19.47	12	.002	.002
			D—λs, δs, ξs invariant	133.629*	102	.916	.935	.916	.076	.051	.039–.062	4.80	6	.006	.001
			E—λs, δs, ξs, φs invariant	156.449*	117	.907	.927	.918	.079	.050	.039–.060	22.82	15	.012	.001
Stage 4	Graphical[a]	CFA	Boys ($n = 212$)	51.567*	39	.939	.945	.907	.059	.074	.052–.095	–	–	–	–
		CFA	Girls ($n = 130$)	47.110*	39	.931	.945	.907	.064	.072	.039–.102	–	–	–	–
		CFA, gender invariance tests	A—No invariance	97.586*	78	.936	.945	.907	.063	.052	.039–.064	–	–	–	–
			B—λs invariant	104.840*	84	.934	.946	.916	.065	.049	.036–.061	7.25	6	.001	.003
			C—λs, δs invariant	123.307*	96	.916	.943	.905	.068	.055	.044–.066	18.47	12	.003	.006
			D—λs, δs, ξs invariant	128.664*	102	.909	.936	.909	.073	.055	.045–.066	5.36	6	.007	.000
			E—λs, δs, ξs, φs invariant	150.759*	117	.894	.935	.908	.069	.057	.047–.067	22.10	15	.001	.002
Stage 5	Graphical[a]	CFA	Self-contained classes ($n = 147$)	46.673*	39	.946	.977	.962	.048	.050	.000–.081	–	–	–	–
		CFA	Specialized schools ($n = 195$)	52.237*	39	.930	.927	.880	.061	.084	.062–.107	–	–	–	–
		CFA, placement invariance tests	A—No invariance	98.782*	78	.937	.951	.917	.061	.051	.038–.063	–	–	–	–
			B—λs invariant	105.302*	84	.931	.944	.913	.062	.052	.039–.064	6.52	6	.007	.001
			C—λs, δs invariant	123.673*	96	.918	.931	.905	.062	.054	.043–.065	18.32	12	.013	.002
			D—λs, δs, ξs invariant	129.421*	102	.915	.929	.909	.062	.053	.042–.064	5.79	6	.002	.001
			E—λs, δs, ξs, φs invariant	152.229*	117	.906	.927	.918	.067	.050	.040–.060	25.81*	15	.002	.003

Table 2 continued

Stages	Version	Model	Description	χ^2 (B–S)	*df*	GFI	CFI	TLI	SRMR	RMSEA	RMSEA 90% CI	$\Delta\chi^2$	Δdf	|ΔCFI|	|ΔRMSEA|
Stage 6	Graphical[a]	CFA	Mild ID ($n = 201$)	49.941*	39	.921	.917	.859	.066	.095	.074–.116	–	–	–	–
		CFA	Moderate ID ($n = 141$)	48.567*	39	.921	.937	.893	.057	.082	.054–.109	–	–	–	–
		CFA, ID invariance tests	A—No invariance	99.228*	78	.921	.925	.873	.066	.063	.052–.075	–	–	–	–
			B—λs invariant	105.874*	84	.917	.919	.872	.064	.064	.052–.075	6.65	6	.006	.001
			C—λs, δs invariant	124.509*	96	.910	.914	.882	.066	.061	.050–.072	18.64	12	.005	.003
			D—λs, δs, ξs invariant	130.316*	102	.908	.914	.889	.068	.059	.049–.070	5.81	6	.000	.002
			E—λs, δs, ξs, φs invariant	153.080*	117	.900	.907	.895	.072	.058	.048–.068	22.76	15	.007	.001

Bootstrapped goodness of fit indexes are reported in this table because of the significant multivariate non-normality within these data

Note: CFA, confirmatory factor analytic model; SEM, structural equation modeling; χ^2 (B–S), Bollen–Stine chi-square; *df*, degrees of freedom; GFI, goodness of fit index; CFI, comparative fit index; TLI, Tucker–Lewis index; SRMR, standardized root mean square residual; RMSEA, root mean square error of approximation; RMSEA 90% CI = 90% Confidence interval for the RMSEA point estimate; ID, intellectual disability; λ, factor loading; δ, uniquenesses; ξ, factor variance; ϕ, factor covariance; $\Delta\chi^2$, change in goodness-of-fit χ^2 relative to the preceding model; Δdf, change in degrees of freedom relative to the preceding model; ΔCFI, change in comparative fit index relative to the preceding model; ΔRMSEA, change in root mean square error of approximation relative to the preceding model

[a] $N = 342$

* $p < .05$

Table 3 CFA's factor loadings and uniquenesses for the total sample

Factor	Item no.	PSI-VSF-ID[a] Likert version $\lambda(\delta)$	PSI-VSF-ID[a] Graphical version $\lambda(\delta)$
GSC			
	1	.660(.436)[b]	.745(.455)[b]
	12	.545(.297)	.620(.284)
PSW			
	2	.700(.490)[b]	.754(.469)[b]
	9	.695(.484)	.693(.380)
PC			
	6	.686(.471)[b]	.824(.578)[b]
	10	.715(.511)	.792(.527)
SC			
	7	.655(.429)[b]	.757(.573)[b]
	11	.678(.459)	.761(.579)
PA			
	4	.619(.384)[b]	.717(.415)[b]
	8	.489(.239)	.472(.123)
PS			
	3	.593(.351)[b]	.631(.299)[b]
	5	.297(.088)	.540(.191)

All loadings and uniquenesses are significant ($p < .001$)

Note: λ, factor loading; δ, uniquenesses; GSC, global self-concept; PSW, physical self-worth; PC, physical condition; SC, sport competence; PA, physical attractiveness; PS, physical strength

[a] $N = 342$

[b] Item that was set to be 1.0

Table 4 Descriptive statistics for the PSI-VSF-ID based on the answers from the total sample ($N = 342$)

	Possible scoring range	Likert version Mean(SD)	Likert ρ	Likert r_{tt}	Graphical version Mean(SD)	Graphical ρ	Graphical r_{tt}
GSC	1–6	4.65(1.30)	.66	.74*	4.94(1.30)	.72	.80*
PSW		4.64(1.19)	.67	.68*	4.97(1.17)	.71	.85*
PC		3.84(1.53)	.67	.67*	3.99(1.56)	.70	.93*
SC		4.10(1.28)	.67	.36*	4.44(1.30)	.71	.78*
PA		4.24(1.25)	.66	.64*	4.53(1.33)	.72	.72*
PS		3.85(1.27)	.65	.72*	4.25(1.32)	.74	.86*

Note: GSC, global self-concept; PSW, physical self-worth; PC, physical condition; SC, sport competence; PA, physical attractiveness; PS, physical strength; SD, standard deviation; ρ, composite reliability estimate; r_{tt}, test–retest intraclass correlations

*$p < .01$

RMSEA found in the 12–14 years old group (see Table 4). The results from the various steps of the age-related measurement invariance tests showed that (1) all of the χ^2 were significant but none of the χ^2 difference tests was significant; (2) the GFI, CFI, TLI, SRMR and RMSEA indicated

Table 5 Factor correlations among latent factors according to the PSI-VSF-ID version ($N = 342$)

Scale	GSC	PSW	PC	SC	PA	PS
GSC	1.00	.710*	.418*	.586*	.990*	.507*
PSW	.768*	1.00	618*	.692*	.852*	.536*
PC	.463*	.578*	1.00	.727*	.546*	.732*
SC	.436*	.622*	.809*	1.00	.675*	.901*
PA	.958*	.755*	.584*	.568*	1.00	.652*
PS	.537*	.533*	.734*	.962*	.739*	1.00

Note: Results for the Likert version are below the diagonal and results for the graphical version are over the diagonal; GSC, global self-concept; PSW, physical self-worth; PC, physical condition; SC, sport competence; PA, physical attractiveness; PS, physical strength

*$p < .01$

adequate model fit; (3) the ΔCFI did not exceed .01; and (4) the ΔRMSEA remained under .015. These results confirm the measurement invariance of the PSI-VSF-ID across age groups.

Stage 4

The initial analyses performed separately within both gender groups revealed acceptable fit indices in both groups. The results from the various steps of the gender-related measurement invariance tests showed that: (1) all of the χ^2 were significant but none of the χ^2 difference tests was significant; (2) the GFI, CFI, TLI, SRMR and RMSEA indicated adequate model fit; (3) the ΔCFI did not exceed .01; and (4) the ΔRMSEA remained under .015. These results confirm the measurement invariance of the PSI-VSF-ID across genders.

Stage 5

The initial analyses performed separately within both school placement groups revealed acceptable GFI, TLI and SRMR in both groups, satisfactory TLI and RMSEA in the self contained classes and unsatisfactory TLI and RMSEA in the specialized schools. The results from measurement invariance tests showed that: (1) all of the χ^2 were significant but the χ^2 difference tests were non-significant for hypotheses B, C and D; (2) the χ^2 difference test was significant for hypothesis E (factor covariance); (3) the GFI, CFI, TLI, SRMR and RMSEA values all indicate adequate model fit; (4) the ΔCFI values suggest that the factor loadings, variances and covariances are invariant across groups whereas the uniqueness may be slightly non invariant (it should be noted that the ΔCFI remains under .02 for hypothesis B); and (5) the ΔRMSEA values remained all under the recommended cutoff point of .015. These results generally confirm the invariance of the measurement model across school placement types, at least up to the level of the latent factor covariance. The ΔCFI suggest that the factor uniqueness may be slightly non invariant (ΔCFI = .012) but this result remains under .02 and not replicated with the ΔRMSEA and the χ^2 difference test.

Stage 6

The initial analyses performed separately within both ID level groups revealed acceptable GFI, TLI and SRMR, and unsatisfactory TLI and RMSEA. However, the results from measurement invariance tests showed that: (1) all of the χ^2 were significant but none of the χ^2 difference tests were significant; (2) the GFI, CFI, and SRMR values all indicate adequate model fit; (3) the TLI and RMSEA values were slightly unsatisfactory for all models; (4) the ΔCFI values did not exceed .01; and (5) the ΔRMSEA values remained all under the recommended cutoff point of .015. These results show that the measurement model may not be optimal when the ID level groups are considered separately. This could be related to the range restriction due to the greater homogeneity of the subgroups cognitive processes. In addition, the results confirm the invariance of the measurement model of the PSI-VSF-ID across ID groups.

Discussion

The objectives of the first study were to verify the clarity of the PSI-VSF items within a sample of adolescents with ID and to use these results to develop two versions of this questionnaire that were easy to understand for this population. The results led to the development of two versions of the PSI-VSF-ID, one in which the original Likert-type answer scale was kept and one in which this scale was replaced by a graphical one, showing smiling and unsmiling faces. The resulting instrument and both forms of answer scales proved to be far easier to understand for ID adolescents. The psychometric properties of these instruments were then empirically verified within the second study. However, before the results from the second study can be considered, it should be noted that the results from this first study suggest that the direct transposition of physical self-concept questionnaires to ID adolescents without the preliminary verification of their applicability may be highly problematic. Theses results thus confirm the observations and warnings previously noted by Wichstrøm (1995) and Marsh and Holmes (1990).

The objectives of the second study were to directly evaluate the psychometric properties of both versions of the PSI-VSF-ID in a sample of adolescents with ID. These results first revealed that although both versions appeared to possess satisfactory psychometric properties, the version with the graphical answer scale was superior: the six-factor measurement model of this version appeared to fit the data better and possessed higher reliability coefficients (i.e. internal consistency and test–retest reliability). It should be noted that the results from both versions of the questionnaire clearly showed the inadequacy of a one-dimensional conception of the physical self-concept. These results contrast with those from Silon and Harter (1985) study by showing that adolescents with ID are indeed able to successfully distinguish six dimensions of their physical self-concept (i.e. GSE, PSW, PC, SC, PA and PS). This discrepancy could potentially be related to the absence of content adaptation in the Silon and Harter (1985) study: ID adolescents may answer unclear items without being able to clearly differentiate their meanings. This could artificially create a blur in the observed factor structure and yield an apparent one-dimensional model: ID adolescents can probably decode that all items refer to their self-concept, even without knowing precisely what each of them signifies. This reinforces the preceding conclusion about the importance of adapting questionnaires before using them in ID populations.

Additional results indicate that the PSI-VSF-ID latent factor correlations are elevated (i.e. >.50) and sometimes even greater than .90. This result confirms the proposed interrelations between the various dimensions (i.e. discriminant validity) of the PSI-VSF-ID and is of similar magnitude to those found by Maïano et al. (2008) on the PSI-VSF and by others on the PSPP-RSEI combination (Atzienga et al. 2004; Fox and Corbin 1989; Hagger et al. 2004, 2005; Marsh and Redmayne 1994; Marsh et al. 2002, 2006). However, according to Marsh and Redmayne (1994) and Marsh et al. (2002, 2006), the strength of those relations also brings into question the real independence of physical self dimensions, and by extension their discriminant validity. Indeed, for these authors (Marsh and Redmayne 1994; Marsh et al. 2002, 2006), such a result may be observed with short scales that attempt to cover a broad range of dimensions with few items, as it is the case for the PSI-VSF-ID. However, it may also suggest that ID adolescents' ability to discriminate between those various dimensions of their physical self-concept may be more limited.

The SEMs analyses of the PSI-VSF-ID failed to support the hierarchical structure of the physical self-concept of Fox and Corbin's (1989) model, contrasting with the results from studies of adolescents answers to the PSI-VSF (Maïano et al. 2008) and to the PSPP-RSEI combination (Atzienga et al. 2004; Fox and Corbin 1989; Ninot et al. 2000b). Although this conclusion should be replicated with additional and larger samples of adolescents with ID, this result suggest that this structure may not hold with this population. ID adolescents' physical self-concept, although multidimensional, may still possess a more simple structure than "normal" adolescents' physical self-concept.

Subsequent results also fully supported the measurement invariance of the PSI-VSF-ID across genders, age groups and ID severity. These results were highly consistent with those found by Maïano et al. (2008) in the validation study of the PSI-VSF. However, the measurement invariance of the PSI-VSF-ID across the type of school placement did not hold as well. Still, the results from these analyses confirmed that the factor loadings were invariant across groups and suggest that the items uniquenesses may be partially non invariant. However, this result remains tentative and should be replicated in future studies because this non invariance was only suggested by one of the indicators and not replicated with the others. Additionally, this result is promising given the fact that complete uniquenesses invariance has often be found to be a too stringent condition for multiple group comparisons and do not appear to represent a necessary condition to conduct such tests (although partial uniquenesses invariance may be more important; Vandenberg and Lance 2000). Additional results also suggest that the latent factor covariance may also be non invariant across school placement type, suggesting that the various components of the physical self-concept may relate differently to each other in both subgroups. This substantive results should not, however, be interpreted as a lack of measurement invariance (Vandenberg and Lance 2000), but rather as a prompt for more studies designed to better understand how school placement may influence the organization of ID adolescents physical self-concept.

Another interesting result comes from the fact that the measurement model did not seem to hold as well when it was estimated separately in the sub-samples of adolescents from specialized schools and self-contained classes, as well as in both sub-samples formed on the basis of ID severity. This result could potentially be attributed to the fact that these sub-samples may have been more homogenous regarding to their cognitive processes and abilities, and thus have provided a more restricted array of answers to the PSI-VSF items. Range restriction, coupled with reduced sample size may explain these results. This would explain the fact that the overall measurement model fit the data well when the overall sample is considered. This overall sample may be considered as more representative of ID youths in general. This is supported by the fact that the measurement models appear almost completely invariant across these subgroups (configuration, loadings and variance). Notwithstanding this hypothesis, the present result may also indicate that the PSI-VSF-ID measurement model is less than optimal when it is used within highly homogenous subgroups of ID adolescents. Any use of the PSI-

VSF-ID within such samples should thus be made with caution or wait for the present results to be replicated.

In addition to what was previously noted, six limitations of the present series of studies must be taken into account in the interpretation of the findings. First, the present studies were based on a sample of adolescent with ID, which could not be considered as representative of the French population with ID. This indicates that the use of this instrument should be limited to a population similar to the one of the present study. Clearly, until additional studies have investigated the generalizability of the PSI-VSF-ID to other cultural (i.e. French speaking Maghreb adolescents) or linguistic (i.e. English speaking adolescents) groups of adolescents with ID or to adults with ID, its cross-cultural or -linguistic application cannot be recommended.

Second, these adolescents were tested in the context of their APE classes, a context which may have heightened the salience of their physical self-concept. It thus remains unknown whether the present results, especially regarding the discriminant validity of the various subscales, could be replicated in other contexts, such as clubs or sport and leisure associations.

Third, the present results rely on a single sample of adolescents and should clearly be replicated. To avoid capitalizing on chance, we avoided testing modified models and fitting alternate measurement models for which no a priori hypotheses could be found in the literature. For instance, even though some of the latent variables presented an elevated level of inter-correlations, we did not verify whether a model in which those factors were combined could provide a better fit to the data. This should be more systematically tested in ulterior studies. More precisely, this limitation suggests that, although ID adolescents could differentiate between more dimensions of the self-concept than what previous studies suggest (Silon and Harter 1985), they may not fully discriminate between the six domains of Fox and Corbin's (1989) model.[4]

Fourth, the reliance on a cross-sectional sample also precludes the verification of the developmental stability of the PSI-VSF-ID. Although the present study allowed for the verification of the test–retest reliability of the instrument over a 2-week period, a complete test of the construct validity of this instrument would involve testing the developmental change of PSI-VSF-ID during the early to late adolescent years, a period of marked changes in adolescents' physical self-concept (Maïano et al. 2004; Marsh 1998). Fifth, the criterion-related validity of this instrument was not evaluated with: (1) instruments measuring other relevant concepts (i.e. body image, anxiety, depression…) and (2) multiple external criterions (i.e. body mass index, physical fitness or activity level…). All of these issues should clearly be addressed in the context of future studies.

Finally, when using interviews or self-report questionnaires with ID adolescents, acquiescence bias represents a particularly important issue.[5] Acquiescence bias, or the "tendency to agree or say yes to statements or questions, regardless of the content of the items", is a tendency that is known to be particularly present in ID populations (Finlay and Lyons 2002, p. 14). According to Finlay and Lyons (2002), this tendency results from the combination of three main factors: (1) personality-related factors, such as suggestibility (i.e. the tendency to accept any information as true) and submissiveness (i.e. the desire to please or to avoid public disagreements); (2) cognitive and linguistic factors (i.e. misunderstanding of the question content/phrasing and of the required response format); and (3) factors related to the social context of the interview (i.e. involving known interviewers). In order to reduce this bias during interviews or self-report questionnaires, Finlay and Lyons (2001, 2002) proposed several specific recommendations regarding the phrasing of the questions, their content, their response format, and the psychometric validation process. Although these recommendations were followed during the design and administration of the questionnaires and although acquiescence bias is usually less present in the context of self-reported questionnaires than in the context of interviews, the presence of potential bias was not systematically evaluated in the present study. However, an analysis of the frequency to which each answer was chosen suggests that acquiescence bias may not have affected the present results. Consequently, future research should attempt to more systematically identify and control this bias and to evaluate whether it is indeed present within various subgroups of ID adolescents exposed to the PSI-VSF-ID.

In conclusion, it is important that the present study is viewed as a preliminary step in the validation of a very short instrument for individuals with ID that (1) simultaneously assesses the multidimensionality of the physical self-concept; (2) can be rapidly completed; (3) can be correctly understood by this population; (4) requires a very short attention span; and (5) does not require elaborate reading skills. All of these characteristics represent a serious advantage of this instrument, which is also appropriate for use in the context of in-depth longitudinal or idiographic studies given its reduced length. Nevertheless, based on the present results and their limitations, the use of this instrument should be, for the time being, restricted to samples of French ID adolescents similar to this one. We

[4] Additional results available from the first author suggest that this might not be the case.

[5] The authors which to thank an anonymous reviewer for bringing this issue to our attention.

also cannot at present recommend this instrument in the context of multiple groups' comparisons of mildly versus moderately ID adolescents and of adolescents schooled within self contained classes versus specialized schools before more is known regarding the reasons for the less than optimal fit indices obtained in these specific and more homogeneous subgroups.

Acknowledgments The authors would like to thank the Collège des vallées du Paillon, Collège Joseph Pagnol, Collège des Campelières, Collège Louis Nucera, Collège Pablo Picasso, Collège de l'Archet, Collège Pierre Bonnard, Institut Henri Wallon, IME Valfleurs, IME les Terrasses, IME Pierre Merli, IME Le Mont Boron, IME les Paradoux, IME les Ecureuils, IME Bariquand Alphand, IME Bel-air, IME Vert pré, IME les Capitelles, IME les Oliviers, IME les Mûriers for their invaluable assistance in data collection.

References

Arbuckle, J. (2006). *AMOS 7.0 user's guide*. Chicago, IL: SPSS.

Atzienga, F. L., Balaguer, I., Moreno, Y., & Fox, K. R. (2004). El perfil de autopercepción física: Propiedades psicométricas de la versión española y análisis de la estructura jerárquica de las autopercepciones físicas. *Psicothema, 16*, 461–467.

Bagozzi, R. P., & Kimmel, S. K. (1995). A comparison of leading theories for the prediction of goal directed behaviours. *The British Journal of Social Psychology, 34*, 437–461.

Bear, G. G., Clever, A., & Proctor, W. A. (1991). Self-perceptions of nonhandicapped children and children with learning disabilities in integrated classes. *The Journal of Special Education, 24*, 409–426.

Butler, R., & Marinov-Glassman, D. (1994). The effects of educational placement and grade level on the self-perceptions of low achievers and students with learning disabilities. *Journal of Learning Disabilities, 27*, 325–334.

Byrne, B. M. (1996). Academic self-concept: Its structure, measurement, and relation to academic achievement. In B. A. Bracken (Ed.), *Handbook of self-concept: Developmental, social, and clinical considerations* (pp. 287–316). New York, NY: Wiley.

Byrne, B. M. (2004). Testing for multigroup invariance using AMOS graphics: A road less traveled. *Structural Equation Modeling, 11*, 272–300. doi:10.1207/s15328007sem1102_8.

Byrne, B. M. (2005). Factor analytic models: Viewing the structure of an assessment instrument from three perspectives. *Journal of Personality Assessment, 85*, 17–32. doi:10.1207/s15327752jpa8501_02.

Castagno, K. S. (2001). Special Olympics unified sports: Changes in male athletes during a basketball season. *Adapted Physical Activity Quarterly, 18*, 193–206.

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement. *Structural Equation Modeling, 14*, 464–504.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*, 233–255. doi:10.1207/S15328007SEM0902_5.

Dykens, E., & Cohen, D. J. (1996). Effects of special Olympics international on social competence in persons with mental retardation. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*, 223–229. doi:10.1097/00004583-199602000-00016.

Finlay, W. M. L., & Lyons, E. (2001). Methodological issues in interviewing and using self-report questionnaires with people with mental retardation. *Psychological Assessment, 13*, 319–335. doi:10.1037/1040-3590.13.3.319.

Finlay, W. M. L., & Lyons, E. (2002). Acquiescence in interviews with people with mental retardation. *Mental Retardation, 40*, 14–29. doi:10.1352/0047-6765(2002)040<0014:AIIWPW>2.0.CO;2.

Fonseca, A. M., & Fox, K. R. (2002). Como avaliar o modo como as pessoas se percebem fisicamente? Um olhar sobre a versão portuguesa do physical self-perception profile (PSPP). *Revista Portuguesa de Ciências do Desporto, 2*, 11–23.

Fox, K. R. (2000). Self-esteem, self-perception and exercise. *International Journal of Sport Psychology, 31*, 228–240.

Fox, K. R., & Corbin, C. B. (1989). The physical self-perception profile: Development and preliminary validation. *Journal of Sport & Exercise Psychology, 11*, 408–430.

Gibbons, S. L., & Bushakra, F. (1989). Effects of special Olympics participation on the perceived competence and social acceptance of mentally retarded children. *Adapted Physical Activity Quarterly, 6*, 40–51.

Hagger, M. S., Asci, H., & Linwall, M. (2004). A cross-cultural evaluation of a multidimensional and hierarchical model of physical self-perceptions in three national samples. *Journal of Applied Social Psychology, 34*, 1075–1107. doi:10.1111/j.1559-1816.2004.tb02584.x.

Hagger, M. S., Biddle, S. J. H., & Wang, C. K. J. (2005). Physical self-concept in adolescence: Generalizability of a multidimensional, hierarchical model across gender and grade. *Educational and Psychological Measurement, 65*, 297–322. doi:10.1177/0013164404272484.

Harter, S. (1978). Effectance motivation reconsidered. *Human Development, 21*, 34–64.

Harter, S. (1982). The perceived competence scale for children. *Child Development, 53*, 87–97. doi:10.2307/1129640.

Harter, S. (1988). *Manual for the adolescent self-perception profile*. Denver, CO: Author.

Harter, S. (1999). *The construction of the self: A developmental perspective*. New York, NY: Guilford.

Harter, S., & Kreinik, P. (1998). *The self-perception profile for late adulthood*. Denver, CO: Author.

Harter, S., & Pike, R. (1984). The pictorial scale of competence and social acceptance for young children. *Child Development, 55*, 1969–1982. doi:10.2307/1129772.

Hu, L.-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.

Kistner, J. A., Haskett, M., White, K., & Robbins, F. (1987). Perceived competence and self-worth of LD and normally achieving students. *Learning Disability Quarterly, 10*, 37–44. doi:10.2307/1510753.

Luckasson, R. (2002). *Mental retardation: Definition, classification and systems of supports* (10th ed.). Washington, DC: American Association on Mental Retardation.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*, 130–149. doi:10.1037/1082-989X.1.2.130.

Maïano, C., Morin, A. J. S., Ninot, G., Monthuy-Blanc, J., Stephan, Y., Florent, J.-F., et al. (2008). A short and very short form of the physical self-inventory for adolescents: Development and factor validity. *Psychology of Sport and Exercise, 9*, 830–847. doi:10.1016/j.psychsport.2007.10.003.

Maïano, C., Ninot, G., & Bilard, J. (2004). Age and gender effects on global self-esteem and physical self-perception in adolescents. *European Physical Education Review, 10*, 53–69. doi:10.1177/1356336X04040621.

Maïano, C., Ninot, G., Bruant, G., & Benattar, B. (2003). Effect of placement in specialized establishments on adolescent perceived competence following school failure. *Canadian Psychology, 44*, 139–141. doi:10.1037/h0086932.

Maïano, C., Ninot, G., Bruant, G., & Bilard, J. (2002). Effects of alternated basketball competition on perceived competence in adolescents with intellectual disabilities over a period of 13 months. *International Journal of Disability Development and Education, 49*, 413–420. doi:10.1080/1034912022000028376.

Maïano, C., Ninot, G., & Erraïs, B. (2001). Effect of alternated sport competition in perceived competence for adolescent males with mild to moderate mental retardation. *International Journal of Rehabilitation Research, 24*, 51–58. doi:10.1097/00004356-200103000-00007.

Marsh, H. W. (1998). Age and gender effects in physical self-concepts for adolescent elite athletes and nonathletes: A multicohort-multioccasion design. *Journal of Sport & Exercise Psychology, 20*, 237–259.

Marsh, H. W., Asci, H., & Marco, I. T. (2002). Multi-trait multi-method analyses of two physical self-concept instruments: A cross-cultural perspective. *Journal of Sport & Exercise Psychology, 24*, 99–119.

Marsh, H. W., Bar-Eli, M., Zach, S., & Richards, G. E. (2006). Construct validation of Hebrew versions of three physical self-concept measures: An extended multitrait-multimethod analysis. *Journal of Sport & Exercise Psychology, 28*, 310–343.

Marsh, H. W., & Holmes, I. W. M. (1990). Multidimensional self-concepts: Construct validation of responses by children. *American Educational Research Journal, 27*, 89–117.

Marsh, H. W., & Redmayne, R. S. (1994). A multidimensional physical self-concept and its relations to multiple components of physical fitness. *Journal of Sport & Exercise Psychology, 16*, 43–55.

Messer, B., & Harter, S. (1986). *Manual of the adult self-perception profile*. Denver, CO: University of Denver.

Ninot, G., Bilard, J., & Delignières, D. (2005). Effects of integrated or segregated sport participation on the physical self for adolescents with intellectual disabilities. *Journal of Intellectual Disability Research, 49*, 682–689. doi:10.1111/j.1365-2788.2005.00407.x.

Ninot, G., Bilard, J., Delignières, D., & Sokolowski, M. (2000a). Overestimation of perceived competence for adolescents with mental retardation placed in segregated schools. *European Review of Applied Psychology, 50*, 165–173.

Ninot, G., Bilard, J., Delignières, D., & Sokolowski, M. (2000b). Effects of integrated sport participation on perceived competence for adolescents with mental retardation. *Adapted Physical Activity Quarterly, 17*, 208–221.

Ninot, G., Bilard, J., & Sokolowski, M. (2000c). Athletic competition: A means of improving self image of the mentally retarded adolescent? *International Journal of Rehabilitation Research, 23*, 111–117.

Ninot, G., Delignières, D., & Fortes, M. (2000d). L'évaluation de l'estime de soi dans le domaine corporel. *Sciences et Techniques des Activités Physiques et Sportives, 53*, 35–48.

Ninot, G., & Maïano, C. (2007). Long-term effects of athletics meet on the perceived competence of individuals with intellectual disabilities. *Research in Developmental Disabilities, 28*, 176–186. doi:10.1016/j.ridd.2006.02.008.

Pierrehumbert, B., Zanone, F., Kauer-Tchicaloff, C., & Plancherel, B. (1988). Image de soi et échec scolaire. *Bulletin de Psychologie, 7–9*, 333–345.

Renick, M. J., & Harter, S. (1989). Impact of social comparisons on developing self-perceptions of learning disabled students. *Journal of Educational Psychology, 81*, 631–638. doi:10.1037/0022-0663.81.4.631.

Rosenberg, M. (1965). *Society and the adolescent self-image*. New Jersey, NJ: Princeton University.

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of Educational Research, 46*, 407–411.

Sherrill, C. (1997). Disability, identity, and involvement in sport and exercise. In K. R. Fox (Ed.), *The physical self* (pp. 257–286). Champaign, IL: Human Kinetics.

Silon, E. L., & Harter, S. (1985). Assessment of perceived competence, motivational orientation, and anxiety in segregated and mainstreamed educable mentally retarded children. *Journal of Educational Psychology, 77*, 217–230. doi:10.1037/0022-0663.77.2.217.

Streiner, D. L. (2003). Starting at the beginning: An introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment, 80*, 99–103. doi:10.1207/S15327752JPA8001_18.

Ulrich, D. A., & Collier, D. H. (1990). Perceived competence in children with mental retardation: Modification of a pictorial scale. *Adapted Physical Activity Quarterly, 7*, 338–354.

Van de Vliet, P., Knapen, J., Onghena, P., Fox, K., Van Coppenolle, H., David, A., et al. (2002). Assessment of physical self-perceptions in normal Flemish adults versus depressed psychiatric patients. *Personality and Individual Differences, 32*, 855–863. doi:10.1016/S0191-8869(01)00091-5.

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods, 3*, 4–70. doi:10.1177/109442810031002.

Weiss, J., Diamond, T., Demark, J., & Lovald, B. (2003). Involvement in special Olympics and its relations to self-concept and actual competency in participants with developmental disabilities. *Research in Developmental Disabilities, 24*, 281–305. doi:10.1016/S0891-4222(03)00043-X.

Wichstrøm, L. (1995). Harter's self-perceptions profile for adolescents: Reliability, validity and evaluation of the question format. *Journal of Personality Assessment, 65*, 100–116. doi:10.1207/s15327752jpa6501_8.

Wong, D. L., & Baker, C. M. (1988). Pain in children: Comparison of assessment scales. *Pediatric Nursing, 14*, 9–17.

Wright, J., & Cowden, J. (1986). Changes in self-concept and cardiovascular endurance of mentally retarded youths in a special Olympics swim training program. *Adapted Physical Activity Quarterly, 3*, 177–183.

Yuan, K.-H., & Hayashi, K. (2003). Bootstrap approach to inference and power analysis based on three statistics for covariance structure models. *The British Journal of Mathematical and Statistical Psychology, 56*, 93–110. doi:10.1348/000711003321645368.

Yun, J., & Ulrich, D. A. (1997). Perceived and actual physical competence in children with mild mental retardation. *Adapted Physical Activity Quarterly, 14*, 285–297.