Journal of Sports Sciences

ISSN: 0264-0414 (Print) 1466-447X (Online) Journal homepage: https://www.tandfonline.com/loi/rjsp20

Identifying profiles of actual and perceived motor competence among adolescents: associations with motivation, physical activity, and sports participation

An De Meester, Jolien Maes, David Stodden, Greet Cardon, Jacqueline Goodway, Matthieu Lenoir & Leen Haerens

To cite this article: An De Meester, Jolien Maes, David Stodden, Greet Cardon, Jacqueline Goodway, Matthieu Lenoir & Leen Haerens (2016) Identifying profiles of actual and perceived motor competence among adolescents: associations with motivation, physical activity, and sports participation, Journal of Sports Sciences, 34:21, 2027-2037, DOI: 10.1080/02640414.2016.1149608

To link to this article: https://doi.org/10.1080/02640414.2016.1149608

Published online: 29 Feb 2016.

JOURNAL OF SPORTS SCIENCES, 2016
VOL. 34, NO. 21, 2027–2037
http://dx.doi.org/10.1080/02640414.2016.1149608

Identifying profiles of actual and perceived motor competence among adolescents: associations with motivation, physical activity, and sports participation

An De Meester [a,b], Jolien Maes[a], David Stodden[c], Greet Cardon[a], Jacqueline Goodway[d], Matthieu Lenoir[a] and Leen Haerens[a]

[a]Department of Movement and Sports Sciences, Ghent University, Ghent, Belgium; [b]The Policy Research Centre on Sports, funded by the Flemish Government, Brussels, Belgium; [c]Department of Physical Education & Athletic Training, University of South Carolina, Columbia, SC, USA; [d]Department of Human Sciences, Ohio State University, Columbus, OH, USA

ABSTRACT

The present study identified adolescents' motor competence (MC)-based profiles (e.g., high actual and low perceived MC), and accordingly investigated differences in motivation for physical education (PE), physical activity (PA) levels, and sports participation between profiles by using regression analyses. Actual MC was measured with the Körperkoordinationstest für Kinder. Adolescents (n = 215; 66.0% boys; mean age = 13.64 ± .58 years) completed validated questionnaires to assess perceived MC, motivation for PE, PA-levels, and sports participation. Actual and perceived MC were only moderately correlated and cluster analyses identified four groups. Two groups of overestimators (low – overestimation, average – overestimation) were identified (51%), who particularly displayed better motivation for PE when compared to their peers who accurately estimated themselves (low – accurate, average – accurate). Moreover, adolescents with low actual MC, but high perceived MC were significantly more active than adolescents with low actual MC who accurately estimated themselves. Results pointed in the same direction for organised sports participation. Underestimators were not found in the current sample, which is positive as underestimation might negatively influence adolescents' motivation to achieve and persist in PA and sports. In conclusion, results emphasise that developing perceived MC, especially among adolescents with low levels of actual MC, seems crucial to stimulate motivation for PE, and engagement in PA and sports.

ARTICLE HISTORY
Accepted 28 January 2016

KEYWORDS
Motor competence; motivation for physical education; physical activity; sports participation; adolescents; person-centred analyses

Regular physical activity (PA) and sports participation positively impact physical, psychological, and social health (Biddle & Asare, 2011; Janssen & LeBlanc, 2010) and evidence suggests that active adolescents are more likely to become active adults (Kjonniksen, Torsheim, & Wold, 2008; Telama et al., 2005). Despite the well-known positive health effects, an increasing number of adolescents do not meet the daily recommendations of at least 60 min of moderate to vigorous PA (Currie et al., 2008) and do not enjoy the related health benefits (Biddle, Gorely, & Stensel, 2004). To increase PA levels, it is necessary to identify underlying mechanisms that promote PA engagement and sports participation. Significant attention has been paid to psychosocial and environmental correlates of PA, and accordingly to the promotion of PA via behavioural change or environmental interventions (e.g., Haerens, De Bourdeaudhuij, Maes, Cardon, & Deforche, 2007; McKenzie et al., 2003).

However, motor competence (MC) has received less attention as an underlying mechanism of PA and sports participation among adolescents. Actual MC, which also has been noted in previous literature as motor coordination, motor skill proficiency, fundamental movement skill or motor ability (Robinson et al., 2015), can be defined as the degree of skilled performance in a wide range of motor tasks as well as the movement quality, coordination, and control underlying a particular motor outcome (Burton & Miller, 1998; Gabbard, 2015). In addition to actual MC, there has recently been an increased focus on individuals' perceptions of MC, how perceived MC relates to actual MC, and their collective impact on adolescents' engagement in PA and sports (e.g., Barnett, Morgan, van Beurden, Ball, & Lubans, 2011; Logan et al., 2014; Stodden et al., 2008). A child's perception of his or her MC is an evolving phenomenon that changes across developmental time (Harter, 1999). While young children may lack the cognitive capability to accurately estimate their actual MC (Goodway & Rudisill, 1997; Harter & Pike, 1984), adolescents' perceived MC is expected to more closely align with their actual MC (Harter, 1999). To gain more insight in the relationship between actual and perceived MC, the first aim of this study was to examine whether young adolescents are indeed capable of correctly assessing their MC. As noted by Harter (1999) and Stodden et al. (2008), it was hypothesised that young adolescents in the current study would demonstrate moderate to strong associations among perceived and actual MC.

Previous studies mainly used a variable-centred approach to provide an overall picture of the average relationship between actual and perceived MC (Barnett, Morgan, van Beurden, & Beard, 2008; Khodaverdi, Bahram, Khalaji, & Kazemnejad, 2013), but they did not provide an

CONTACT An De Meester A.DeMeester@UGent.be

understanding of whether, at the personal level, there might be adolescents who think they are incompetent when they are not (or vice versa). Up until now, the relationship between actual and perceived MC (and different outcomes) has only been studied once by means of person-centred analyses (Weiss & Amorose, 2005). Weiss and Amorose used a four-item questionnaire to measure actual MC among voluntary sports participants and identified five groups who varied in age, actual MC, and perceived MC with the majority of adolescents (74%) having a high perceived MC but only 54% of them having a high actual MC. The present study also used a person-centred approach to delineate whether, and how, actual and perceived MC might be combined in individual adolescents and adds to the findings of the above mentioned study by using a valid and reliable test battery to assess actual MC in a random sample of adolescents. If discrepancies between actual and perceived MC are identified at the personal level, these may influence adolescents' motivation to achieve and persist in PA and sports, especially if adolescents underestimate themselves (Goodway & Rudisill, 1997; Ulrich, 1987). Indeed, Self-Determination Theory (SDT), a macro-theory on human motivation (Guay, Ratelle, & Chanal, 2008), suggests that perceived competence is one of three basic psychological needs (apart from autonomy and relatedness) that is to be satisfied in order to obtain optimal (i.e., autonomous) motivation (Deci & Ryan, 2000). Students who feel more competent, will accordingly display more self-determined or autonomous forms of motivation. Many studies in psychological literature provided support for the notion that adolescents' perceived MC affects their motivation (Roberts, Kleiber, & Duda, 1981; Weiss, Bredemeier, & Shewchuk, 1986), but few studies have investigated adolescents' motivation in relation to their actual and perceived MC-based profile. Additionally, although numerous studies have already demonstrated the importance of actual MC with regard to PA and sports participation in younger children (Hebert, Moller, Andersen, & Wedderkopp, 2015; Holfelder & Schott, 2014; Logan et al., 2014; Lubans, Morgan, Cliff, Barnett, & Okely, 2010), far less research in this area has been conducted among adolescents (but see Hands, Larkin, Parker, Straker, & Perry, 2009; Kalaja, Jaakkola, Liukkonen, & Digelidis, 2012; Okely, Booth, & Patterson, 2001 for an exception). So far, a limited number of studies provided initial evidence to show that actual and perceived MC predict a substantial proportion of the variance in adolescents' PA (Khodaverdi et al., 2013) and that perceived MC is a mediator in the relationship between actual MC and PA (Barnett et al., 2011). Hence, the second aim of this study was to explore how MC-based profiles relate to motivation for PE, PA levels, and organised sports participation. Based on SDT (Deci & Ryan, 2000) and previous studies (Bagoien & Halvari, 2005; Weiss & Amorose, 2005), it was hypothesised that students with a high perceived MC profile would display the highest levels of autonomous motivation for PE. In terms of PA and sports participation, it was expected that adolescents with the most optimal MC-based profile (i.e., high actual MC and high perceived MC) would display the most beneficial outcomes (Bagoien & Halvari, 2005; Khodaverdi et al., 2013; Lubans et al., 2010).

Methods

Participants and procedure

The intention was to have 15 classes of students involved, so 32 teachers (based on expected refusal rates) were randomly chosen from a database of 265 PE teachers who previously participated in studies conducted by our University. As a result 17 teachers employed in ten different schools (academic, technical, and vocational schools), agreed to participate. One eighth-grade class per PE teacher was then randomly selected to participate in the current study. About half of the adolescents in the selected sample (51.2%) were enrolled in academic education, 29.4% were enrolled in technical education, and 19.4% in vocational education. All participants and their parents received an information letter and with the exception of six, all parents consented to the participation of their child (response rate = 97%). In total, 215 adolescents (142 boys; 66.05%) with a mean age of 13.64 years *(SD* = 0.58, range 12.42–14.92 years) completed questionnaires on PA, sports participation, motivation for PE, and perceived MC and they completed a test battery to assess their actual MC. The administration of the questionnaires and the test battery took place during a PE lesson in the presence of a team of researchers and took approximately 1 h per class group. The study protocol was approved by the Ethical Committee of Ghent University.

Measures

Self-reported PA and organised sports participation

As previous studies showed that the Flemish Physical Activity Questionnaire (FPAQ) is a reliable (test-retest reliability of $r > 0.70$) and valid (concurrent validity of $r = 0.43–0.78$ with respect to accelerometer data) instrument to assess different dimensions of PA in 12- to 18-year-old Flemish boys and girls (Philippaerts et al., 2006), this questionnaire was used to determine adolescents' PA levels and their participation in organised sports. The FPAQ contains questions with regard to four PA-related domains: (a) walking and cycling as active transportation and as leisure time activity (6 questions, i.e., average time spent on walking and cycling; e.g., "How much time do you usually spend cycling on a weekday?"), (b) intracurricular PA (i.e., average time spent in PE classes during school hours; 1 question, "How many hours of PE do you partake in per week?"), (c) extracurricular school-based sports (i.e., average time spent in all sports activities not included in the curriculum but organised by the school either during lunch break, during after-school hours or on Wednesday afternoon; 11 questions, e.g., "How many hours do you spend on extra-curricular school-based sports (a) during lunch break, (b) during after-school hours, (c) on Wednesday afternoon?"), and (d) non-school-based sports (i.e., average time spent in community sports and unorganised sports during leisure time; 12 questions, e.g., "How many minutes a week do you usually spend practicing your first, second and third sport?"). Adolescents' overall weekly PA was the sum of the time (expressed in minutes per week) spent walking and cycling, in intra-curricular PA, in extracurricular school-based sports, and in non-school-based sports activities.

Motivation for PE

Motivation for PE was measured with the Dutch version of the valid and reliable (for Flemish 12- to 18-year-olds) Behavioral Regulation in Physical Education Questionnaire (BRPEQ; (Aelterman et al., 2012). A distinction was made between the different types of motivation as defined by Deci and Ryan (2000): autonomous motivation is the most optimal form of motivation which involves the regulation of behaviour with the experiences of volition, psychological freedom, and reflective self-endorsement (Vansteenkiste, Niemiec, & Soenens, 2010), while controlled motivation refers to the pressured engagement in an activity. Autonomous motivation and controlled motivation are contrasted with amotivation, which exists when people lack intentionality or engage in behaviours for unknown reasons (Deci & Ryan, 2000). Sixteen items with the stem "I put effort in PE because…" were used to measure autonomous motivation (eight items, $\alpha = 0.83$; e.g., "I put effort in PE because I find it a pleasurable activity.") and controlled motivation (eight items, $\alpha = 0.83$; e.g., "I put effort in PE because I feel guilty if I don't."). Amotivation was measured by four items ($\alpha = 0.88$; e.g., "I don't see why I should bother putting effort in PE."). Participants responded to each of the twenty items via a 5-point Likert scale from 1 (*not at all true for me*) to 5 (*very true for me*).

Perceived MC

Similar to previous studies (Barnett et al., 2008; Weiss & Amorose, 2005), the sport/athletic competence subscale (Harter, 1985) of the Dutch version of the Children and Youth Physical Self-Perception Profile (CY-PSPP; Whitehead, 1995) was used to assess adolescents' perceptions of their athletic ability and their ability to learn sports skills. The CY-PSPP is a reliable and valid instrument to assess different dimensions of physical self-perception (Whitehead, 1995). Answering categories of the sport/athletic competence subscale (six items, $\alpha = 0.70$) consist of a four-choice structured alternating format to minimise socially desirable responses (Lubans, Morgan, & McCormack, 2011). For each of the items, adolescents first decided which of the two statements (e.g., "Some adolescents do very well at all kinds of sports but other adolescents don't feel they are very good when it comes to sports") best described them and then determined whether the statement was "*sort of true*" or "*really true*" for them. Each item was accordingly scored from 1 (low perceived competence) to 4 (high perceived competence) (Lubans et al., 2011; Weiss & Amorose, 2005).

Actual MC

The Körperkoordinationstest für Kinder (KTK) or body coordination test for children (Kiphard & Schilling, 1974, 2007) was used to assess adolescents' actual MC. The KTK is a standardised test battery suitable for all children between 5 and 15 years. It is a highly reliable and valid instrument to assess gross motor and dynamic balance skills (Kiphard & Schilling, 2007; Smits-Engelsman, Henderson, & Michels, 1998; Vandorpe et al., 2011) and is therefore a valuable tool for assessing MC (Fransen et al., 2014). The test battery has been used to evaluate MC in a wide variety of settings and target groups, ranging from clinical populations, typically developing children and adolescents, to young elite athletes (D'Hondt et al., 2012; Opstoel et al., 2015; Pion, 2014). The administration of the KTK involves the completion of four subtests: (1) walking backwards along balance beams of decreasing width (6.0 cm, 4.5 cm, 3.0 cm), (2) moving sideways by stepping on and moving two wooden boards during 20 s, (3) two-legged jumping from side to side for 15 s, and (4) one-legged hopping over foam obstacles with increasing height in consecutive steps of 5 cm. In the current study, the fourth subtest was excluded due to its time consuming nature and the risk of ankle sprain (Pion et al., 2014; Pratorius & Milani, 2004). In the first subtest, participants are given three trials per beam and can obtain a maximum score of 72 (i.e., maximum eight steps per trial). In the second subtest, participants are given two trials and they get one point for each transition to the next board. The scores of both trials are summed and counted as the final score for this subtest. In the third subtest, participants are given two trials and their scores consist of the total number of jumps, again by summing the scores of both trials. The raw performance scores on the three subtests used in the present study were converted into motor quotient (MQ) scores per subtest (=standardised scores adjusted for age). All three of these MQ scores (and the MQ of the fourth subtest which was not administered in the present study) are scaled in the same way and account for the same proportion of the overall MQ. The MQ scores of the three subtests were summed and then divided by 3, which allowed the use of the original cut points as established by Kiphard and Schilling (2007). The overall MQ was used in the analyses as a measurement of adolescents' actual MC. It is believed that excluding the fourth subtest does not impact the overall MQ score and accordingly students' assessment of their actual MC since correlations between MQ scores based on the three subtests and MQ scores based on all four subtests are very strong ($r = 0.98$, $P < 0.001$ in a sample of 2902 Flemish children; 52.69% boys; mean age = 9.05; $SD = 1.68$, range 5.77–13.93 years; and $r = 0.99$, $P < 0.001$ in a sample of 37 Flemish adolescents with similar characteristics of the adolescents in the present study; 62.16% boys; mean age = 12.75; $SD = 0.31$, range 12.44–13.93 years) (Vandorpe et al., 2011, 2012).

Analyses

Aim 1: the relationship between actual and perceived MC

Variable-centred approach. To examine the relationship between adolescents' actual and perceived MC, multilevel regression analyses were conducted in MLwiN (version 2.34). First, a three-level null model (school, class, and adolescent) or intercept-only model including only the dependent variable (perceived MC) was estimated (null model 1). This null model partitioned the total variance of perceived MC into the between-adolescent, between-class and between-school variance and further served as a baseline model with which all explanatory models were compared. In a second step, age, educational track, and sex were inserted in the model as covariates (model 1a). In a third step, actual MC was included in the model as a predictor (model 1b).

Person-centred approach. Cluster analyses were performed to examine whether subgroups could be defined based on adolescents' actual and perceived MC. First, the scores of actual and perceived MC were standardised and univariate and multivariate outliers were removed since they can substantially perturb cluster solutions (Garson, 2014). Univariate outliers (values of more than three SD above or below the mean) were not found. However, eleven multivariate outliers (as identified using the Mahalanobis distance measure) had to be removed. This resulted in a final sample of 204 adolescents.

Subsequently, a two-step procedure (Gore, 2000) was applied in SPSS 22.0 to conduct a cluster analysis. First, a hierarchical cluster analysis was carried out using Ward's hierarchical clustering method (Everitt, Landau, & Leese, 2001). In a stepwise fashion, clusters that were similar in terms of squared Euclidean distance were combined, resulting in three-, four-, and five-cluster solutions. As the explained variance in both MC dimensions of each cluster solution was at least 50%, all the cluster solutions were retained for the following step (Milligan & Cooper, 1985) in which the cluster centres were used as non-random initial cluster centres in an iterative, non-hierarchical k-means clustering procedure (Asendorpf, Borkenau, Ostendorf, & Van Aken, 2001). The resulting cluster solutions were evaluated based on interpretability and parsimony (von Eye & Bogat, 2006). With the exception of the extra cluster, the five-cluster solution was similar to the four-cluster solution. Students in the fifth cluster had a similar profile as students in the fourth cluster but with a higher mean for actual MC. Due to the similarity between clusters 4 and 5, only the three- and four-cluster solution were retained for analyses of replicability.

To examine the stability of the remaining cluster solutions, a double-split cross-validation procedure was implemented (Breckenridge, 2000) by randomly splitting the total sample into halves and applying the two-step procedure (Ward and k-means) in each subsample. Next, the participants in each half of the sample were assigned to new clusters based on their Euclidean distances to the cluster centres of the other half of the sample. These new clusters were then compared for agreement with the original clusters by means of Cohen's kappa (K). The two resulting kappas were averaged and a Cohen's kappa of at least .60 (good agreement) was considered acceptable (Asendorpf et al., 2001). Stability and replicability were acceptable only for the four-cluster solution with a kappa of .79. The three-cluster solution had a kappa of only .58. Hence, it was decided only to use the four-cluster solution for further interpretation. Figure 1 presents the final four-cluster solution, which accounted for 65% of the variance in actual MC and 71% of the variance in perceived MC. To define each of the clusters, absolute values of both actual and perceived MC were inspected. Levels of actual MC were defined using previously established KTK cut points (Kiphard & Schilling, 2007). These cut points are generally used to evaluate children's and adolescents' MC and to detect possible delays in their motor development (Kiphard & Schilling, 2007). MQ-scores between 56 and 70 (< 3rd percentile) represent a severe motor impairment; scores between 71 and 85 (3rd–15th percentile) are considered indicators of low MC or a moderate motor impairment; scores between 86 and 115 (16th–84th percentile) represent a normal or average MC; scores between 116 and 130 (85th–98th percentile) are considered indicators of good MC; and scores between 131 and 145 (≥ 99th percentile) indicate high MC. Perceived MC levels were defined by comparing mean cluster scores to the 2.50 midpoint of the perceived MC scale by means of one-sample t-tests. Scores that were not significantly different from 2.50 were considered "average perceived MC" while scores significantly lower than 2.50 were labelled "low perceived MC" and scores significantly higher than 2.50 were considered "high perceived MC". Subsequently, the comparison of the levels of actual and perceived MC within one cluster was used to determine the accuracy of adolescents' self-perceptions. A distinction was made between underestimation (i.e., a combination of average actual MC and low perceived MC or a

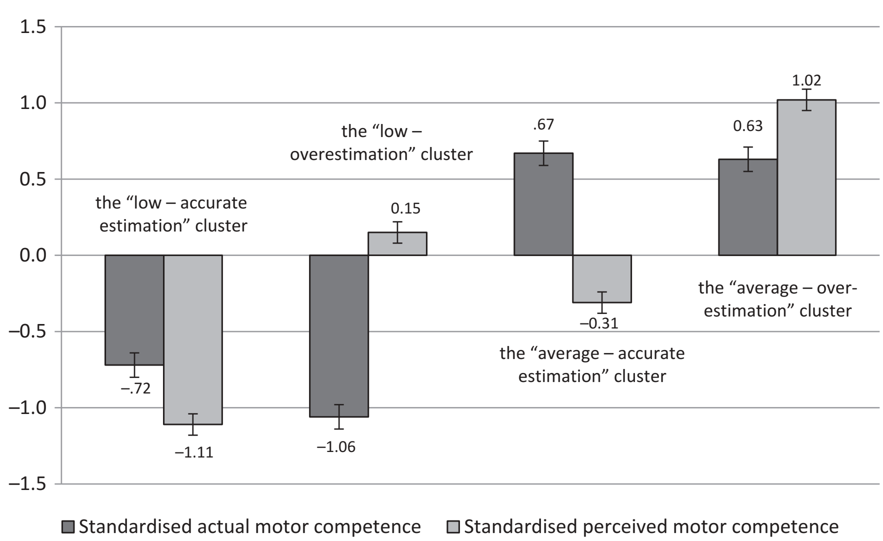

Figure 1. Four-cluster solution based on z-scores for actual motor competence and perceived motor competence.

combination of high actual MC and average/low perceived MC), accurate estimation (i.e., corresponding levels of actual and perceived MC), and overestimation (i.e., a combination of low actual MC and average/high perceived MC or a combination of average actual MC and high perceived MC).

Aim 2: associations among actual and perceived MC and motivation for PE, PA levels, and organised sports participation

Variable-centred approach. Intercept-only models were estimated for autonomous motivation for PE (null model 2), PA levels (null model 3), and organised sports participation (null model 4). After adding the covariates (model 2a, 3a, and 4a), the independent variables actual MC, perceived MC and the two-way interaction effect between the both were included in each of the models (model 2b, 3b, and 4b). Since the interaction effect was not significant in any of the models, it was not retained in the final and most parsimonious models (model 2c, 3c, and 4c).

Person-centred approach. To investigate differences in autonomous motivation (i.e., the most optimal form of motivation) for PE, weekly PA, and organised sports participation between the four clusters, multilevel regression analyses were conducted by adding cluster membership as a predictor in model 2a, 3a, and 4a. To obtain coefficients for each of the clusters, the regression equations were repeated several times for each outcome by changing the reference category.

The level of significance was for all statistical analyses defined as lower than .05.

Results

Descriptives

Adolescents had a mean MQ of 97.62 (*SD* = 17.53), which is just slightly below average (*M* = 100). Boys did not significantly differ from girls in terms of actual MC (β = −1.20, *S.E.* = 2.69, $\chi^2[1] = .20$, *P* = .66). However, girls' perceived MC was significantly lower than boys' (β = -.16, *S.E.* = .08, $\chi^2[1] = 4.28$, *P = .04)*. Both boys and girls reported relatively high levels of autonomous motivation for PE with an average of 3.83 (*S.E.* = .09) on a 5-point Likert-scale and participants engaged on average in 606.58 min (*S.E.* = 33.31) of weekly PA (86.65 min/day), of which 150.81 min (*S.E.* = 13.97) were spent in organised sports. Girls had marginally significantly lower PA levels than boys (β = −94.66, *S.E.* = 51.92, $\chi^2[1] = 3.32$, *P = .07)*, but no significant differences were found in terms of organised sports participation (β = −43.91, *S.E.* = 29.44, $\chi^2[1] = 2.23$, *P = .14)*. Just under 60% of adolescents (57.9% of the boys and 54.9% of the girls) reported participating in organised sports.

Aim 1: the relationship between actual and perceived MC

Variable-centred approach

The results of model 1a confirmed previous findings (Barnett et al., 2008; Harter, 1985) with boys displaying higher levels of perceived MC than girls (β = -.16, *S.E.* = .08, $\chi^2[1] = 4.28$, *P* = .04). As shown in Table 1 (Model 1b), adolescents' perceived MC was significantly positively related to actual MC (β = .01, *S.E.* = .00, $\chi^2[1] = 21.43$, *P* < .001). However, they were only moderately correlated (*r* = .30).

Table 1. Relationship between perceived motor competence and actual motor competence.

	Perceived motor competence (Model 1)		
Parameter	Null model 1	Model 1a	Model 1b
Fixed part			
Intercept	2.76 (0.05)	2.90 (0.06)	2.86 (0.07)
Age		−0.05 (0.07)	−0.00 (0.07)
Technical track[a]		−0.24 (0.08)**	−0.17 (0.09)
Vocational track[a]		−0.09 (0.11)	−0.04 (0.12)
Adolescent sex (girl)[b]		−0.16 (0.08)*	−0.15 (0.08)
Actual motor competence			0.01 (0.00)***
Random part			
School-level variance	0.01 (0.01)	0.00 (0.00)	0.01 (0.01)
Class-level variance	0.00 (0.01)	0.00 (0.00)	0.00 (0.00)
Adolescent-level variance	0.28 (0.03)***	0.28 (0.03)***	0.25 (0.03)***
Deviance test model	326.85	316.95	298.20
χ^2 (df)		9.9*	18.75**

Values in parentheses are standard errors.
* *P* < .05, ** *P* < .01, *** *P* < .001.
Reference category = 0.
[a] 0 = academic track, 1 = technical track, 2 = vocational track; reference category = academic track.
[b] 0 = boy, 1 = girl; reference category = boy.

Person-centred approach

Four clusters were retained (Figure 1 and Table 5). Cluster 1 (*n* = 40; 24 boys) was characterised by adolescents who had low levels of actual MC (mean MQ = 83.15) and low levels of perceived MC (mean score = 2.06; t[39] = −10.60; *P* < .001 for the difference with 2.5). This cluster was labelled the "low – accurate estimation" cluster. Cluster 2 (the "low – overestimation" cluster; *n* = 40; 29 boys) consisted of adolescents with low actual MC (mean MQ = 76.90) and high perceived MC (mean score = 2.82; t[39] = 8.48; *P* < .001). Cluster 3 (the "average – accurate estimation" cluster; *n* = 60; 34 boys) comprised of adolescents who had average actual MC (mean MQ = 109.35) and average perceived MC (mean score = 2.55; t[39] = 1.37; *P* = .18). Finally, Cluster 4 (the "average – overestimation" cluster; *n* = 64; 46 boys) was characterised by adolescents who had average actual MC (mean MQ = 108.61) and high perceived MC (mean score = 3.34; t[39] = 21.12; *P* < .001). Chi-square analyses revealed a proportionate sex representation within the clusters ($\chi^2[3] = 4.60$; *P* = .20). As intended by using cluster analyses, significant differences in actual and perceived MC were found between the four clusters (Table 5).

Aim 2: associations among actual and perceived MC and motivation for PE, PA levels, and organised sports participation

Variable-centred approach

As can be seen in Table 2, adolescents' perceived MC (β = .45, *S.E.* = .10, $\chi^2[1] = 20.13$, *P* < .001) but not their actual MC (β = .00, *S.E.* = .00, $\chi^2[1] = 1.97$, *P* = .16) was significantly positively related to their autonomous motivation. A similar

Table 2. Relationship among autonomous motivation for PE, actual motor competence, and perceived motor competence.

	Autonomous motivation for PE (Model 2)			
Parameter	Null model 2	Model 2a	Model 2b	Model 2c
Fixed part				
Intercept	3.78 (0.09)	3.83 (0.09)	3.76 (0.10)	3.75 (0.09)
Age		0.06 (0.10)	0.09 (0.10)	0.09 (0.10)
Technical track[a]		0.05 (0.13)	0.06 (0.13)	0.07 (0.13)
Vocational track[a]		0.07 (0.17)	0.16 (0.17)	0.15 (0.17)
Adolescent sex (girl)[b]		−0.18 (0.11)	−0.09 (0.11)	−0.09 (0.11)
Controlled motivation		0.22 (0.08)**	0.22 (0.08)**	0.22 (0.08)**
Amotivation		−0.60 (0.07)***	−0.49 (0.06)***	−0.49 (0.06)***
Actual motor competence			0.00 (0.00)	0.00 (0.00)
Perceived motor competence			0.45 (0.10)***	0.45 (0.10)***
Actual motor competence × perceived motor competence			−0.00 (0.01)	
Random part				
School-level variance	0.03 (0.03)	0.01 (0.02)	0.02 (0.02)	0.02 (0.02)
Class-level variance	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Adolescent-level variance	0.76 (0.08)***	0.52 (0.05)***	0.45 (0.05)***	0.45 (0.05)***
Deviance test model	526.80	447.59	421.30	421.66
χ^2 (df)		79.21***	26.29**	25.93**

Values in parentheses are standard errors.
* $P < .05$, ** $P < .01$, *** $P < .001$
Reference category = 0.
[a] 0 = academic track, 1 = technical track, 2 = vocational track; reference category = academic track.
[b] 0 = boy, 1 = girl; reference category = boy
Model 2b and 2c were both compared to model 2a to calculate χ^2.

result was found for weekly PA with only perceived MC ($\beta = 163.38$, *S.E.* = 45.78, $\chi^2[1] = 12.74$, $P < .001$), but not actual MC ($\beta = 1.50$, *S.E.* = 1.45, $\chi^2[1] = 1.08$, $P = .30$) being a significant correlate (Table 3). Neither actual MC ($\beta = .97$, *S.E.* = .83, $\chi^2[1] = .91$, $P = .34$) nor perceived MC ($\beta = 31.50$, *S.E.* = 27.46, $\chi^2[1] = 1.32$, $P = .25$) were significantly related to time spent in organised sports (Table 4).

Person-centred approach

As expected, adolescents in the low – accurate estimation cluster displayed significantly lower levels of autonomous motivation for PE ($\beta_0 = 3.07$, *S.E.* = .13) and weekly PA ($\beta_0 = 414.69$, *S.E.* = 60.16) than adolescents in the average – accurate ($\beta_0 = 3.78$, *S.E.* = .12, and $\beta_0 = 645.46$, *S.E.* = 53.34, respectively) and in the average – overestimation group ($\beta_0 = 4.13$, *S.E.* = .11 and $\beta_0 = 738.24$, *S.E.* = 51.57, respectively, Table 5). They also spent less time in organised sports ($\beta_0 = 98.50$ min/week, *S.E.* = 31.02) than adolescents in the average – accurate estimation cluster ($\beta_{0=}168.01$; *S.E.* = 25.54) and adolescents in the average – overestimation cluster ($\beta_{0=} = 169.44$; *S.E.* = 24.91). However, these differences were only marginally significant.

Interestingly, adolescents in the low – accurate estimation group were also found to be significantly less physically active and autonomously motivated for PE than adolescents in the low – overestimation cluster ($\beta_0 = 642.94$, *S.E.* = 61.74 and $\beta_0 = 3.87$, *S.E.* = .14, respectively), who had in fact the overall lowest levels of actual MC. The latter spent on average 148.88 min per week (*S.E.* = 31.02) in organised sports.

Table 3. Relationship among physical activity, actual motor competence, and perceived motor competence.

	Weekly self-reported physical activity (Model 3)			
Parameter	Null model 3	Model 3a	Model 3b	Model 3c
Fixed part				
Intercept	631.89 (33.31)	628.85 (41.88)	627.59 (47.87)	606.58 (46.27)
Age		−45.10 (47.16)	−34.23 (45.50)	−35.59 (45.84)
Technical track[a]		72.08 (60.51)	83.38 (68.28)	102.02 (67.92)
Vocational track[a]		92.41 (77.17)	116.70 (84.73)	114.90 (84.36)
Adolescent sex (girl)[b]		−94.66 (51.92)	−72.20 (52.09)	−66.73 (52.14)
Actual motor competence			1.38 (1.44)	1.50 (1.45)
Perceived motor competence			160.06 (45.48)***	163.38 (45.78)***
Actual motor competence × perceived motor competence			−5.02 (2.77)	
Random part				
School-level variance	4089.96 (5845.70)	0.00 (0.00)	2802.83 (5499.52)	1893.58 (5329.92)
Class-level variance	1304.88 (5985.30)	2130.33 (4162.04)	3419.50 (6248.67)	4120.24 (6554.31)
Adolescent-level variance	117032.76 (12,109.90)***	116075.20 (11,998.93)***	102591.08 (10,621.43)***	104325.77 (10,800.90)***
Deviance test model	2966.51	2961.35	2941.75	2944.97
χ^2 (df)		5.16	19.6**	16.38*

Values in parentheses are standard errors.
* $P < .05$; ** $P < .01$, *** $P < .001$
Reference category = 0.
[a] 0 = academic track, 1 = technical track, 2 = vocational track; reference category = academic track.
[b] 0 = boy, 1 = girl; reference category = boy
Model 3b and 3c were both compared to model 3a to calculate χ^2.

Table 4. Relationship among organised sports participation, actual motor competence, and perceived motor competence.

	Weekly self-reported time spent in organised sports (Model 4)			
Parameter	Null model 4	Model 4a	Model 4b	Model 4c
Fixed part				
Intercept	150.81 (13.97)	159.28 (22.38)	157.29 (23.57)	153.64 (22.49)
Age		4.25 (26.87)	7.56 (26.74)	7.77 (26.78)
Technical track[a]		21.54 (31.67)	30.64 (32.42)	33.05 (32.10)
Vocational track[a]		−1.55 (41.51)	2.76 (41.24)	2.90 (41.27)
Adolescent sex (girl)[b]		−43.91 (29.44)	−40.43 (29.76)	−39.36 (29.71)
Actual motor competence			0.76 (0.84)	0.79 (0.83)
Perceived motor competence			31.22 (27.45)	31.50 (27.46)
Actual motor competence x perceived motor competence			−0.86 (1.67)	
Random part				
School-level variance	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Class-level variance	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Adolescent-level variance	39224.00 (3912.63)***	38673.80 (3857.75)***	38026.22 (3793.15)***	38076.48 (3798.16)***
Deviance test model	2696.40	2693.56	2690.17	2690.43
χ^2 (df)		2.84	3.39	3.13

Values in parentheses are standard errors.
* $P < .05$; ** $P < .01$, *** $P < .001$
Reference category = 0.
[a]0 = academic track, 1 = technical track, 2 = vocational track; reference category = academic track.
[b] 0 = boy, 1 = girl; reference category = boy
Model 4b and 4c were both compared to model 4a to calculate χ^2.

Table 5. Mean scores and cluster comparisons for the four clusters (N = 204).

	Cluster			
	Cluster 1: Low – accurate estimation	Cluster 2: Low – overestimation	Cluster 3: Average – accurate estimation	Cluster 4: Average – overestimation
Variable	n = 40 19.61%	n = 40 19.61%	n = 60 29.41%	n = 64 31.37%
Cluster dimensions (z-scores)				
Actual motor competence	−0.72 (0.09)[b]	−1.06 (0.09)[a]	0.67 (0.07)[c]	0.63 (0.07)[c]
Perceived motor competence	−1.11 (0.07)[a]	0.15 (0.08)[c]	−0.31 (0.06)[b]	1.02 (0.06)[d]
Cluster dimensions (raw scores)				
Actual motor competence	83.15 (1.60)[b]	76.90 (1.60)[a]	109.35 (1.31)[c]	108.61 (1.27)[c]
Perceived motor competence	2.06 (0.05)[a]	2.82 (0.05)[c]	2.55 (0.04)[b]	3.34 (0.04)[d]
Adolescent outcomes				
Autonomous motivation for PE	3.07 (0.13)[a]	3.87 (0.14)[bc]	3.78 (0.12)[b]	4.13 (0.11)[c]
Physical activity	414.69 (60.16)[a]	642.94 (61.74)[b]	645.46 (53.34)[b]	738.24 (51.57)[b]
Organised sports participation	98.50 (31.02)[(a)]	148.88 (31.02)[(ab)]	168.01 (25.54)[(b)]	169.44 (24.91)[(b)]

Values in parentheses are standard errors. A cluster mean is significantly different from another mean if they have different superscripts. Different superscripts between parentheses indicate a trend to significance. Differences between the four clusters were tested by repeating the equations several times and changing the reference category. As such, coefficients for each cluster were obtained, which enabled pairwise comparisons.

The low – overestimation cluster and the average – overestimation cluster did not significantly differ from each other in terms of motivation (β_0 = 3.87, *S.E.* = .14 and β_0 = 4.13, *S.E.* = .11, respectively), PA (β_0 = 642.94, *S.E.* = 61.74 and β_0 = 738.24, *S.E.* = .51.57, respectively) or organised sports participation (β_0 = 148.88, *S.E.* = 31.02 and β_0 = 169.44, *S.E.* = 24.91, respectively). Finally, adolescents in the average – accurate estimation cluster had significantly lower levels of autonomous motivation (β_0 = 3.78, *S.E.* = .12) than the average – overestimation cluster (β_0 = 4.13, *S.E.* = .11). However, they did not differ from each other in terms of PA and organised sports participation.

Discussion

The present study used a combination of variable-centred and person-centred approaches to investigate relationships between actual and perceived MC, to identify MC-based profiles, and to explore how adolescents with different MC-based profiles differ in terms of motivation for PE, PA levels, and organised sports participation.

Results showed that actual and perceived MC were positively related but the strength of the association was only moderate. Cluster analyses revealed a group of students who displayed a combination of both low actual and perceived MC (19.61%), who were not only less physically active and less autonomously motivated to participate in PE, but were also on average an hour per week less engaged in organised sports than their peers with higher levels of actual and/or perceived MC. Furthermore, two groups of overestimators were identified representing 51% of the sample, with boys and girls equally being represented in these groups. The results of the present study showed that overestimators are significantly more autonomously motivated for PE than their peers with similar levels of actual MC who accurately perceive their competence, suggesting that overestimation is a favourable phenomenon. Furthermore, it was found that overestimation of competence is also linked to higher levels of PA among adolescents with low actual MC. Despite having the overall lowest actual MC of the entire sample, adolescents in the low – overestimation cluster were equally autonomously motivated, physically active, and participated in almost equal amounts of organised sports when compared to students with average actual MC who either accurately estimated or overestimated their competence. These findings indicate a key role of perceived MC for participation in PA and sports, especially when actual MC is low. This was confirmed by the variable-centred analyses, which indicated higher levels of perceived but not actual MC are associated with higher levels of self-reported PA. Finally, the results of this study also suggest that adolescents do not underestimate their actual MC levels, which is positive, as underestimation might discourage adolescents from engaging in PA and sports, an issue that warrants further investigation.

Based on the finding that only half of the adolescents are capable of accurately assessing their own competence and the findings of the literature (Weiss & Amorose, 2005), one could suggest that considerable attention should be paid to improving adolescents' assessment skills. Overestimation might be due to an inaccurate perception of competence, but it might also represent a conscious attempt to present oneself in a favourable light, a phenomenon known as positive illusory bias (Hoza et al., 2004). It is often suggested that through education (e.g., PE), adolescents need to develop the ability to correctly assess their own and others' MC. Developing the capability to accurately estimate competence is suggested to provide more realistic expectations about individuals' competence and should help in avoiding unsuccessful outcomes and resultant lower levels of motivation (Harter, 1982). Accurate estimations of competence are also suggested to trigger an individual's motivation to improve skills in order to be more successful. Our findings, however, do not support these assumptions since overestimation of competence is linked to more positive PA-related and motivational outcomes, improving assessment skills among overestimators would not necessarily be beneficial. Rather, results of the current study suggest that PE teachers and PA and sports professionals may want to pay special attention to adolescents who have poor perceptions of their competence, or to those who have accurate perceptions of their low competence to avoid negative outcomes. Providing an environment where success can be promoted for all adolescents, irrespective of their level of actual MC, may help to foster positive perceptions of competence (Papaioannou, 1997) and may contribute to higher levels of PA and autonomous motivation (Ntoumanis, 2001). Such conclusions are in line with previous studies that found that perceived competence explained a significant amount of adolescents' autonomous motivation for PE (Goudas, Biddle, & Fox, 1994; Ntoumanis, 2001).

Limitations, strengths, and future research

The cross-sectional design of the present study does not provide causal evidence regarding relationships among actual MC, perceived MC, motivation, PA, and organised sports participation. To gain more insight in the direction of these relationships, longitudinal or experimental studies should be conducted. An additional recommendation is that future studies include sports-specific skill measurements to determine actual MC, as the more general tasks of the KTK that measures the gross motor coordination and dynamic balance do not align very well with the items in the sport/athletic competence subscale of the CY-PSPP (Whitehead, 1995). Alternatively, measurements of perceived competence could more closely correspond to actual MC measurements.

A second limitation is the use of self-report questionnaires, which can lead to over- or underestimation of certain variables (Bermudez et al., 2013); although all questionnaires were validated for the target population. Some caution also is required with respect to the measurement of perceived MC. The sport/athletic competence subscale implies a certain degree of comparison. Adolescents have to specify their perceived MC compared to other adolescents' MC, but they may have different frames of reference and might therefore perceive themselves as more or less competent. Future research would benefit from the development of a live MC video instrument specific to the skills being tested. This would enable adolescents to estimate their actual MC in comparison with an objective competence rating system resulting in a more objective measurement of perceived MC. Alternatively, adolescents can also rate how competent they think they are by means of more neutral items (e.g., rating their confidence at performing several skills on a 1–10 Likert scale) that do not directly refer to the comparison with others (McGrane, Belton, Powell, Woods, & Issartel, 2015).

A third limitation is the use of a database of contacts of PE teachers who previously participated in studies conducted by our University. This implies that only a specific "type" of teacher was contacted (namely those who were willing to participate in research studies in the past). However, since the measurements were conducted among students (and not among the teachers through which the class groups and thus the participating students were selected), it may be assumed that the selection procedure did not affect the study results.

A strength of this study is the relatively large and diverse sample with 215 adolescents. Also, despite the fact that randomisation was not conducted at the school subgroup level (academic, technical, and vocational education), the sample was representative of the actual Flemish eighth grade school population (45.4%, 30.5%, and 22.0%, respectively and a minority of 4.3% enrolled in arts education; Scheys, 2014).

Another strength was the use of person-centred, multilevel analyses. This innovative approach sheds new light on the findings of previous studies and emphasises the need for further research focusing on the mediating role of perceived MC on the relationships among actual MC, motivation, PA, and organised sports participation. It is recommended for future studies to use even larger samples. Larger sample sizes could allow identifying more profiles (e.g., underestimators with various levels of actual MC) and provide more insight about differences among clusters in terms of motivation and PA levels. Examining the misalignment of perceived and actual competence is also warranted. A mixed method study with quantitative measurements of MC and qualitative data by means of focus group conversations and individual depth interviews with adolescents could provide more insight in this matter. A recent qualitative study (Barnett, Cliff, Morgan, & van Beurden, 2013) among Australian 16-

to 18-year olds indicated that motivation towards participation in sports and PA is affected by adolescents' perception of their MC.

Conclusions

The results of the present study demonstrated that actual and perceived MC are positively related among adolescents but the strength of the association is moderate. Half of the adolescents overestimate their MC, and overestimation positively relates to motivation for PE and engagement in PA and sports, especially among adolescents with low actual MC. As such, it is recommended that professionals in PE, PA, and sports pay sufficient attention to developing perceived MC, especially among adolescents with low levels of actual MC. The results also suggest that adolescents do not underestimate their actual MC levels, which is positive, as underestimation might discourage adolescents from engaging in PA and sports.

Abbreviations

CY-PSPP = Children and Youth Physical Self-Perception Profile; FPAQ = Flemish Physical Activity Questionnaire; KTK = KörperkoordinationsTest für Kinder; MC = motor competence; MQ = motor quotient; PA = physical activity; PE = physical education; BRPEQ = Behavioral Regulations in Physical Education Questionnaire.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This research was supported by a grant from the Flemish research Foundation [1.5.038.13N]

ORCID

An De Meester http://orcid.org/0000-0003-2270-719X

References

Aelterman, N., Vansteenkiste, M., Van Keer, H., Van den Berghe, L., De Meyer, J., & Haerens, L. (2012). Students' objectively measured physical activity levels and engagement as a function of between-class and between-student differences in motivation towards physical education. *Journal of Sport and Exercise Psychology*, *34*(4), 457–480.

Asendorpf, J. B., Borkenau, P., Ostendorf, F., & Van Aken, M. A. G. (2001). Carving personality description at its joints: Confirmation of three replicable personality prototypes for both children and adults. *European Journal of Personality*, *15*(3), 169–198. Retrieved from WOS:000169578300001. doi:10.1002/per.408

Bagoien, T. E., & Halvari, H. (2005). Autonomous motivation: Involvement in physical activity, and perceived sport competence: Structural and mediator models. *Perceptual and Motor Skills*, *100*(1), 3–21. Retrieved from WOS:000227110900001. doi:10.2466/pms.100.1.3-21

Barnett, L., Cliff, K., Morgan, P., & van Beurden, E. (2013). Adolescents' perception of the relationship between movement skills, physical activity and sport. *European Physical Education Review*, *19*(2), 271–285. Retrieved from WOS:000320304200008. doi:10.1177/1356336X13486061

Barnett, L., Morgan, P., van Beurden, E., & Beard, J. (2008) Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: A longitudinal assessment. *International Journal of Behavioral Nutrition and Physical Activity*, *5*(1), 40. doi:10.1186/1479-5868-5-40

Barnett, L. M., Morgan, P. J., Van Beurden, E., Ball, K., & Lubans, D. R. (2011). A reverse pathway? Actual and perceived skill proficiency and physical activity. *Medicine & Science in Sports & Exercise*, *43*(5), 898–904. Retrieved from WOS:000289557100022. doi:10.1249/MSS.0b013e3181fdfadd

Bermudez, V. J., Rojas, J. J., Cordova, E. B., Anez, R., Toledo, A., Aguirre, M. A., … López-Miranda, J. (2013). International physical activity questionnaire overestimation is ameliorated by individual analysis of the scores. *American Journal of Therapeutics*, *20*(4), 448–458. Retrieved from WOS:000321982100019. doi:10.1097/MJT.0b013e318235f1f2

Biddle, S. J. H., & Asare, M. (2011). Physical activity and mental health in children and adolescents: A review of reviews. *British Journal of Sports Medicine*, *45*(11), 886–895. Retrieved from WOS:000293787200009. doi:10.1136/bjsports-2011-090185

Biddle, S. J. H., Gorely, T., & Stensel, D. J. (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. *Journal of Sports Sciences*, *22*(8), 679–701. Retrieved from WOS:000223491100002. doi:10.1080/02640410410001712412

Breckenridge, J. N. (2000). Validating cluster analysis: Consistent replication and symmetry. *Multivariate Behavioral Research*, *35*(2), 261–285. Retrieved from WOS:000087819200005. doi:10.1207/S15327906MBR3502_5

Burton, A., & Miller, D. (1998). *Movement skill assessment*. Champaign, IL: Human Kinetics.

Currie, C., Gabhainn, S. N., Godeau, E., Roberts, C., Smith, R., Currie, D., … Barnekow, V. (Eds.). (2008). Inequalities in young people's health. In *Health behaviour in school-aged children study: International report from the 2005/2006 survey*. Copenhagen: WHO Regional Office for Europe (Health Policy for Children and Adolescents, No.5).

D'Hondt, E., Deforche, B., Gentier, I., De Bourdeaudhuij, I., Vaeyens, R., Philippaerts, R. M., & Lenoir, M. (2012). A longitudinal analysis of gross motor coordination in overweight and obese children versus normal-weight peers. *International Journal of Obesity*, *37*(1), 61–67. doi:10.1038/ijo.2012.55

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268. Retrieved from WOS:000166046400001. doi:10.1207/S15327965PLI1104_01

Everitt, B. S., Landau, S., & Leese, M. (2001). *Cluster analysis*. New York, NY: Oxford University Press.

Fransen, J., D'Hondt, E., Bourgois, J., Vaeyens, R., Philippaerts, R. M., & Lenoir, M. (2014). Motor competence assessment in children: Convergent and discriminant validity between the BOT-2 short form and KTK testing batteries. *Research in Developmental Disabilities*, *35*(6), 1375–1383. Retrieved from PM:24713517. doi:10.1016/j.ridd.2014.03.011

Gabbard, C. (2015). *Lifelong motor development* (5th ed.). San Francisco, CA: Pearson Benjamin Cummings.

Garson, G. (2014). *Cluster analysis: 2014 edition* (Statistical Associates Blue Book Series 24). Asheboro, NC: Statistical Associates Publishing.

Goodway, J. D., & Rudisill, M. E. (1997). Perceived physical competence and actual motor skill competence of African American preschool children. *Adapted Physical Activity Quarterly*, *14*(4), 314–326. Retrieved from WOS: A1997XX90500004.

Gore, P. (2000). Cluster analysis. In H. E. A. Tinsley & S. D. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 297–321). San Diego, CA: Academic Press.

Goudas, M., Biddle, S., & Fox, K. (1994). Perceived locus of causality, goal orientations, and perceived competence in school physical-education classes. *British Journal of Educational Psychology*, *64*, 453–463. Retrieved from WOS:A1994PU18100008. doi:10.1111/bjep.1994.64.issue-3

Guay, F., Ratelle, C. F., & Chanal, J. (2008). Optimal learning in optimal contexts: The role of self-determination in education. *Canadian Psychology-Psychologie Canadienne*, *49*(3), 233–240. Retrieved from WOS:000270862600009. doi:10.1037/a0012758

Haerens, L., De Bourdeaudhuij, I., Maes, L., Cardon, G., & Deforche, B. (2007). School-based randomized controlled trial of a physical activity intervention among adolescents. *Journal of Adolescent Health*, *40*(3), 258–265. Retrieved from WOS:000244620700011. doi:10.1016/j.jadohealth.2006.09.028

Hands, B., Larkin, D., Parker, H., Straker, L. M., & Perry, M. (2009). The relationship among physical activity, motor competence and health-related fitness in 14-year-old adolescents. *Scandinavian Journal of Medicine & Science in Sports*, *19*(5), 655–663. Retrieved from WOS:000270312000009. doi:10.1111/sms.2009.19.issue-5

Harter, S. (1982). The perceived competence scale for children. *Child Development*, *53*(1), 87–97. Retrieved from WOS:A1982NB00400007. doi:10.2307/1129640

Harter, S. (1985). *Manual for the self-perception profile for children*. Denver: University of Denver.

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

Harter, S., & Pike, R. (1984). The pictorial scale of perceived competence and social acceptance for young-children. *Child Development*, *55*(6), 1969–1982. Retrieved from WOS:A1984AAG5600001. doi:10.2307/1129772

Hebert, J. J., Moller, N. C., Andersen, L. B., Wedderkopp, N., & Baker, J. L. (2015). Organized sport participation is associated with higher levels of overall health-related physical activity in children (CHAMPS Study-DK). *Plos One*, *10* (8), Retrieved from WOS:000359353300032. doi:10.1371/journal.pone.0134621

Holfelder, B., & Schott, N. (2014). Relationship of fundamental movement skills and physical activity in children and adolescents: A systematic review. *Psychology of Sport and Exercise*, *15*(4), 382–391. Retrieved from WOS:000338393700008. doi:10.1016/j.psychsport.2014.03.005

Hoza, B., Gerdes, A. C., Hinshaw, S. P., Arnold, L. E., Pelham, W. E., Molina, B. S. G., … Wigal, T. (2004). Self-perceptions of competence in children with ADHD and comparison children. *Journal of Consulting and Clinical Psychology*, *72*(3), 382–391. Retrieved from WOS:000221624800002. doi:10.1037/0022-006X.72.3.382

Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, *7*, 40. Retrieved from WOS:000279902200003. doi:10.1186/1479-5868-7-40

Kalaja, S., Jaakkola, T., Liukkonen, J., & Digelidis, N. (2012). Development of junior high school students' fundamental movement skills and physical activity in a naturalistic physical education setting. *Physical Education & Sport Pedagogy*, *17*(4), 411–428. Retrieved from WOS:000308138300005. doi:10.1080/17408989.2011.603124

Khodaverdi, Z., Bahram, A., Khalaji, H., & Kazemnejad, A. (2013). Motor skill competence and perceived motor competence: Which best predicts physical activity among girls? *Iranian Journal of Public Health*, *42*(10), 1145–1150. Retrieved from WOS:000326245200010.

Kiphard, E. J., & Schilling, F. (1974). *Körperkoordinationstest für Kinder*. Weinheim, Germany: Beltz Test GmbH.

Kiphard, E. J., & Schilling, F. (2007). *Körperkoordinationstest für Kinder. Überarbeitete und ergänzte Auflage*. Göttingen, Germany: Beltz Test GmbH.

Kjonniksen, L., Torsheim, T., & Wold, B. (2008). Tracking of leisure-time physical activity during adolescence and young adulthood: A 10-year longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity*, *5*, 69. Retrieved from WOS:000263238700001. doi:10.1186/1479-5868-5-69

Logan, S. W., Robinson, L. E., Getchell, N., Webster, E. K., Liang, L. Y., & Golden, D. (2014). Relationship between motor competence and physical activity: A systematic review. *Research Quarterly for Exercise and Sport*, *85*, 14. Retrieved from WOS:000340367400039.

Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2010). Fundamental movement skills in children and adolescents review of associated health benefits. *Sports Medicine*, *40*(12), 1019–1035. Retrieved from WOS:000285176200002. doi:10.2165/11536850-000000000-00000

Lubans, D. R., Morgan, P. J., & McCormack, A. (2011). Adolescents and school sport: The relationship between beliefs, social support and physical self-perception. *Physical Education & Sport Pedagogy*, *16*(3), 237–250. Retrieved from WOS:000308137000003. doi:10.1080/17408989.2010.532784

McGrane, B., Belton, S., Powell, D., Woods, C. B., & Issartel, J. (2015). Physical self-confidence levels of adolescents: Scale reliability and validity. *Journal of Science and Medicine in Sport*, Retrieved from http://www.sciencedirect.com/science/article/pii/S144024401500139

McKenzie, T. L., Li, D. L., Derby, C. A., Webber, L. S., Luepker, R. V., & Cribb, P. (2003). Maintenance of effects of the CATCH physical education program: Results from the CATCH-ON study. *Health Education & Behavior*, *30*(4), 447–462. Retrieved from WOS:000184249900004. doi:10.1177/1090198103253535

Milligan, G. W., & Cooper, M. C. (1985). An examination of procedures for determining the number of clusters in a data set. *Psychometrika*, *50*(2), 159–179. Retrieved from WOS:A1985AJS6400002. doi:10.1007/BF02294245

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology*, *71*, 225–242. Retrieved from WOS:000169580000003. doi:10.1348/000709901158497

Okely, A. D., Booth, M. L., & Patterson, J. W. (2001). Relationship of physical activity to fundamental movement skills among adolescents. *Medicine and Science in Sports and Exercise*, *33*(11), 1899–1904. Retrieved from WOS:000171960200015. doi:10.1097/00005768-200111000-00015

Opstoel, K., Pion, J., Elferink-Gemser, M., Hartman, E., Willemse, B., Philippaerts, R., … Buchowski, M. (2015). Anthropometric characteristics, physical fitness and motor coordination of 9 to 11 year old children participating in a wide range of sports. *Plos One*, *10*(5), e0126282. Retrieved from WOS:000354916100060. doi:10.1371/journal.pone.0126282

Papaioannou, A. (1997). Perceptions of motivational climate, perceived competence, and motivation of students of varying age and sport experience. *Perceptual and Motor Skills*, *85*(2), 419–430. Retrieved from WOS:A1997YA57800005. doi:10.2466/PMS.85.6.419-430

Philippaerts, R. M., Matton, L., Wijndaele, K., Balduck, A.-L., De Bourdeaudhuij, I., & Lefevre, J. (2006). Validity of a physical activity computer questionnaire in 12-to 18-year-old boys and girls. *International Journal of Sports Medicine*, *27*(2), 131–136. Retrieved from WOS:000235563700008. doi:10.1055/s-2005-837619

Pion, J. (2014). The value of non-sport-specific characteristics for talent orientation in young male judo, karate and taekwondo athletes. *Archives of Budo*, *10*, 147–152. Retrieved from WOS:000347428600001.

Pion, J., Segers, V., Fransen, J., Debuyck, G., Deprez, D., Haerens, L., … Lenoir, M. (2014). Generic anthropometric and performance characteristics among elite adolescent boys in nine different sports. *European Journal of Sport Science*, 1–10. Retrieved from PM:25143133. doi:10.1080/17461391.2014.944875

Pratorius, B., & Milani, T. L. (2004). Motor abilities of children: Abilities of coordination and balance: Examination of differences between children of different social groups. *Deutsche Zeitschrift fur Sportmedizin*, *55*(7–8), 172–176. Retrieved from WOS:000223467500001.

Roberts, G., Kleiber, D., & Duda, J. (1981). An analysis of motivation in children's sport: The role of perceived competence in participation. *Journal of Sport Psychology*, *3*, 206–216.

Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2015). Motor competence and its effect on positive developmental trajectories of health. *Sports Medicine*, *45*(9), 1273–1284. Retrieved from PM:26201678. doi:10.1007/s40279-015-0351-6

Scheys, M. (2014). Vlaams Onderwijs in cijfers 2013-2014. Retrieved from http://www.ond.vlaanderen.be/onderwijsstatistieken/2013-2014/VONC_13-14/VONC_2013_2014_Integraal.pdf

Smits-Engelsman, B. C. M., Henderson, S. E., & Michels, C. G. J. (1998). The assessment of children with developmental coordination disorders in the Netherlands: The relationship between the movement assessment battery for children and the korperkoordinations test fur kinder. *Human Movement Science*, *17*(4–5), 699–709. Retrieved from WOS:000075788900012. doi:10.1016/S0167-9457(98)00019-0

Stodden, D. F., Goodway, J. D., Langendorfer, S. J., Roberton, M. A., Rudisill, M. E., Garcia, C., & Garcia, L. E. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest*, *60*(2), 290–306. Retrieved from Routledge. doi:10.1080/00336297.2008.10483582

Telama, R., Yang, X. L., Viikari, J., Valimaki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood - A 21-year tracking study. *American Journal of Preventive Medicine*, *28*(3), 267–273. Retrieved from WOS:000227789900004. doi:10.1016/j.amepre.2004.12.003

Ulrich, B. (1987). Perceptions of physical competence, motor competence, and participation in organized sport: Their interrelationships in young children. *Research Quarterly for Exercise and Sport*, *58*(1), 57–67. Retrieved from Routledge. doi:10.1080/02701367.1987.10605421

Vandorpe, B., Vandendriessche, J., Lefevre, J., Pion, J., Vaeyens, R., Matthys, S., … Lenoir, M. (2011). The korperkoordinationstest fur kinder: Reference values and suitability for 6-12-year-old children in Flanders. *Scandinavian Journal of Medicine & Science in Sports*, *21*(3), 378–388. Retrieved from WOS:000290589700006. doi:10.1111/sms.2011.21.issue-3

Vandorpe, B., Vandendriessche, J., Vaeyens, R., Pion, J., Matthys, S., Lefevre, J., … Lenoir, M. (2012). Relationship between sports participation and the level of motor coordination in childhood: A longitudinal approach. *Journal of Science and Medicine in Sport*, *15*(3), 220–225. Retrieved from WOS:000304796900007. doi:10.1016/j.jsams.2011.09.006

Vansteenkiste, M., Niemiec, C., & Soenens, B. (2010). The development of the five mini-theories of self-determination theory: An historical overview, emerging trends, and future directions. In T. Urdan & S. Karabenick (Eds.), *Advances in motivation and achievement* (Vol. 16 (The decade ahead), pp. 105–166). Bingley: Emerald Publishing.

von Eye, A., & Bogat, G. A. (2006). Person-oriented and variable-oriented research: Concepts, results, and development. *Merrill-Palmer Quarterly-Journal of Developmental Psychology*, *52*(3), 390–420. Retrieved from WOS:000241633300002. doi:10.1353/mpq.2006.0032

Weiss, M., Bredemeier, B., & Shewchuk, R. (1986). The dynamics of perceived competence, perceived control, and motivational orientation in youth sport. In R. Weiss & D. Gould (Eds.), *Sport for children and youth: Proceedings of the 1984 olympic scientific congress* (pp. 89–102). Champaign, IL: Human kinetics.

Weiss, M. R., & Amorose, A. J. (2005). Children's self-perceptions in the physical domain: Between- and within-age variability in level, accuracy, and sources of perceived competence. *Journal of Sport & Exercise Psychology*, *27*(2), 226–244. Retrieved from WOS:000229862600007.

Whitehead, J. (1995). A study of children's physical self-perceptions using an adapted physical self-perception questionnaire. *Pediatric Exercise Science*, *7*, 132–151.