

The relationship between perceived physical competence and fundamental motor skills in preschool children

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Accepted for publication 09 October 2010

Abstract

Background The purpose of this investigation had two folds. First, it aimed to discover the relationship between perceived physical competence and fundamental motor skills in preschoolers. Secondly, it examined the effect of sex on perceived physical competence and fundamental motor skills within the sample.

Methods A total of 119 children (mean age 4.00, SD 0.55 years) participated in this study. The Test of Gross Motor Development – 2nd Edition was used to assess fundamental motor skills and the Pictorial Scale of Perceived Competence and Social Acceptance was used to assess perceived physical competence.

Results The results show a moderate and significant correlation between perceived physical competence and fundamental motor skills. Sex differences were also found with boys demonstrating more proficient motor skills and reporting higher perceived physical competence compared with girls.

Conclusions The findings provide relevant information to the child development literature and suggest that a positive relationship exist between preschoolers' self-perceptions of the physical ability and fundamental motor skills.

Keywords

children, locomotor skills, motor skills, object control skills, self-perceptions

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Introduction

The prevalence of obesity among preschool-age children has increased over the past years (Centers for Disease Control 2009). Although the exact causation of childhood obesity has not been established, physical inactivity has been implicated (Hedley *et al.* 2004). Data suggest that children are moving less and are adopting more sedentary lifestyles [U. S. Department of Health and Human Services (USDHHS) 2004]. These behaviours have health consequences now and later in life. Recently, the importance of fundamental motor skills and perceived physical competence towards lifetime participation in movement and physical activity was hypothesized (Stodden *et al.*

2008). The authors suggest that fundamental motor skills and perceived physical competence are primary mechanisms that are associated with physical activity participation and health-related fitness. Additionally, over the past decade, other investigators have explored these variables and found that fundamental motor skills (Goodway & Branta 2003; Piek *et al.* 2006; Robinson & Goodway 2009) along with perceived physical competence (Goodway & Rudisill 1997; Weiss & Amorose 2005; McCullough *et al.* 2009; Robinson *et al.* 2009) could contribute to the health of young children because of their potential effects of physical activity participation.

Children move and engage in physical activity through the execution of fundamental motor skills. Fundamental motor

skills are considered the building blocks for more advanced movement and sports-specific skills (Clark & Metcalfe 2002; Robinson & Goodway 2009). Fundamental motor skills are broken down into two categories: *locomotor skills* that involve moving the body through space (i.e. run, jump, hop, leap, slide, gallop) and *object control skills* that entail using the hands and feet to manipulate and/or project objects (i.e. throw, catch, kick, dribble, roll, strike and catch; Haywood & Getchell 2009). Locomotor and object control skills enable individuals to move and actively engage in their environment. It is essential for young children to achieve basic competence in motor skills in order to break through a hypothetical 'proficiency barrier' (Seefeldt 1980) that will lead to successful engagement in various forms of movement, sport and physical activities (Clark & Metcalfe 2002). Emerging evidence supports the concept that children who are competent movers tend to be more physically active (Okely & Booth 2000), have higher level of cardiovascular fitness (Okely *et al.* 2003; Haga 2008) and are less likely to be overweight (Okely *et al.* 2004; Logan *et al.* 2010). Children between the ages of 6 to 12 years, with advanced fundamental motor skills spend more time engaged in non-sedentary behaviours in comparison to children with low fundamental motor skills (Houwen *et al.* 2009). Haga (2008) also found that physical fitness and motor skill competence (i.e. the ability to execute different motor acts such as coordination, agility, fine and gross motor skills; Henderson & Sugden 1992) are also strongly correlated in 9–10 years old children and suggest that both are needed in order to develop and maintain one's quality of health. There is growing evidence indicating that preschoolers' fundamental motor skills are associated with physical activity participation (Fisher *et al.* 2005; Williams *et al.* 2008; Robinson *et al.* 2009). These findings support the importance of fundamental motor skills as it relates to cardiovascular fitness and physical activity participation.

In addition to fundamental motor skills, perceived physical competence (i.e. 'what a child believes to be his/her motor ability') is also a mechanism associated with movement (Goodway & Rudisill 1997; McCullough *et al.* (2009) and physical activity (Carroll & Loumidis 2001). Perceived competence is an important determinant of achievement-related behaviours and actions (Deci & Ryan 2000). Children with high perceived competence exhibit higher self-esteem, exert greater effort and select tasks that challenge their ability (Weiss & Amorose 2005). For example, children who perceive themselves to be highly competent at a skill or task will demonstrate persistence and attempt to master a skill, while those with low competence will not persist and lose interest in that task (Rudisill *et al.* 1993; Weiss & Amorose 2005; Sollerhed *et al.* 2008). Perceived physical competence also influences the motivation to participate in

physical education settings (Papaioannou 1997; Ferrer-Caja & Weiss 2000). Thus, perceived physical competence along with fundamental motor skills play an essential role in children's motivation to learn and their engagement in current and future motor behaviours (Rudisill *et al.* 1993; Valentini & Rudisill 2004; Robinson *et al.* 2009). Studies have found a direct association between perceived physical competence and physical activity participation in older children between the ages of 8 and 12 years. Carroll and Loumidis (2001) found that children who reported high perceived physical competence also demonstrated higher physical activity frequency and intensity compared with those with low perceived physical competence. McCullough and colleagues' (2009) findings indicate that children who are overweight and from impoverished backgrounds report more negative self-perceptions. The study also noted sex differences with boys reporting higher athletic competence compared with girls. To the author's knowledge, only one study has investigated the relationship of perceived physical competence and fundamental motor skills in preschool-age children. Goodway and Rudisill (1997) studied this relationship in 59 African-American preschoolers. Findings revealed that children's object control skill ability significantly predicted their perceived physical competence and sex differences, favouring the boys, were found in object control skill performance.

Given the current health status of preschool-age children, there is a need to revisit the relationship between perceived physical competence and fundamental motor skills. Additional information could lead to a better understanding of factors that potentially influence children's participation in movement and physical activity. It is imperative to understand preschoolers' self-perceptions because of its influence on current and future behaviours, especially when children are in the initial stages of motor skill learning. The knowledge regarding children's ability to judge their fundamental motor skills will provide insight towards understanding their view of themselves while assisting in the design and implementation of preschool movement and physical activity programmes. Based on this need, the aim of this study was to discover the relationship between perceived physical competence and fundamental motor skills in preschool-age children. A secondary purpose was to determine if sex differences existed between these variables.

Methods

Participants and setting

A total of 124 preschoolers were recruited for this study. From this total, 119 preschoolers, mean age 4.00 year (SD 0.55 years)

completed all assessments. This sample was made up of 54 girls and 65 boys. Participants attended a Head Start preschool centre in a large urban Midwestern city located in the USA. Eligibility criteria for this compensatory programme were based on preschool readiness scores and federal guidelines that include a gross family income that is no more than 100% of the federal poverty guidelines (e.g. a family size of four, annual income is at or below \$22 050.00 USD). The sample of participants were from low socio-economic backgrounds and the racial/ethnic demographical was made up predominantly of Blacks (82%).

Rationale

Participants for this study were specifically selected because this study was a replication of Goodway and Rudisill's (1997) work that examined the relationship of perceived and motor competence in a preschool population of similar demographics 10 years earlier. The researcher aimed to have a population that closely resembled this population. The participants in both studies were part of a compensatory early childhood education Head Start programme located in a large, urban Midwestern city with at least 80% of the participants being Black and of low socio-economic status. This population is considered to be at risk for developmental delays and the federal government has identified this group as needing early intervention and remediation to promote optimal growth and development (Individuals with Disabilities Education Improvement Act of 2004). Therefore, additional research in this population is warranted. Findings will contribute to the design of movement programmes and will lead to a better understanding of their gross motor development.

The Test of Gross Motor Development – 2nd Edition

The Test of Gross Motor Development – 2nd Edition (TGMD-2) (Ulrich 2000) was used to assess fundamental motor skills. The TGMD-2 is a well-validated criterion- and norm-referenced standardized test that quantitatively assesses the fundamental motor skills of children between the ages of 3 and 10 years. The test consists of 12 items that are broken down into two subscales: locomotor and object control. The locomotor subscale focuses on six locomotor skills (run, leap, horizontal jump, slide, gallop and hop) while throw, kick, catch, strike, dribble, and roll make-up the skills for the object control subscale. Each skill is evaluated on three to five performance criteria. For example, one performance criterion for running was that 'arms move in opposition to legs, elbows bent'. If partici-

pants demonstrated this behaviour, they received a 1; if they did not demonstrate the behaviour they received a 0. The raw scores from the two TGMD-2 subscales (locomotor and object control) ranges from a score of 0 to 48. The two subscale scores are combined and yield the TGMD-2 Total Score that ranges from a low of 0 to a high of 96. A higher raw score and total score represents higher motor skill competence while lower raw scores and total score indicate the absence of critical elements (i.e. lower motor skill competence). The locomotor and object control skill raw scores were used for the analyses instead of the standard scores for the following reasons. First, raw scores provide a more accurate indicator of children's performance compared with the standardized score. Standardized scores account for age differences and there was no significant difference between the participants' age ($P = 0.215$). It is highly unlikely that children between the ages of 3 to 5 years will consider chronological age differences when it comes to their motor ability. Individuals often compare themselves based on their current performance or mastery of a skill, without the consideration of age. Additionally, this study served as a replication of Goodway and Rudisill (1997) which used raw scores to examine the relationship between fundamental motor skills and perceived physical competence. Mean test-retest reliability coefficients were reported to be 0.96 for the locomotor subscale and 0.97 for the object control items.

Pictorial Scale of Perceived Competence and Social Acceptance

The physical competence subscale of Harter and Pike's (1984) Pictorial Scale of Perceived Competence and Social Acceptance for preschool- and kindergarten-age children was used to assess perceived physical competence. The 6-item questionnaire is presented on a pictorial plate that represents of the child's sex (girl or boy) and race (Black, White or Hispanic). Specifically, the subscale assesses children's self-perceptions as it relates to the psychomotor domain (i.e. ability to run, hop, swing, climb, tie shoelaces and skip). On each pictorial plate, two pictures are displayed side by side. One picture depicts a child who is competent in a particular task and the other depicts a child who is not. First, the child selects the picture that is more like him/her. Then, the child focuses on the selected picture and indicates if he/she is just a little bit like the child in the picture or a lot like the child in the picture. The range of scores for each item on the subscale is 1 to 4. Specifically, a 1 represents a poorly skilled child 'a lot like them'; 2, a poorly skilled child 'a little like them'; 3, a highly skilled child 'a little like them' and 4, a highly skilled

Table 1. Descriptive statistics of age, total and raw TGMD-2 scores, and perceived physical competence

	Total (<i>n</i> = 119)		Boys (<i>n</i> = 65)		Girls (<i>n</i> = 54)	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	4.00	0.55	4.06	0.49	3.94	0.61
TGMD-2 total score (0–96)*	29.33	10.00	32.95	10.62	24.29	7.16
Object control raw score (0–48)*	13.63	5.31	15.83	5.36	10.80	3.88
Locomotor raw score (0–48)*	15.70	5.68	17.12	6.19	13.98	4.47
Perceived physical competence (0–4)*	2.50	0.63	2.75	0.59	2.21	0.57

*Significant difference between boys and girls ($P < 0.01$).

TGMD-2, Test of Gross Motor Development – 2nd Edition.

child ‘a lot like them’. The perceived physical competence has an internal consistency of 0.86 and a reliability of 0.89 (Harter & Pike 1984).

Procedures

Upon receiving permission from the Institutional Review Board for Research Involving Human Subjects, parental consent and participant assent were obtained. The assessment of perceived physical competence and fundamental motor skills took place on an individual basis. The perceived physical competence was administered by a trained female investigator independent to the project and the appropriate plates representing each child’s sex and ethnicity were used. The assessment was completed for each participant in a quiet room away from distractions and the standard test protocol and procedures were followed (Harter & Pike 1984). Following the completion of this assessment, the TGMD-2 was administered by the author and three research assistants in a multipurpose room. The standardized procedures and directions for the TGMD-2 were followed and the assessments were videotaped. Participants were given verbal encouragement and support throughout the testing procedures. The author coded all of the TGMD-2 data through videotape analysis and conducted intra-rater reliability on 50% of the data (98.8% agreement). Inter-rater reliability checks were also completed on 50% of the data by a trained, blinded independent rater. The reliability confirmed an agreement of 97.8% between the two coders.

Statistical analyses

An ANOVA was used to examine the effect of sex on perceived physical competence and fundamental motor skills and Pearson product moment correlation coefficients were used to examine the relationships among perceived physical competence and fundamental motor skills. All analyses were

Table 2. Correlation (Pearson, two-tailed) between TGMD-2 scores (total and subscale scores) and perceived physical competence by sex

	Perceived physical competence		
	Total (<i>n</i> = 119)	Boys (<i>n</i> = 65)	Girls (<i>n</i> = 54)
TGMD-2 total score	0.478**	0.310*	0.506*
Object control skills	0.434**	0.280*	0.346*
Locomotor raw skills	0.435**	0.289*	0.509*

*Correlation is significant at the 0.05 level ($P < 0.005$), **Correlation is significant at the 0.01 level ($P < 0.001$).

TGMD-2, Test of Gross Motor Development – 2nd Edition.

conducted using SPSS version 16 and alpha level was set at 0.05 a priori.

Results

Table 1 provides descriptive statistics aggregated by sex for TGMD-2 total score, object control score, locomotor score and perceived physical competence. As it relates to sex differences, boys demonstrated higher TGMD-2 total score; $F_{1,118} = 22.19$, $P \leq 0.001$, object control score; $F_{1,118} = 30.76$, $P \leq 0.001$, locomotor score; $F_{1,118} = 9.69$, $P = 0.002$, and reported higher perceived physical competence, $F_{1,118} = 24.75$, $P \leq 0.001$ compared to girls.

Correlations between perceived physical competence and total fundamental motor skills along with scores on the object control and locomotor subscales are presented in Table 2. According to Cohen (1988), there was a moderate and significant correlation between perceived physical competence and TGMD-2 total score (0.478) for the whole sample. A moderate and significant correlation was also present between perceived physical competence and the subscales of the TGMD-2 [object control (0.434) and locomotor (0.435)] for all participants. In terms of sex differences, the correlation between perceived physical competence and fundamental motor skills was also significant in both boys and girls for all the three categories. Boys demonstrated a significant but small correlation between TGMD-2 total score (0.310), object control skills (0.280) and

locomotor motor skills (0.289). The same correlation was also seen between girls' object control scores (0.346). However, girls also demonstrated a moderate and significant relationship between TGMD-2 total (0.506) and locomotor skills scores (0.509).

Discussion

The purpose of the study was to establish an understanding of the relationship between perceived physical competence and fundamental motor skills in preschool-age children and to determine if sex differences exist among these variables. As it relates to sex differences, boys demonstrate more proficient gross motor skills and reported higher perceived physical competence compared with girls. The findings from this current study align with the motor development literature (Branta *et al.* 1984; Goodway & Rudisill 1997; Goodway *et al.* 2003). These sex differences could be attributed to various environmental, contextual and socio-cultural factors. Anecdotal observations during this study suggest that many of the girls appeared to be unfamiliar with the equipment used for the motor skill assessment (i.e. a bat for striking) along with the actual skills (i.e. leaping, sliding and dribbling a ball). The differences seen in fundamental motor skills at this early age support the importance of 'planned' movement programmes within preschool and early learning centres that are developmentally and instructionally appropriate (Goodway & Branta 2003; Goodway *et al.* 2003; Robinson & Goodway 2009; Robinson 2010). These studies have demonstrated that effective and planned motor skill interventions promote motor skill development in preschool-age children in comparison to typical free-play and movement programmes. Thus, it is important that children have the opportunity to engage in instructionally and developmentally appropriate movement experiences that eliminate or reduce constraints that prevent movement.

In terms of perceived physical competence, studies in the past have focused predominately on older children, and indicate that boys report higher perceived physical competence compared with girls (Ulrich 1987; Rudisill *et al.* 1993; McCullough *et al.* 2009). Goodway and Rudisill (1997) found no sex differences in the preschoolers' perceived physical competence, in contrast, these findings indicate that girls reported significantly lower perceived physical competence compared with boys. Like the differences seen in fundamental motor skills, these differences might be attributed to girls not engaging or participating in similar types of movement programmes during the early childhood years.

In terms of the relationship between perceived physical competence and fundamental motor skills, these findings do not fully align with the work from Goodway and Rudisill (1997), which found a small but significant correlation between object control skills and perceived physical competence. Findings from this current study demonstrate a moderate relationship for all three components of the preschoolers' fundamental motor skills (TGMD-2 total score, object control and locomotor) and align with the views of Stodden and colleagues (2008) as to the close relationship between one's fundamental motor skills and perceptions of their physical abilities. However, caution should be warranted because the preschoolers' reported lower perceived physical competence in comparison to similar populations (Harter & Pike 1984; Goodway & Rudisill 1997; Valentini & Rudisill 2004), indicating that they identified with negative feelings of competence and self-perceptions. Often, children under the age of 7 tend to demonstrate higher perceived physical competence which is linked to mastery attempts and task persistence (Goodway & Rudisill 1997; Valentini & Rudisill 2004). This inflated perceived competence will drive the acquisition of motor skills because children will continue to engage in mastery attempts in activities in which they believe they are skilful (Stodden *et al.* 2008, p. 296). However, the participants in this study reported low perceived physical competence, and this is a concern because the literature indicates that children who perceive themselves to have low competence will not persevere and will lose interest in movement-related tasks (Harter 1982; Ulrich 1987; Dweck 1998).

It is unclear why these findings do not align with Goodway & Rudisill (1997). A potential reason could be attributed to differences of socio-cultural and environmental influences. The preschoolers in both studies were similar; both were part of a compensatory early childhood education Head Start programme located in a large, urban Midwestern city with at least 80% of the participants being Black. The only differences between the two populations were that the investigation took place 10 years apart and in a different, but neighbouring state. Within these 10 years, vast changes have occurred in terms of the environment in which a child is raised, which could potentially influence their self-perceptions. However, caution should be noted as it relates to the results being generalized to other populations. The participants, majority of the Black, were of part of a federally funded Head Start programme and of low socio-economic status. Therefore, future studies should incorporate a diverse population as it relates to socio-economic status and race/ethnicity. Additionally, descriptive information was not gathered in this study, but would provide valuable details for future studies. Another possible flaw could relate to

the assessment of perceived physical competence, which is a validated and established assessment of children's perceived physical competence. The subscale specifically assesses a child's perceptions related to their ability to run, hop, swing, climb, tie shoelaces and skip which does not encompass a wide range of fundamental motor skills, especially object control skills. However, the perceived physical competence subscale does provide a global view of children's overall perceptions of their physical abilities. Lastly, in order to get a more accurate understanding of the long-term affect of perceived physical competence on fundamental motor skills and potentially physical activity, objective measures of physical activity participation should also be investigated, and these variables need to be assessed overtime.

Conclusion

Harter proposes that self-perceptions are based on four psychological constructs: (i) past experiences; (ii) difficulty or challenge associated with a task; (iii) reinforcement and personal interaction with significant others; and (iv) intrinsic motivation (Harter 1998, 1999). Thus, it is imperative for children to receive appropriate movement and physical activity experiences that challenge their abilities. It is important for children to receive feedback, directions and encouragement from teachers and peers as it relates to their motor skills. Earlier work from Ames (1992) also suggests that children who possess few skills also lack self-confidence, and are often unprepared for learning. The results from this study warrant the need for future investigations of children's perceived physical competence and fundamental motor skills. From a teaching and learning perspective, the findings reinforce the need for regular planned and well-designed movement programmes during the childhood years that promote perceived physical competence and fundamental motor skills. As it relates to the design of movement programmes, emerging literature support the use of high-autonomy (i.e. mastery motivational climate) movement programmes that assist in promoting motor skill development (Valentini & Rudisill 2004; Robinson 2007; Robinson & Goodway 2009; Robinson 2010) and perceived physical competence (Valentini & Rudisill 2004; Robinson *et al.* 2009; Robinson 2010) in young children. By understanding more about the relationship of these variables, physical educators and movement specialists would get a better understanding of the development of self-perceptions in children and how perceived physical competence relates to one's motor skills. More importantly, this knowledge will be able to assist children in developing the skills and attitudes that improve perceived competence

which contribute to an appreciation of movement and potentially making them lifetime movers and active participants in physical activity.

Key messages

- Fundamental motor skills are the building blocks for more advanced movement and sport specific skills.
- A relationship exists between perceived physical competence and fundamental motor skills in preschool-age children.
- Children with low perceived physical competence might be at risk of demonstrating low fundamental motor skills.
- Perceived physical competence and fundamental motor skills could potentially influence children's participation in movement and physical activity settings.

Acknowledgements

The author thanks the Head Start centres, classroom teachers, and children for all of their participation in this project along with Erica N. Johnson, an undergraduate student, who assisted with data collection. I also thank my colleagues for providing feedback on this manuscript. A portion of this study was presented at the 2009 American Alliance for Health, Physical Education, Recreation, and Dance (Tampa, Florida).

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