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The relationship between fundamental movement skill proficiency and physical self-confidence among adolescents

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ABSTRACT
This study aims to assess fundamental movement skill (FMS) proficiency, physical self-confidence levels, and the relationship between these variables and gender differences among adolescents. Three hundred and ninety five adolescents aged 13.78 years (SD = ±1.2) from 20 schools were involved in this study. The Test of Gross Motor Development-2nd Edition (TGMD), TGMD-2 and Victorian Skills Manual were used to assess 15 FMS. Participants' physical self-confidence was also assessed using a valid skill-specific scale. A significant correlation was observed between FMS proficiency and physical self-confidence for females only ($r = 0.305$, $P < 0.001$). Males rated themselves as having significantly higher physical self-confidence levels than females ($P = 0.001$). Males scored significantly higher than females in FMS proficiency ($P < 0.05$), and the lowest physical self-confidence group were significantly less proficient at FMS than the medium ($P < 0.001$) and high physical self-confidence groups ($P < 0.05$). This information not only highlights those in need of assistance to develop their FMS but will also facilitate in the development of an intervention which aims to improve physical self-confidence and FMS proficiency.

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KEYWORDS
Youth; motor skill; locomotor; object control; perceived competence

Introduction

Fundamental movement skills (FMSs) are regarded as the prerequisite for more complex motor skills and movement patterns (Gallahue, Ozmun, & Goodway, 2012). They are categorised into three different domains: locomotor, object control and stability skills, whereby they represent the performance competency required for participation in physical activity (PA) during life (Isaacs & Payne, 2002). From childhood to adolescence, continual movement changes are observed in a sequential manner with the development of FMS followed by the development of sport-specific skills (Gallahue et al., 2012). It is important to note that FMSs are not acquired naturally and they must be taught (Isaacs & Payne, 2002). Differences in various factors, such as teachers, learning environments and exposure to free-play may also affect FMS development levels (Breslin, Murphy, McKee, Delaney, & Dempster, 2012; Logan, Robinson, Wilson, & Lucas, 2011). By the time children are age 10, they should reach mastery level in FMS performance (Gallahue et al., 2012) however this is often not the case. Recent findings have highlighted that children are entering adolescence lacking in basic FMS (O'Brien, Belton, & Issartel, 2015a), which is expected to have a subsequent effect on their sport-specific skill development and consequently their PA participation (Gallahue et al., 2012). Hardy, Barnett, Espinel, Cosgrove, and Bauman (2010) documented skill mastery did not exceed 40% for five of the seven FMS assessed in this study on early adolescent youth in Australia. Results were similar in a study on 5–13 year olds in New Zealand as less than half of the participants exhibited proficiency in kicking (21%), throwing (31%) and striking (40%) (Mitchell et al., 2013). This trend was again similar in Ireland with 11% of early adolescents assessed achieving master or near mastery on the nine FMS assessed (O'Brien et al., 2015).

Research has identified several factors influencing the development of FMS proficiency: age, gender, weight status, PA and self-confidence, (Armstrong & Welsman, 2006; O'Brien, Belton, & Issartel, 2015b). Barnett et al.'s systematic review (2016) highlights that increasing age, a healthy weight status, being male and having a higher socioeconomic status are all positively correlated with aspects of motor competence. Adolescence is a transitional period of life marked by many biological, environmental, social, and psychological transformations, and these changes in turn may affect the level of FMS proficiency (Garcia, 1994). Davies and Rose (2000) highlight that "Investigators have suggested that these physiological and anatomical changes during puberty … [such as growth spurts] … may contribute to motor performance differences between males and females" (p. 39). This would suggest that depending on age, there may be gender differences within FMS as a result of puberty. Wrotniak, Epstein, Dorn, Jones, and Kondilis (2006) stated that gender differences after puberty may be due to biological factors with males becoming stronger and taller so therefore would be more proficient than females in FMS requiring strength such as throwing and running. In addition to this, females participate less in PA than males at this time (Belcher et al., 2010; Woods, Tannehill,

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Quinlan, Moyna, & Walsh, 2010), so they have less exposure to skill development. Before puberty, however, there are little differences between males and females physically; therefore, environmental factors are the main reason for gender differences in the majority of motor tasks (Thomas, Nelson, & Church, 1991). This view is supported by Raudsepp and Pääsuke (1995) who stated that if only biological variables were used to predict motor performance, they would only explain 30% of the performance variance on average. Barnett et al. (2016) highlight that there are many factors other than biological variables such as psychological, cultural, social and environmental factors that all correlate with motor competence. In early adolescence, many people also experience an environmental change in the form of a transition in educational settings as they move from primary to second level education. Marks, Barnett, Strugnell, and Allender (2015) highlight that this transition can cause a decline in PA and an increase in sedentary behaviour. According to Bandura (2005), this transition may also result in a change in self-efficacy and confidence levels as they must re-establish social status and self-confidence in a new environment with new peers. For example, a new physical education (PE) environment may affect their self-confidence, which may magnify any lack of FMS proficiency. In addition, at this age the emphasis in sports clubs and extra-curricular activities is on progressing to sport skill development and competition. This may result in less skill practice due to the fear of demonstrating a lack of motor skill proficiency (Piek, Baynam, & Barrett, 2006), which may be even greater for those with low self-confidence, as the concept of self-confidence and FMS proficiency seems to be related in some way (Lubans, Morgan, Cliff, Barnett, & Okely, 2010).

McAuley and Gill (1983) state that self-confidence is a necessity for achieving success in a sporting performance. They also highlight that this confidence may be skill and situation specific. For example, during a basketball game, a player may feel highly confident dribbling the ball up the court but may exhibit low-confidence at shooting. Bandura (1997) refers to this type of specific confidence as self-efficacy and suggests it contributes to behavioural change. Since self-efficacy expectations influence persistence, thoughts, stimulation and behaviour, it is plausible that positive self-perceptions lead to positive experiences (Bandura, 1986). Ryckman, Robbins, and Thornton (1982) suggested that general physical self-efficacy is associated with the performance of basic tasks, such as FMS. However, according to McAuley and Gill (1983), the influence physical self-efficacy has on the performance of complex physical activities is uncertain. They state that it would be plausible to suggest that physical self-confidence affects a more task-specific self-efficacy, which consequently, influences how well one expects to perform (i.e., perceived motor competence), which ultimately may affect performance (McAuley & Gill, 1983). Various studies have been conducted assessing the relationship between perceived motor competence and actual motor competence (De Meester et al., 2016; Raudsepp & Liblik, 2002), however as stated previously self-efficacy is task and skill specific. Therefore, when assessing the relationship between youths' actual motor competence and self-confidence, it is important that it is conducted with assessment tools, which have been specifically designed for assessing this relationship, such as Barnett et al.'s (2015) pictorial scale for children or McGrane et al.'s (2015) physical self-confidence scale, which have both been developed based on specific FMS.

Assessing adolescent's self-confidence and FMS will provide information on confidence and FMS ability levels which may assist in creating an optimal motivational climate for all (McGrane et al., 2015). Dweck (1991) states that those with high performance ability and high self-confidence will continue to choose challenging tasks providing they have a chance of achieving success. Those with high performance ability and low confidence in their ability will choose less challenging tasks that require less effort and will ensure success, which may result in a deterioration in performance over time (Dweck, 1991). Those who possess low performance ability and high confidence in their ability will have unrealistic expectations, which will lead to a sense of failure and loss of motivation (Dweck, 1991). There are few studies highlighting the relationship between perceived motor competence, confidence levels and FMS levels (Barnett, Morgan, van Beurden, & Beard, 2008; Colella, Morano, Bortoli, & Robazza, 2008; Robinson, 2011). There are also no studies published to date that look at FMS and physical self-confidence levels among adolescents at a skill-specific level as prior to the recent study by McGrane et al. (2015) there was no skill-specific self-confidence tool validated for use with this age group. This is a crucial age group to look at these elements, as outlined previously; it is a period in their life where many developmental, social and psychological changes occur. It is known that some children are entering adolescence lacking the proficiency required to progress onto sport-specific skills (Belton, O'Brien, Meegan, Woods, & Issartel, 2014; Hardy, Barnett, Espinel, & Okely, 2013; Lubans et al., 2010; O'Brien et al., 2015a), therefore, it is essential for more researchers to assess FMS at this critical period to determine exact development levels and highlight specific areas to target for improvement (O'Brien et al., 2015b).

This study aims to assist in the examination of this relationship between adolescents FMS and physical self-confidence levels, to investigate the relationship between the two variables, and also to explore difference by gender. Following the recent validation of a skill-specific self-confidence assessment tool for adolescents (McGrane et al., 2015), this is the first study to assess this relationship.

Methods

Participants

In total 506 participants (52% males, 48% females) were recruited to this study from second year classes throughout 20 schools in the Dublin Region, Ireland. Ethical approval was granted by the University Research Ethics Committee. Three hundred and ninety five adolescents (males n = 199, females n = 196) with a mean age of 13.78 years old (SD = ±1.2) had full data available from the FMS assessment, and 309 of these fully completed the physical self-confidence scale (males n = 157, females n = 152).

Procedures

Fifteen FMSs were assessed during a regular 80 min PE class at the participants' school. The Test of Gross Motor Development-2nd Edition (TGMD-2) (Ulrich, 2000) was used to assess 12 of these skills which were made up of 6 locomotor (run, hop, gallop, slide, leap and horizontal jump) and 6 object control skills (catch, kick, throw, dribble, strike and roll). The remaining three skills comprised of the skip, the vertical jump, which were both assessed using the TGMD (Ulrich, 1985) and the balance, which was assessed using the Victorian Fundamental Movement Skills Manual (Department of Education, Victoria, 1996). These skills were included as they were deemed relevant to the Irish sporting culture (Woods et al., 2010). O'Brien et al. (2015b) assessed these 15 skills using the same assessment tools among a similar cohort.

As per protocol of the relevant assessment tools, participants received a brief description of each skill and observed the FMS-trained researchers demonstrating each of the skills once. They then completed one practice go and two trials of each skill with no feedback given at any stage. All trials were video recorded. Prior to data analysis, a minimum of 95% inter-rater and intra-rater reliability was achieved by researchers. Skills were then analysed as per assessment tool guidelines scoring a "1" if the component of the skills is present and a "0" if it is absent (Ulrich, 2000). For each FMS, the two test trials were added together to get the total score for each skill. Scores were then totalled to give overall locomotor, overall object control and overall FMS score.

Participants' physical self-confidence was assessed using the physical self-confidence scale (McGrane et al., 2015). As stated by McGrane et al. (2015), an intra class correlation indicated that this tool has excellent test–retest reliability with an overall r = 0.92. Content validity and concurrent validity were also good, with the scale achieving a correlation coefficient of r = 0.72 with the physical self-perception profile (McGrane et al., 2015). The physical self-confidence scale consists of 15 questions in which participants rate their confidence at performing each of the 15 FMS. Participants rated their confidence at performing each skill on a likert scale of 1–10, "1" being not confident at all and "10" being very confident. The maximum physical self-confidence score which could be achieved was 150 if participants scored their confidence at 10/10 for performing all 15 skills.

Data analysis

Data were analysed using SPSS version 21. Pearson product correlation coefficients were conducted to explore the relationship between FMS and physical self-confidence overall and for each gender. Similar to previous research (Macdonald, Lord, & Ulrich, 2014), participants were divided into 3 tertiles based on physical self-confidence using visual binning in SPSS (≤119 was the low physical self-confidence group, 120–148 was the medium physical self-confidence group and 149+ was the high physical self-confidence group). A chi-square was conducted to assess the association between genders and physical self-confidence groups. Separate between groups ANOVAs (with Tukey's honestly significant difference [HSD] *post hoc* analysis) were used to investigate the effect of gender and physical self-confidence category on overall FMS score, locomotor score and object control score.

Results

A small significant correlation was found between physical self-confidence and total FMS across all participants (r = 0.219, P = 0.000), however, when this analysis was conducted separately by each gender, a medium significant correlation was found for females (r = 0.305, P < 0.001) with no significant correlation for males (r = 0.101, P = 0.209).

The overall mean FMS score of participants was 98.75 (SD = ±15.45) out of a maximum possible score of 124. Mean skill by skill scores by gender for FMS and physical self-confidence are given in Table 1. Mean FMS scores for the three physical self-confidence groups were as follows: low = 97.24 (SD = ±6.45), medium = 100.5 (SD = ±4.89) and high = 100.06 (SD = ±6.43). Mean physical self-confidence scores for the three physical self-confidence groups were as follows: low = 108.62 (SD = ±44.59), medium = 120.12 (SD = ±37.67) and high = 127.13 (SD = ±33.91). Results of

Table 1. Mean scores for fundamental movement skill (FMS) and physical self-confidence by gender.

	FMS			PSC	
Skill	Male	Female	Maximum possible score	Male	Female
Run	7.83 SD = ±0.17	7.75 SD = ± 0.25	8	8.17* SD = ±3.17	7.32 SD = ±2.97
Gallop	6.92 SD = ±1.08	6.81 SD = ±1.19	8	8.31* SD = ±2.99	7.59 SD = ±2.73
Hop	7.74 SD = ±1.48	7.62 SD = ±1.37	10	8.37** SD = ±2.91	7.54 SD = ±2.72
Leap	5.44 SD = ±0.56	5.73** SD = ±0.27	6	8.44 SD = ±3.01	7.91 SD = ±2.69
Horizontal jump	7.09** SD = ±0.91	6.53 SD = ±1.47	8	8.01** SD = ±3.11	6.77 SD = ±3.08
Slide	6.78** SD = ±1.05	6.51 SD = ±0.98	8	8.43** SD = ±2.88	7.43 SD = ±2.78
Vertical jump	10.03 SD = ±1.97	10.08 SD = ±1.91	12	8.31** SD = ±2.99	7.18 SD = ±2.98
Skip	5.42 SD = ±0.68	5.63* SD = ±0.37	6	8.09* SD = ±3.07	7.28 SD = ±2.98
Strike	8.92* SD = ±1.01	8.65 SD = ±1.31	10	8.21** SD = ±2.94	7.14 SD = ±2.80
Bounce	7.52* SD = ±0.48	7.27 SD = ±0.73	8	8.47 SD = ±2.92	8.07 SD = ±2.42
Catch	5.46 SD = ±0.54	5.66* SD = ±0.44	6	8.43 SD = ±2.95	7.95 SD = ±2.49
Kick	7.67** SD = ±0.33	7.23 SD = ±0.77	8	8.46** SD = ±2.82	7.51 SD = ±2.75
Throw	6.89* SD = ±1.11	6.51 SD = ±1.49	8	8.35* SD = ±2.91	7.66 SD = ±2.75
Roll	6.20** SD = ±1.8	5.61 SD = ±1.98	8	8.49 SD = ±2.89	7.99 SD = ±2.55
Balance	7.42 SD = ±2.10	7.39 SD = ±1.99	10	8.02 SD = ±3.05	7.44 SD = ±2.74

*P ≤ 0.05; **P ≤ 0.01.
PSC: Physical self-confidence.

the chi-square indicated a significant association of medium effect size between gender and physical self-confidence group (χ^2(2, n = 309) = 26.31, P = 0.00, Cramer's V = 0.292). It is evident from the chi-square results in that males score higher than females in physical self-confidence.

Results of the between groups ANOVA on total FMS score demonstrated a significant main effect for gender (F(2, 304) = 5.210, P = 0.023, partial eta squared = 0.02), with males (mean = 99.92, SD = ±6.21) scoring significantly higher than females (mean = 97.57, SD = ±6.02). There was also a significant main effect for physical self-confidence groups (F(2, 304) = 6.179, P = 0.002, partial eta squared = 0.039). *Post hoc* comparisons indicated a significant difference in FMS score between the low and medium (P = 0.000), and the low and high (P = 0.002) physical self-confidence groups. There was no significant interaction between gender and physical self-confidence group (F(2, 304) = .818, P = 0.66).

Results of the between groups ANOVA on locomotor score and object control score demonstrated a significant main effect for gender (F (2, 302) = 5.479, P = 0.005, partial eta squared = 0.035). There were significant differences between males and females in object control skill proficiency with males scoring higher than females (male mean = 42.67 SD = ±3.66, female mean = 40.92, SD = ±3.78, P < 0.001) out of a maximum possible score of 48. However, there was no significant difference between genders in locomotor proficiency but again both genders scored below the maximum possible score of 66 level (male mean = 57.25, SD = ±4.27, female mean = 56.65, SD = ±4.25, P = 0.751). *Post hoc* comparisons indicated a significant difference in object control scores between the low and medium (P < 0.01), and the low and high (P < 0.05) physical self-confidence groups. This was also the case for locomotor scores. There was no significant interaction between gender and physical self-confidence group (F (4, 604) = 0.543, P = 0.74).

Discussion

According to Gallahue et al. (2012), most children are developmentally able to master most FMS by the age of 6 and should have mastered all by age 10. This would imply an expected score of 124 (the maximum score) across these 15 skills for this group of 12–14 year olds, however, as can be seen from the descriptive results the mean score of participants was 99. This low FMS proficiency level indicates that 12–14 year olds underperform the basic locomotor, object control and a balance skill. Despite these poor results this age group should be making the transition to the sport-specific stage. According to previous research (De Meester et al., 2016; Hardy et al., 2013; Robinson, Logan, Webster, Getchell, & Pfeiffer, 2015), FMS proficiency is proven as a predictor for increased PA and FMS proficiency during childhood and also during adolescence (Barnett et al., 2008), therefore, one can suspect that the likelihood to dropout of PA may increase for those with low FMS proficiency levels.

In this study, while both males and females are performing below expected levels of FMS, consistent with the literature (Barnett, van Beurden, Morgan, Brooks, & Beard, 2010; Hardy, King, Farrell, Macniven, & Howlett, 2010) males scored significantly higher than females both overall and for object control skills. As suggested in Barnett et al.'s review (2016) one possible explanation for this may be due to maturation and biological factors. Furthermore, research has proposed that a reason for higher male proficiency in object control skills is linked with the fact that such skills are evident within sports more commonly partaken by males (Hardy et al., 2013). It is also suggested that gender variations may be accredited to the individual gender differences in habitual PA and sports participation (Barnett et al., 2010; O'Brien et al., 2015b). As Barnett et al. (2016) highlights males receive more encouragement and opportunities in sport and PA than females both at home, in school and in the community which provides them with more opportunity to develop their FMS. No significant gender variation was observed in the locomotor domain, with female and male participants achieving similar scores. Barnett et al.'s (2016) review also found that in some studies gender was a correlate of locomotor skills and in other studies gender was not a correlate of locomotor skills. Whereas a study by O'Brien, Belton, and Issartel (2015a) found that males scored significantly higher than females in the locomotor domain while Iivonen and Sääkslahti (2013) found females scored significantly higher than males. These inconsistencies in findings point to the need for further research to investigate this particular domain.

Harten, Olds, and Dollman (2008) found that the games children choose to play during free-play time affect their proficiency at FMS. Boys for example chose games that relied heavily on gross motor skills for success such as the kick and tend to be more competitive. Whereas girls may have played games which relied more on balance or flexibility and were less competitive in comparison to those chosen by males. Another factor which may result in differences between genders is the social acceptance of their peers to be involved in sport and organised PA. In the case of girls, participation in certain sports and team games can be seen as outside the social norm, whereas for boys, participation in sport and team games are seen as a part of their social and personal development (Okely, Booth, & Patterson, 2001). Indeed, social acceptance of boys among their peers may be more at risk if they do not participate (Okely et al., 2001).

In this study, physical self-confidence and FMS proficiency levels were moderately correlated among females (r = 0.305). Suggesting that if a female has low FMS ability she will tend to have low physical self-confidence levels, or vice versa. Among males, there was no significant correlation between FMS and physical self-confidence. Similar to the results of this study, Vedul-Kjelsås, Sigmundsson, Stensdotter, and Haga (2012) also found that FMS and self-perception was most strongly correlated among girls (r = 0.312, mean age 11.46 years). Viholainen et al.'s study (2014) on self-concept, FMS and psychosocial well-being also found that FMS proficiency is connected to self-concept and psychosocial well-being among adolescent girls. When each individual mean was considered, males consistently scored a mean of 8 or above (out of 10) in confidence for each skill regardless of their actual ability which has resulted in males not having a significant correlation. Females on the other hand had a more varied spread of physical self-confidence scores, which reflected their actual abilities resulting in a significant correlation. Dwecks theory (1991) highlights that if you perceive yourself at being proficient at a skill you are more likely to participate in the activity and have a good experience, which may be the case with males as they are more proficient at FMS than females. It is important to note that males may still be below expected FMS proficiency levels for their age group, however, if they have high physical self-confidence they are more likely to participate and keep practising (Dweck, 1991) which over time should result in improved FMS levels.

When physical self-confidence was categorised into low, medium and high, the results highlight that those with low physical self-confidence have significantly lower FMS proficiency than those with medium and high physical self-confidence. This was similar to a study comparing FMS and perceived competence in overweight children, which found that those with low perceived competence also had low FMS proficiency (Southall, Okely, & Steele, 2004). Research suggests that those who are not confident about their ability (in this case those in the low physical self-confidence group) will not want to put themselves in a situation where they may display low ability levels, which in turn may affect their performance (Harter & Pike, 1984). This leads to a vicious cycle of events as those not confident in FMS may not participate as often in FMS, which according to Schoemaker and Kalverboer (1994) will lead to deterioration in performance and has the potential to reduce or even cease participation in PA.

Conclusion

This study highlights low levels of adolescent FMS proficiency at an age where they should be ready to progress onto sport-specific skills. In addition physical self-confidence levels of adolescents, particularly females, across these skills are low. McAuley and Gill (1983) have stated that self-confidence is a necessity for achieving success in a sporting performance, and Bandura (1997) has suggested that it provokes behavioural change. For this reason, it is important in the future to assess PA, FMS proficiency and physical self-confidence to gain a better understanding of this emergent relationship between skill proficiency and self-confidence, and the potential interaction FMS and physical self-confidence have in influencing PA level. Due to the discrepancies in the physical self-confidence levels of males and females in the results of this study, it is important to analyse this relationship separately for each gender. Assessing both FMS and physical self-confidence will not only highlight those in most need of an intervention, but will also facilitate in the development of the intervention. Due to differences in FMS proficiency and self-confidence, some adolescents may require different attention and a different intervention focus specifically targeting their requirements.

Disclosure statement

No potential conflict of interest was reported by the authors.

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