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The PLUNGE randomized controlled trial: Evaluation of a games-based physical activity professional learning program in primary school physical education

Andrew Miller [a,*], Erin M. Christensen [a], Narelle Eather [a], John Sproule [b], Laura Annis-Brown [a], David Revalds Lubans [a]

[a] School of Education, University of Newcastle, Newcastle, Australia
[b] PE & Health Science, University of Edinburgh, Edinburgh, United Kingdom

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ABSTRACT

Objective. To evaluate the efficacy of the Professional Learning for Understanding Games Education (PLUNGE) program on fundamental movement skills (FMS), in-class physical activity and perceived sporting competence.

Methods. A cluster-randomized controlled trial involving one year six class each from seven primary schools (n = 168; mean age = 11.2 years, SD = 1.0) in the Hunter Region, NSW, Australia. In September (2013) participants were randomized by school into the PLUNGE intervention (n = 97 students) or the 7-week wait-list control (n = 71) condition. PLUNGE involved the use of Game Centered curriculum delivered via an in-class teacher mentoring program. Students were assessed at baseline and 8-week follow-up for three object control FMS (Test of Gross Motor Development 2), in-class physical activity (pedometer steps/min) and perceived sporting competence (Self-perception Profile for Children).

Results. Linear mixed models revealed significant group-by-time intervention effects (all $p < 0.05$) for object control competency (effect size: d = 0.9), and in-class pedometer steps/min (d = 1.0). No significant intervention effects ($p > 0.05$) were observed for perceived sporting competence.

Conclusions. The PLUNGE intervention simultaneously improved object control FMS proficiency and in-class PA in stage three students.

Introduction

Children who participate in adequate amounts of moderate-to-vigorous physical activity (MVPA) are more likely to enjoy better physical health (Janssen and LeBlanc, 2010), better psychological health (Eime et al., 2013), and report greater physical self-concept (Babic et al., 2014). There is strong evidence from cross-sectional studies of a positive association between fundamental movement skill (FMS) competency and physical activity (PA) levels (including MVPA) in children and adolescents (Lubans et al., 2010; Barnett et al., 2011). Perceived sports competence is considered as a mediator of the reciprocal relationship between FMS competency and PA in young people (Barnett et al., 2008, 2011), and interventions targeting both perceived and actual FMS competency may assist in preventing the PA decline typically observed during adolescence (Morgan et al., 2013).

It is well recognized that physical education (PE) is the central vehicle responsible for promoting PA within schools (Cox et al., 2010; Eather et al., 2013). Currently, in the primary school context, motor skills are not being taught adequately (Hardy et al., 2011) and activity levels in PE typically do not achieve the recommended 50% of class time in MVPA (Fairclough and Stratton, 2005). Generalist teachers (non-PE specialists responsible for all student content) describe PE programs as inadequate for achieving outcomes (Morgan and Hansen, 2008), and report a lack of FMS knowledge (Morgan and Hansen, 2007).

In addition to low teaching efficacy in a PE setting, a skills based pedagogical approach in which skills are taught and practiced in isolation before being integrated into game play (Rink et al., 1996) is used most commonly in PE (Dudley et al., 2011). This process may see a reduction in the focus on motor skill development once game play is initiated, particularly among teachers lacking pedagogical understanding of FMS development and game play constructs. Additionally, in the context of teaching games and sports, a skills based approach is often low in MVPA (Lonsdale et al., 2013), and may inhibit development of perceived competence due to the difficulty of incorporating an isolated

* Corresponding author at: EN 205, 10 Chittaway Rd, OURIMBAH, NSW 2258, Australia.
E-mail addresses: Andrew.miller@newcastle.edu.au (A. Miller), Erin.m.christensen@newcastle.edu.au (E.M. Christensen), Narelle.eather@newcastle.edu.au (N. Eather), jsproule@staffmail.ed.ac.uk (J. Sproule), Laura.Annis-Brown@uon.edu.au (L. Annis-Brown), David.Lubans@newcastle.edu.au (D.R. Lubans).

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skill into the dynamic and complex nature of the game the skill is used in.

A game centered approach (GCA) for teaching PE offers a method of addressing motor skill development, cognitive aspects of how to play games and affective outcomes by situating learning within game play activities (Kirk and MacPhail, 2002). Due to the active nature of game play, this approach also offers the opportunity to promote MVPA during PE lessons. A recent systematic review of GCA research (Miller, in press) supports the development of: i) motor skills assessed using product based measures within game play, and ii) cognitive factors of game play, when intervention volume is sufficient (around 8 h). A GCA also displayed a positive effect on the perceived abilities of students; however no studies were identified that focused on the improvement of motor skills using process oriented assessment (FMS), or the ability of this approach to keep students active while learning in PE lessons.

The ability to simultaneously improve FMS and in-class PA is a distinct challenge (van Beurden et al., 2003). The primary aim of this study was to evaluate the efficacy of a game centered learning program for the improvement of FMS. A secondary aim was to evaluate the simultaneous improvement of in-class PA and the potential of this approach to improve perceived sporting competence in elementary school students. The Professional Learning for Understanding Games Education (PLUNGE) program was developed to facilitate student outcomes through a teacher professional learning program designed for the development of practical instruction skills, promotion of mastery motivational climate and instruction of game centered approach curriculum. We hypothesized that participants in the PLUNGE intervention, compared to those in the control group, would display more favorable changes in FMS (throw, catch and kick), in-class PA, and perceived athletic competence over the 8-week study period.

Methods

Study design

The PLUNGE intervention was evaluated using a clustered randomized controlled trial in seven schools. The PLUNGE study conformed to the Consolidated Standards of Reporting Trials guidelines (Moher et al., 2010) and was registered with Australia and New Zealand Clinical Trials registry (ACTRN12613000605796). Ethical approval was obtained from the University of Newcastle ethics committee. Written informed consent was provided by students' parents/guardians prior to baseline assessment via return of a consent document sent home with the student. The study was conducted from September to December, 2013 (8 week intervention followed by an 8 week period for the control group).

Sample size

The sample size calculations were based on data from a large scale Australian study of primary school children's FMS (Lubans et al., 2012). Assuming an alpha of 0.05 and power of 80%, it was determined that a total sample size of 144 was needed to detect a between group difference of 1.5 units (SD = 3.2) for a composite object control competency (throw, catch and kick) using the Test of Gross Motor Development 2 (TGMD-2) (Ulrich, 2000). Based on a recent review of FMS interventions (Morgan et al., 2013), this was considered an achievable target.

Recruitment and participants

Ten primary schools selected randomly from Newcastle Maitland Catholic Diocese Schools, NSW Australia, were invited to participate in the study. One teacher of a year 5–6 class (10–12 years of age) from each consenting school was invited to participate in the study. To maintain generalizability of results to the majority of generalist primary school teachers, a teacher was excluded

Table 1
PLUNGE intervention components (Australia from September to December 2013).

Professional development content	In-class mentoring content
Instructional (In-class theory)	Structural:
– Connection of a Game Centered Approach to the existing NSW Personal Development Health and Physical Education syllabus (Board of Studies NSW, 2007b) – Develop motor skills, cognition of game play and socio-cultural (team-work, co-operation, etc..) outcomes within game play – The use of questioning to assist student cognition – Active Learning Time (ALT) – Classroom management for improved ALT – Identification and use of Teachable Moments in PE classes – Development of a learning environment to foster mastery motivation	– Establishing expectations – Efficient game setup and instruction – Classroom management during stoppages
Theoretical:	Promotion of learning:
– Physical activity research findings – Theoretical grounding: achievement goal theory (Nicholls, 1989) – Game Centered Approach research overview – Game Centered Approach comparison to a direct instruction methodology – Mastery motivation within P.E. classes: – Diversity of challenge (Nicholls, 1989; Marshall and Weinstein, 1984) – Individual development of process related aspects of learning tasks (Ames, 1992; Meece, 1991) – Coordination of curriculum and instructional motivational goals (Ames, 1992; Marshall, 1988)	– Developing effective game environments – Game appreciation – Use of questioning to identify learning focus (motor skill, game cognition or socio-cultural) – Promoting cognition – Throw, catch and kick skills – Establish equity based constraints – Recognizing teachable moments
	Class environment:
	– Positive support of classmates – Contribution by all – Fun and fair games – Diminishing over-competitive behavior/reaction
	Motivational:
	– Promote personal improvement of process outcomes within activities (Ames, 1992; Meece, 1991) – Promotion of class focus of the game process, not the result (Ames, 1992; Meece, 1991) – Help students establish a class version of a quality game performance (Nolen and Haladyna, 1990) – Promote positive peer recognition of effort, particularly in situations involving failure (Clifford et al., 1988) – Provide private recognition of effort and improvement (Garner, 1990)