Evidence to inform effective physical education policy, pedagogy and practice in New South Wales secondary schools

Dean A. Dudley

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Evidence to Inform Effective Physical Education Policy, Pedagogy and Practice in New South Wales Secondary Schools

Dean A. Dudley

Thesis submitted for the degree of Doctor of Philosophy,

Faculty of Education

University of Wollongong
Declaration

I, Dean A. Dudley, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Education, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualification at any other academic institution.

Dean A. Dudley
M.Ed (Research), Grad Dip Ed (Secondary), B.HSc
Dedication

This dissertation is dedicated to my family. My mother Alison and my father Alan Dudley have been the most supportive parents a person could ask for. Throughout my life, you have always been my foundation and unwavering in your belief of what I am capable of. Thanks to my two younger brothers, Ryan Dudley and Trent Dudley. The three of us are vastly different in persona but singular in a common belief that ‘Blood is thicker than water’. You both have proved to me throughout our lives, whether on the sporting field, in the school yard, or even in our careers, family comes first!

Most importantly, I dedicate this thesis to the three women who suffered most during its creation, my wife Ana and my two daughters Carolina and Georgia Dudley. You are my rock and my very purpose for being. I want you to know that all else fails in purpose without your love and support.
Acknowledgements

I am grateful to my supervisors. My primary supervisor, Associate Professor Anthony Okely provided guidance and support from the beginning to end in all facets of this project. Thank you Tony for treating me as a colleague throughout my graduate studies program. Your attention to detail and work ethic have provided me with the foundation for my career in academia.

My co-supervisors, Dr Philip Pearson and Dr Wayne Cotton shared the high and lows of this study from inception to completion. I am thankful for the countless hours you spent on the data collection trail with me and reviewing my writing. I consider you both two of the most professional teachers I have ever worked with and I look forward to much more collaboration in the coming years.

I would also like to acknowledge Associate Professor Peter Caputi for his work with me on the data analysis and the publication of this thesis. Your unselfishness of time and effort working with me cannot be expressed adequately, suffice to say, the timeline on completing this study would have been much longer without your involvement.

I also need to thank my friends, colleagues and mentors who supported me during my doctoral journey. Specifically, I would like to mention Dr David Baxter, Darryl Honeysett, and Dr Dylan Cliff.
Finally, it would be remiss of me not to thank the fantastic staff I work with at Charles Sturt University in the School of Human Movement Studies, and especially my supervisor for most of my tenure being Professor Frank Marino whom has given me the support, both professionally and financially, to complete my doctoral studies.
Abstract

This doctoral dissertation is presented by publication to provide evidence that is capable of informing effective physical education (PE) policy, pedagogy and practice in New South Wales (NSW) secondary schools. This thesis contains two distinct phases of research. Firstly, this thesis presents a systematic review of published literature on the effectiveness of physical education in promoting participation in physical activity (PA), enjoyment of physical activity and movement skill instruction and practice in children and adolescents. Twenty three (23) papers met the inclusion criteria established for this review and were rated independently by three reviewers using a 10-item methodological quality scale derived from the CONSORT 2010 statement.

The results of the review detail the nature, scope and focus of intervention strategies and the reported outcomes of the interventions. The most effective strategies to increase children’s levels of physical activity and improving movement skills in physical education were direct instruction teaching methods and providing teachers with sufficient and ongoing professional development in using these PE instruction methods. The review revealed a lack of statistical power and high quality evaluations to draw conclusions concerning the effectiveness of interventions conducted in PE to improve enjoyment outcomes. It is argued that adequately powered interventions that target movement skills in secondary schools and evaluate school sport curriculum are urgently needed.

The second phase of the research reports the cross-sectional and longitudinal levels of physical activity, lesson context and teacher interaction students receive during PE in NSW
secondary schools and how student enjoyment of PE changes over these first two years of secondary schooling.

Eighty one (n=81) PE lessons were randomly observed in 2008 and then followed up 12-months later in 2009 (n=51) using systematic direct observation (System for Observing Fitness Instruction Time). During the same months in 2008 and 2009, 560 students consented to completing an enjoyment of PE questionnaire.

There was a reduction in the PE time spent in moderate-to-vigorous physical activity (MVPA) (Baseline= 56.9%, Follow-up 52.1%, Mean Difference= -4.8%; p=.777) and vigorous physical activity (VPA) (Baseline= 20.8%, Follow-up= 12.9%, Mean Difference= -7.9%; p=.009). Significant declines also occurred in percentages of PE time spent in management (Baseline= 30.8%, Follow-up= 22.3%, Mean Difference = -8.8%; p<.0001) and in the time that teachers spent promoting PA (Baseline= 30.8%, Follow-up= 10.1%, Mean Difference = -20.7%; p<.0001). Increases in PE time spent in fitness (Baseline= 7.1%, Follow-up= 10.6%, Mean Difference =3.5%; p=.191) and game play (Baseline= 43.5%, Follow-up= 46.6%, Mean Difference =3.1%; p=.199) were also observed.

Students enjoyed PE in Year 7 but their enjoyment of PE declined slightly as they progressed through Year 8. There was a small (Baseline= 45.8, Follow-up= 44.0, Mean Difference = -1.8, d= -0.30) but significant (p<.001) overall mean decline in enjoyment of PE between Year 7 and Year 8. The decline in enjoyment of PE was greater among girls (Mean Difference=-1.3) regardless of school-type. Being active with their peers had the largest negative effect size (d= -0.40) on boys enjoyment of PE and changing clothes had the largest negative effect size (d=-0.42) on girls. Based on the evidence presented in this dissertation, schools should consider
changing their PE uniform policies and increasing teacher and peer support strategies in PE to maintain enjoyment of this subject.
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Publications and Presentations

The following publications and presentations have been produced as a result of the research conducted for this thesis.

Publications in Refereed Journals


Conference Presentations


National Physical Activity Conference/Australian Conference of Science and Medicine in Sport: Brisbane, Queensland

List of Acronyms and Abbreviations

AC: Accelerometry

CDC: Centres for Disease Control and Prevention (U.S. Department of Health and Human Services)

Co-ed: Coeducational school (i.e. enrols both male and female students)

Con: Control

CT: Controlled trial

DO: Direct Observation

FU: Follow-up

HPE: Health and Physical Education

Int: Intervention

MET’s: Metabolic equivalent tasks

Min(s): Minutes, p/w: per week

MS/FMS: Movement skills

MVPA: Moderate to vigorous physical activity

NS: Not significant

NSW: New South Wales, Australia

NSW BOS: New South Wales Government, Office of the Board of Studies

NSW DEC: New South Wales Government, Department of Education and Communities

PA: Physical activity

PE: Physical Education

PESS: Physical Education and School Sport

PD: Professional Development

PI: Post-intervention

PM: Pedometers

RCT: Randomised controlled trial

SR: Self Report
SS: School Sport

VPA: Vigorous physical activity
CHAPTER 1

Introduction

1.1 Background

Physical education is a mandated curricula in all Australian states and territories and is compulsory for students in Years K-10 in New South Wales (NSW) public, Catholic and independent schools. Physical education in NSW is taught within the larger Key Learning Area (KLA) of Personal Development, Health, and Physical Education (PDHPE). This KLA pursues multiple objectives that are not all directly related to physical activity, movement skill acquisition or psychosocial outcomes but also include cognitive, social, emotional and spiritual domains. Yet, providing students with opportunities to engage in physically active pursuits, learn movement skills and supporting the adoption of lifelong physical activity still remain at the core of the PDHPE rationale in the Years K-6 primary school and the Years 7-10 secondary school PDHPE syllabi. The PDHPE rationale that resides within the secondary school Years 7-10 PDHPE Syllabus (2007) is written, managed and administered by the NSW Office of the Board of Studies. According to the NSW Board of Studies (2007) Year 7-10 PDHPE rationale,

Personal Development, Health and Physical Education (PDHPE)... provides opportunities for students to learn about, and practise ways of, adopting and maintaining a healthy, productive and active life. It also involves students learning through movement experiences that are both challenging and enjoyable, and improving their capacity to move with skill and confidence in a variety of contexts. It promotes the value of physical activity in their lives. (NSW Board of Studies, p.9, 2007).
Young people’s motivation to be physically active is influenced by their level of **enjoyment, perceived competence and social support**. Trends toward inactivity in young people are of particular concern due to the associated range of short-term and long-term health implications. PDHPE plays a key role in promoting physical activity and developing **competency in movement skills**. It provides opportunities for students to develop, adapt and improvise their movement skills in a wide variety of challenging contexts and environments that appeal to their needs and interests, **enhance enjoyment** and excitement in their lives, and ultimately **increase the likelihood of lifelong physical activity**. (NSW Board of Studies, p.9, 2007).

The bolded words from the NSW Board of Studies Years 7-10 PDHPE Syllabus (2007) above are consistent with the key elements of Harter’s Competency Motivation Theory (1978) adapted for the physical domain (Weiss, 2000). That is, although not explicitly stated, it appears that the NSW PDHPE syllabus has been based, at least to some extent, on Competency Motivation Theory in the physical domain as represented diagrammatically in Figure 1.1.
Figure 1.1: Harter’s Competency Motivation Theory adapted for the physical domain (Weiss, 2000)

Competency Motivation Theory in the physical domain (Weiss, 2000) suggests that individuals are motivated in achievement domains in which their competence can be demonstrated. In a physical activity context, successful mastery of a physical skill or action is associated with positive emotion and low anxiety (Biddle, Sallis, & Cavill, 1998). Competence Motivation Theory (Harter, 1978) adapted for the physical domain by (Weiss 2000) posits that physical activity is influenced directly by enjoyment and physical self-esteem. In turn, physical self-esteem is influenced by perceived competence and social support from significant others.
In Competency Motivation Theory, perceived competence is the key determinant of physical self-esteem and, in turn, of enjoyment of and participation in physical activity. For adolescents, it is thought that they construct their perceptions of competence from interactions they receive from peers, teachers and coaches, and from their perceptions of their performances in comparison to their peers, and from how they internalise their improvement and attainment of self-set goals (Weiss, 2000).

Competency Motivation Theory in the physical domain and the similar implicit wording of the Years 7-10 PDHPE syllabus rationale by the NSW Board of Studies suggests specific goals of the KLA’s intention. Specifically, if the syllabus stipulates that PDHPE curriculum exists, at least in substantial part, to develop competency in movement skills, promote physical activity, and influence enjoyment and social support of their students, then it can be assumed that effective PDHPE lessons should demonstrate measurable elements of instruction time and the related outcomes dedicated to the following aspects of PDHPE lessons. They are;

a) Development of movement skills is important. Explicit instruction of movement skills should be observable during PDHPE lessons.

b) Participation in high levels of physical activity

c) Social support given by teachers that promotes physical activity participation and the learning of movement skills

d) PDHPE lessons are enjoyable and encourage participation in physical activity
There is some evidence to support that when explicit instruction of movement skills, high levels of physical activity participation, social support from teachers, and enjoyment are observed in PE programs that they have an impact on efficacy of various PE outcomes. These areas are reviewed in detail in Chapter 2. A brief review is provided of a small number of highly cited studies here that have been shown to be efficacious in affecting these outcomes in physical education.

1.1.1 Physical education that contains explicit and observable instruction of movement skills

McKenzie, Alcaraz, Sallis, and Faucette (1998) examined the effect of the Sports, Play, and Active Recreation for Kids (SPARK) PE program (McKenzie & Rosengard, 1994) on three manipulative skills (catch, throw, and kick) of 4th and 5th grade students. The study involved seven schools in the US which were randomly assigned to one of three conditions: 1) having the program delivered by a physical education specialist, 2) having the program delivered by a trained classroom teacher, or 3) a control group that continued with their existing PE curriculum. The SPARK PE curriculum involved three, 30 minute PE lessons every week with 15 minutes of each lesson dedicated explicitly to skill and fitness instruction. At six month follow-up, children in the physical education specialist or trained teacher group receiving the SPARK PE program had skill improvements of 21% and 19% respectively compared with those in the control group who showed gains of 13%. These gains were statistically significant for catching ($p=.005$) and throwing ($p=.008$) for boys and girls in all age groups when comparing trained and specialist trained teachers with the control group. This shows that the explicit instruction of fundamental movement skills in PE lessons, whether by a PE specialist or trained generalist teacher can improve motor skill proficiency among children.
1.1.2 Physical education that has high levels physical activity participation

The Middle School Physical Activity and Nutrition (M-SPAN) program (McKenzie, Sallis, Prochaska, Conway, Marshall, & Rosengard, 2004) examined the effect of the SPARK PE program on physical activity levels in 24 middle schools in Southern California. The schools participated in a randomised trial for two years whereby 12 schools were assigned to intervention and 12 to a control group. Intervention schools taught to the SPARK PE curriculum (which focused on spending more PE class time in skill and fitness instruction and less time participating in unstructured free play) and were supported with ongoing staff development where teachers also set goals for modifying PE at their schools in order to promote physical activity during PE. Control schools continued with their existing PE programs. The primary outcome of the study was increasing moderate to vigorous physical activity (MVPA) during PE classes. Compared with control schools, students in the intervention schools had significant ($p=0.02$) increases in MVPA in PE. Furthermore, these effects were cumulative and by the end of the second year the intervention schools had increased student MVPA in PE by 18%. In terms of mean minutes spent in MVPA, intervention schools spent 20 minutes per lesson compared with 17 minutes per lesson in the control schools by the end of the second year. This implies that PE lessons targeted to improving the quantity of MVPA occurring during PE lessons need to have trained teachers who are committed to providing substantial amounts of time dedicated to observable skill and fitness instruction whilst reducing the amount of time spent in unstructured free play.
1.1.3 Physical education where teachers provide social support in the participation of physical activity and learning of movement skills

The literature ascertaining the effect teacher social support has on the efficacy of PE programs is sparse. Evidence from an observational study conducted by van der Mars, Vogler, Darst, and Cusimano (1998) on PE learning environments examined the active teaching patterns of 18 primary school physical education teachers in relation to physical activity levels of three randomly assigned students per teacher (n=54) during allotted PE class time. The main outcomes of the study were to determine teacher patterns of interaction during PE and the relationship between these patterns and student physical activity levels. Significant correlation coefficients were found when teachers engaged in verbal feedback behaviours and student physical activity. Specifically, higher rates of corrective feedback, corrective behaviour feedback, and specific feedback were significantly related to higher rates of students’ time spent in PA modes of walking and MVPA with r values ranging from 0.52 to 0.87. In addition, when teachers demonstrated engagement in the PE activity, this correlated positively with students’ engaging in MVPA (r[16]=.50, p<.05) and being very active (r[16]=.57, p<.05).

1.1.4 Physical education that is enjoyable and encourages participation in physical activity

The literature surrounding PE curricula that actively targets an enjoyment outcome is again sparse. Enjoyment of PE is usually reported as a secondary outcome to physical activity in an intervention program. McKenzie et al. (2004) examined how the Middle School Physical Education Intervention (M-SPAN) program affected enjoyment of PE in 24 middle schools in
Southern California. M-SPAN focused on providing sample materials and assisting middle-school physical educators with revising existing programs and instructional strategies to increase student moderate to vigorous physical activity (MVPA). Results indicated that the intervention only slightly increased enjoyment of PE in boys and girls, but not significantly ($p=0.7$) for boys and girls.

In addition, McKenzie et al. (2004) and Neumark-Sztainer et al. (2003) examined how an enhanced PE program effected enjoyment and physical activity among adolescent girls in a girls-only alternative PE program in secondary schools. There were 89 girls in the intervention group and 112 girls in the control group, from three intervention and three control secondary schools in the Twin Cities area school districts in Minnesota. The intervention program addressed socio-environmental (i.e., supportive atmosphere and different opportunities for physical activity), personal (i.e., self-perceptions, self-efficacy, and attitudes regarding physical activity), and behavioural (i.e., goal-setting, skills) factors, and the interactions between these factors. At post-intervention (Intervention Mean= 7.62, Control Mean= 7.25; $p=0.39$) and 3-month follow-up (Intervention Mean= 7.65, Control Mean= 7.37; $p=0.51$) assessments of enjoyment of physical activity, the intervention group showed higher levels of enjoyment of physical activity during PE but these were not significantly different to the control group. These studies show that enhanced PE lessons can increase the levels of enjoyment of PE but they may not be a result of targeting enjoyment as an outcome.

1.1.5 Linking existing evidence to NSW PDHPE Rationale

The evidence presented by this short literature review suggests that PE should maximise the amount of PA young people participate in and there appears to be a case for PE to be
accountable for the quantity of physical activity students participate in. There is also some suggestion that the teaching of movement skills during PE also increases proficiency in this domain. However, the role teachers play in providing the social support for students to be physically active, learn movement skills, and enjoy PE and whether enjoyment of physical activity is even a legitimate curriculum outcome of a PE curriculum. A systematic review of high quality PE would help to ascertain what makes for an effective PE program that is capable of improving movement skill proficiency, increasing physical activity participation, and enjoyment of physical activity. In addition, it would be prudent to examine the extent to which the NSW Years 7-10 PDHPE (2007) curriculum delivered in NSW secondary schools actually delivers movement skill instruction, whether high levels of physical activity participation are present, whether social support from teachers for students to be physically active is provided, and assess the enjoyment of PE among students and the factors that contribute to it. Furthermore, it would be useful to know if the nature of these elements of instruction change over time as students’ progress through their compulsory PE curriculum during secondary school.

1.2 Purpose and aims of this study

The aims of this study were to;

1. systematically review the effectiveness of PE interventions on improving movement skills, increasing PA, and enjoyment of PA and;

2. examine the presence (both cross-sectionally and longitudinally) of the elements of instruction (movement skill instruction, PA participation, enjoyment of PE, support to be physically active, and enjoyment of PA) embedded in the rationale of the NSW Board of Studies Years 7-10 PDHPE Syllabus (2007).
1.3 Research questions

The specific research questions were:

1. What interventions utilising PE have significantly improved movement skills, PA levels and enjoyment of PA and what are the pedagogical practices and policies associated with effective interventions?

2. What proportion of PE class time is spent in explicit movement skill instruction or practice and does this change from Year 7 to Year 8 (first and second year of secondary school in NSW, Australia)?

3. What proportion of PE class time have high levels of PA participation and does this change from Year 7 to Year 8?

4. What proportion of PE class time do teachers spend supporting their students in movement skill and PA and does this change from Year 7 to Year 8?

5. What aspects of enjoyment and to what extent do PE lessons change from Year 7 to Year 8?

1.4 Research hypothesis

It was hypothesised that

1. Interventions that utilised a process-product pedagogical approach (Siedel & Shavelson, 2007) during PE would be effective in influencing their targeted outcome (movement skill competence, PA participation or enjoyment of PE).
2. Based on previous United States (McKenzie et al., 2000; McKenzie et al., 2004) data, less than 25% of PE class time will be dedicated to explicit skill instruction and practice and this will not change from Year 7 to Year 8.

3. Based on previous United States (McKenzie et al., 2000; McKenzie et al., 2004) data less than 50% of PE class time will be spent in MVPA and that this participation will decline from Year 7 to Year 8.

4. Based on previous United States (McKenzie et al., 2000; McKenzie et al., 2004) data, less than 35% of observed teacher interaction intervals will be spent with PE teachers giving encouragement and support that promotes movement skills and physical activity participation and that this proportion will decline from Year 7 to Year 8.

5. Enjoyment of physical education will decline from Year 7 to Year 8 and non-curricular aspects of PE (such school policies regarding PE and the relationship they have with their teachers and peers) will contribute most to this decline.

1.5 Significance of the thesis

Recent international and Australian government and non-government reports have called for there to be more scrutiny of the delivery of PE in schools. The United Nations (2010) calls for universal access to quality and effective PE for all school-aged children of the world. In an attempt to specify what ‘effective’ PE is, several national agencies have released their own statement pertaining to the role of PE in schools. The U.S. Department of Health and Human Services (2010) released their ‘Strategies to Improve the Quality of Physical Education’ statement which calls for PE to maximise PA participation during PE lessons. In addition to recommending students spend 50% of PE class time engaged in MVPA, the Centers for Disease Control and Prevention also stressed the importance of PE being enjoyable for
children and youth (Centers for Disease Control and Prevention, 2011). Further to this US statement, the Australian Government has stressed the importance of teaching movement skill to youth during PE (Australian Government Preventative Health Taskforce, 2010) in order to achieve long-term health improvements for the population.

The proportion of PE class time spent in movement skill instruction, MVPA, and the level of student enjoyment of PE in NSW secondary schools is not known. Nor is the role teachers provide in supporting students to be physically active and learning new movement skills. This thesis makes a unique contribution to the literature by providing a systematic review of existing evidence into the effectiveness of PE delivering these outcomes but also by collecting data to examine them in a NSW context over the first two years of compulsory secondary schooling.

1.6 Overview of methodology

This study was conducted in two distinct phases (See Figure 1.2). Phase one involved a systematic review of the published PE interventions that aimed to improve movement skill development, and/or physical activity participation, and/or enjoyment of physical activity. A systematic review of the published literature on the effectiveness of PE interventions in promoting physical activity, movement skill development, and enjoyment of PE in youth may serve as a policy foundation for evidence-based practice guidelines, economic evaluations, and future research agendas. This systematic review examined the evidence from controlled experimental and quasi-experimental trials of PE-based interventions in promoting physical activity, movement skill development, and enjoyment of physical activity in school-aged
youth. It also provided a synthesis of evidence and identified gaps in the literature to indicate where future research is needed.

Phase two of this study used an observational design to examine the nature of PE programs run by single-sex and co-educational public secondary schools situated in south-west Sydney. The six secondary schools were identified by the NSW Department of Education and
Communities (NSW DEC) as having a high proportion of students from culturally and linguistically diverse (CALD) backgrounds. All six schools were invited to participate in the study. Four of the schools were single-sex (two all boys’ and two all girls’ schools) and two were co-educational. In each school, all enrolled Year 7 (first year of high school in NSW) students were invited to participate. Follow-up data were collected from all six schools in the same half of the school year in the following year when the same students were enrolled in Year 8.

The participants were PE teachers and Year 7 students recruited from the six schools. Consenting teachers and students were randomly observed for three PE lessons over a six month period at both baseline and follow-up. Student participants also completed a questionnaire on their enjoyment of PE toward the end of each data collection period.

1.7 Overview of Thesis

This thesis is presented as a dissertation by publication. It consists of four articles submitted, accepted for publication, or published in international peer-reviewed journals. The articles submitted for publication and the dissertation are centred on data collected as part of the Physical Activity in Linguistically Diverse Communities (PALDC) study during 2008 and 2009.

The four papers submitted or accepted for publication within this dissertation are contained within individual chapters and may have been adapted from submitted or published works in
order to maintain continuity. The final chapter has been prepared as a manuscript for publication but not yet submitted for peer-review. The introduction chapter was not submitted for publication as it provides structure for the research.

The chapters within the thesis are as follows:

Chapter One: Introduction (Not submitted for publication)


Chapter Three: Physical Activity Levels, Movement Skill Instruction, and Teacher Interaction in Year 7 Physical Education (Adapted version accepted for publication as: Dudley, D.A., Okely, A.D., Cotton, W.G., Pearson, P, and Caputi, P. Physical activity levels and movement skill instruction in secondary school physical education. Journal of Science and Medicine in Sport; In Press, Accepted 28/10/11)
Chapter Four: Changes in Physical Activity Levels, Movement Skill Instruction, and Teacher Interaction from Year 7 to Year 8 during Physical Education (Adapted version submitted for publication as: Dudley, D.A., Okely, A.D., Cotton, W.G., Pearson, P., and Caputi, P. Physical activity levels, lesson context, and teacher interaction during physical education in Australian secondary schools. Under review, Research Quarterly for Exercise and Sport)


Chapter Six: Summary, Findings, Recommendations and Limitations (Adapted version manuscript prepared for publication as: Dudley, D.A., Okely, A.D., Cotton, W.G., and Pearson, P. Future policy, practice and research of physical education in Australia and New Zealand. Manuscript prepared for peer-review)

1.8 References


CHAPTER 2

Systematic Review of the Effectiveness of Physical Education Interventions Targeting Physical Activity, Movement Skills and Enjoyment of Physical Activity


2.1 Introduction

Most young people participate in some type of organised physical education (PE) during their primary and secondary school education. Effective use of time in PE is considered to be important for many reasons; not least because it may help young people make informed lifestyle choices, develop proficiency in movement skills, and encourage lifelong participation in physical activity (Kay, 2005; Kirk, 2005; Morgan, Kingston, & Sproule, 2005; Bailey, 2006). The recent ‘Strategies to Improve the Quality of Physical Education’ (U.S. Department of Health and Human Services, 2010) statement in the United States called for well-designed PE curriculum to maximise physical activity during lessons (the target being 50% of PE class time spent in moderate-to-vigorous physical activity [MVPA]). In addition, two recent Australian publications have called for a greater awareness of and support for the role of PE and sport in schools. ‘Australia: The healthiest country by 2020’ (Australian Government Preventative Health Taskforce, 2010) and ‘The future of sport in Australia’ (Australian
Independent Sport Panel, 2009) have both argued for adequate time for physical education and sport within school time as a way of improving the nation’s health.

In addition to these goals, a key strategy in achieving long-term health improvements has been to promote the development of movement skill in youth (Australian Government Preventative Health Taskforce, 2010). The Centers for Disease Control and Prevention (CDC) (1997) has also stressed the importance of physical education and school sport (PESS) being enjoyable to young people and recommended the use of active learning strategies to facilitate this.

In New South Wales schools, PE and School Sport (PESS) are often integrated into a single curriculum (Dudley et al., 2008). For this reason, the concept of PESS is worthwhile exploring and based on the literature from leading researchers and policymakers, a definition of what constitutes effective PESS in relation to health and lifestyle outcomes can be proposed. This should include observable elements of instruction time dedicated to:

a) Promoting high levels of physical activity participation;

b) Movement skill instruction and practice; and

c) Active learning strategies with an emphasis on enjoyment.

These components are also consistently found in many PESS curricula across developed countries including, but not limited to, the United Kingdom, France, Belgium, Canada, Australia, and the United States. The United Nations (2010) has recently called for universal access to quality and effective PE for all school-aged children reinforcing the timeliness of reviewing the evidence-base for effective PE.
Previous systematic reviews conducted by Stone et al. (1998) and Kahn et al. (2002) included studies of physical activity in school settings. The purpose of this chapter was to systematically review the evidence from experimental and quasi-experimental studies of curriculum interventions using PESS that aimed to promote physical activity, increase movement skill proficiency and enjoyment of physical activity in children and youth and not interventions that primarily sought to change school policy or the physical school environment. Furthermore, it is the first known systematic review to examine the three outcome variables of physical activity, movement skill development, and enjoyment of physical activity simultaneously in order to inform specific PESS pedagogy, practice and research. The chapter provides a synthesis of evidence and identifies gaps in the literature to indicate where future research is needed.

2.2 Methods

2.2.1 Search Protocol

A literature search of PESS interventions that aimed to promote physical activity, and increase movement skill proficiency and enjoyment of physical activity in children and adolescents was conducted in six electronic databases (Ovid, A+ Education, ERIC, Sports Discus, Science Direct, PsychInfo) published between the 1st January 1990 and up to and including 30th June 2010. The search strategy focused on paediatrics (key words: children, adolescents, youth), physical education (key words: physical education, school sport), movement skill outcomes (key words: fundamental movement skill, movement skill, movement skill acquisition, motor skill), physical activity outcomes (key words: physical
activity, sport, exercise), enjoyment-related outcomes (key words: enjoyment, fun), intervention (key words: program, trial, intervention) and intervention type (key words: randomized controlled trials, controlled trials, evaluations) (See Appendix A for search strategy). Retrieved papers were cross-referenced for additional inclusions as a further search strategy. Once a list of possible inclusions had been retrieved, the references were sent to several leading international researchers who were asked to identify any possible studies that may not have been already sourced via database or cross-referencing searches.

### 2.2.2 Inclusion Criteria

Papers were included in the review if they reported on a curriculum-based intervention where PESS was used as the medium. They had to target school-aged children and youth – with a mean age between 5 and 18 years – and report movement skill proficiency, and/or physical activity participation, and/or enjoyment of physical activity. Included were experimental pilot studies (if they included a control group), controlled trials, randomised controlled trials and cluster randomized trials. Only studies that used experimental or quasi-experimental designs were included because in a world of ‘evidence-informed’ education (Hattie, 2009) experimentally designed studies are still considered to provide the best evidence as to causation in research (Popper, 1968; Scriven, 2005). Studies were excluded if (a) they were published in a language other than English; (b) the intervention was implemented as a community-based program, an extra/non-curricular program or outside a school setting; or (c) there was no control group. Articles were initially excluded by screening the title and abstract and when appropriateness could not be determined, the full article was scrutinised. Three reviewers independently evaluated full text copies of all obtained articles using a standardised
checklist, to determine whether they met the inclusion criteria. Where opinions differed, a consensus was reached through discussion.

2.2.3 Assessment of Methodological Quality

Included articles were then assessed for methodological quality using a 10-item quality assessment scale derived from van Sluijs, McMinn, and Griffin (2007) (See Table 2.1). For each article, three reviewers independently assessed whether the article scored positively (i.e. the assessed item was present) or negatively (i.e. the assessed item was absent) for each item. Where an item was insufficiently described it was allocated a negative (absent) score. Agreement between reviewers for each article was set a priori at 80% (van Sluijs, McMinn, & Griffin, 2007; Alderson, Green, & Higgins, 2005). That is, for each article, reviewers were required to agree that the items were either present or absent for 8 of the 10 items. In the case of less than 80% agreement, consensus was reached by further discussion. The scores were then summed to determine the overall quality of the article. Consistent with van Sluijs McMinn, and Griffin (2007) and Anderson, Green and Higgins, (2005), a paper was deemed to have high methodological quality if it scored 5 or more for a controlled trial or 6 or more for a randomised controlled trial.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Key baseline characteristics are presented separately for treatment groups (age, and one relevant outcome (physical activity, movement skills, instruction time, enjoyment) and for randomised controlled trials and controlled trials, positive if baseline outcomes were statistically tested and results of tests were provided.</td>
</tr>
<tr>
<td>B</td>
<td>Randomisation procedure clearly and explicitly described and adequately carried out (generation of allocation sequence, allocation concealment and implementation)</td>
</tr>
<tr>
<td>C</td>
<td>Validated measures of physical activity and/or movement skills and/or enjoyment (validation in same age group reported and/or cited)</td>
</tr>
<tr>
<td>D</td>
<td>Drop out reported and ≤20% for &lt;6-month follow-up or ≤30% for ≥6-month follow-up</td>
</tr>
<tr>
<td>E</td>
<td>Blinded physical activity and/or movement skills and/or enjoyment assessments</td>
</tr>
<tr>
<td>F</td>
<td>Physical activity and/or movement skills, instruction time, enjoyment assessed a minimum of 6 months after pre-test</td>
</tr>
<tr>
<td>G</td>
<td>Intention to treat analysis for physical activity and/or movement skills, and/or enjoyment outcomes(s) (participants analysed in group they were originally allocated to, and participants not excluded from analyses because of non-compliance to treatment or because of some missing data)</td>
</tr>
<tr>
<td>H</td>
<td>Potential confounders accounted for in physical activity and/or movement skills and/or enjoyment analysis (e.g. baseline score, group/cluster, age)</td>
</tr>
<tr>
<td>I</td>
<td>Summary results for each group + treatment effect (difference between groups) + its precision (e.g. 95% confidence interval)</td>
</tr>
<tr>
<td>J</td>
<td>Power calculation reported, and the study was adequately powered to detect hypothesized relationships</td>
</tr>
</tbody>
</table>
2.2.4 Comparing Results

To facilitate comparison, studies were divided according to their outcome measure: physical activity participation, movement skill proficiency, or enjoyment of physical activity.

2.3 Results

2.3.1 Identification and selection of the literature

The process of identifying the included studies is shown in Figure 2.1. The literature search in the various databases yielded 27,410 potentially relevant publications. After the titles and abstracts of publications were screened, 54 references were identified as potentially relevant and retrieved in full text. Reference checking and expert input revealed another nine potentially relevant publications. Forty publications identified from the search were excluded from the review because they: a) were duplicate papers; b) did not meet the age requirements; c) had no physical activity, movement skill, or enjoyment outcome; d) were conducted as part of an extra-curricular program or non-curricular program; or e) had no control group.
A total of 23 studies provided information on the effect of PESS interventions on physical activity participation (19 studies), movement skill proficiency (4 studies), and enjoyment of physical activity (7 studies) and were selected for inclusion in this review (See Tables 2.2, 2.3, and 2.4), respectively. Note: Included studies are referenced numerically in superscript and included as a separate reference list at the end of this chapter. Six of these studies reported on two or more of the outcomes [1-6]. Most of the included studies (n=15) were published after 2000, the remaining studies (n=8) were published between 1990 and 2000. Note: the papers included in this review are referenced numerically (1 to 23) in text and included in a separate reference list at the end of the chapter. Referenced papers were ordered
from those reporting on two or more outcomes \([1-4]\), physical activity only \([5-19]\), movement skill only \([20-21]\) and enjoyment only \([22-23]\).
# Table 2.2: Description of curriculum-based interventions targeting physical activity participation

<table>
<thead>
<tr>
<th>Author, Year, Country</th>
<th>Design</th>
<th>Sample</th>
<th>Treatment Length</th>
<th>Intervention Groups</th>
<th>Treatment Content</th>
<th>Outcomes &amp; Instrument (Relevant for review)</th>
<th>Post-Intervention &amp; Follow-Up Duration</th>
<th>Results (PA)</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dudley et al. (2010), Australia</td>
<td>RCT</td>
<td>n=38, Mean age 16.5 yrs Girls</td>
<td>11 weeks</td>
<td>(1) Intervention students x 17 (2) Control students x 21</td>
<td>(1) NSW School Sport intervention - 90 min participant designed SS curriculum with PE teacher. Focus on interest and non-competitive activities. (2) Usual SS sessions with or without a PE teacher</td>
<td>PA (AC)</td>
<td>11 weeks (PI)</td>
<td>PI: (1) less decline in PA than (2)</td>
<td>NS</td>
</tr>
<tr>
<td>Fairclough &amp; Stratton. (2006), UK</td>
<td>CT</td>
<td>n=62 Mean age N (Grade 7 11-12yrs) Girls</td>
<td>6 lessons</td>
<td>(1) Intervention class x 1 (2) Control class x 1</td>
<td>(1) UK Active Gym intervention- 82 min modified gymnastics unit focussing on PA. All girls class (2) 76 min usual PE gymnastics unit. Co-ed class</td>
<td>PA (DO)</td>
<td>6 lessons (PI)</td>
<td>PI: (1) &gt; (2) in VPA PI: (1) &gt; (2) in MVPA</td>
<td>p&lt;0.05 NS</td>
</tr>
<tr>
<td>Gorely et al. (2009), UK</td>
<td>CT</td>
<td>n=589 Mean age 8.1yrs Co-ed</td>
<td>10 months</td>
<td>(1) Intervention schools x 4 (2) Control schools x 4</td>
<td>(1) GreatFun2Run intervention - CD resource, Website, two highlight PA events, media campaign, summer activity planner (2) Usual HPE curriculum</td>
<td>PA (PM)</td>
<td>10 months(PI)</td>
<td>PI: (1) &gt; (2) (1) Increase in MVPA (2) Decrease in MVPA</td>
<td>p&lt;0.01 NS</td>
</tr>
<tr>
<td>Gortmaker et al., Planet Health (1999), USA</td>
<td>RCT</td>
<td>n=1295 Mean age 11.7yrs Co-ed</td>
<td>2 years</td>
<td>(1) Intervention schools x 5 (2) Control schools x 5</td>
<td>(1) Planet Health intervention - teacher training, PE materials, wellness sessions and fitness funds. PE materials focused on activity and inactivity themes, student self-assessments of activity, goal setting, evaluations for reducing inactivity, replacing inactive time with MVPA (2) Usual school curriculum</td>
<td>PA (SR)</td>
<td>2 years (PI)</td>
<td>PI: Increase in boys MVPA (1) &amp; (2) PI: Decrease in girls MVPA (1) &amp; (2)</td>
<td>NS NS</td>
</tr>
<tr>
<td>Gortmaker et al., Eat Well, Keep Moving (1999), USA</td>
<td>CT</td>
<td>n=479 Mean age 9.1yrs Co-ed</td>
<td>2 years</td>
<td>(1) Intervention schools x 6 (2) Control schools x 8</td>
<td>(1) The Eat Well and Keep Moving Program – PD for teachers in math, science, language arts, and social studies classes focused on decreasing consumption of foods high in fat, increasing fruit and vegetable intake, reducing TV viewing and increasing PA. (2) Usual school curriculum</td>
<td>PA (SR)</td>
<td>2 years (PI)</td>
<td>PI: Decrease in VPA (1) &amp; (2)</td>
<td>NS NS</td>
</tr>
<tr>
<td>Harrell et al (1996), USA</td>
<td>RCT</td>
<td>n=1274 Mean age 8.9 yrs Co-ed</td>
<td>8 weeks</td>
<td>(1) Intervention schools x 6 (2) Control schools x 6</td>
<td>(1) Cardiovascular Health in Children intervention - PA three times a week. 24 lessons in total which included a 20 minutes of various fun, non-competitive aerobic activities to work the major muscle groups. (2) Usual HPE instruction</td>
<td>PA (SR)</td>
<td>8 weeks (PI)</td>
<td>PI: (1) &gt; (2) increase in PA</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Country</td>
<td>Sample Size</td>
<td>Duration</td>
<td>Intervention Details</td>
<td>Control Details</td>
<td>Participants</td>
<td>Follow-up</td>
<td>Results</td>
</tr>
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<tr>
<td>Jamner et al (2004) USA</td>
<td>CT</td>
<td>USA</td>
<td>n=47</td>
<td>4 months</td>
<td>(1) <strong>Project FAB intervention</strong> – 60 mins of PE daily. Participant directed curriculum with one day p/w devoted to health benefits of PA and exercise. Girls-only PE class, NO PE uniform or 1-mile fitness test. (2) Usual PE curriculum</td>
<td></td>
<td>(1) Intervention students x 25 (2) Control students x 22</td>
<td>Mean age 14.9yrs Girls</td>
<td>PA (SR) 4 months (PI)</td>
</tr>
<tr>
<td>Jurg et al (2006) Netherlands</td>
<td>CT</td>
<td>Netherlands</td>
<td>n=510</td>
<td>12 months</td>
<td>(1) <strong>Jump-In intervention</strong> - SS activities, breaks for PA, relaxation and posture exercises during class, PA assignments to be done in the class and at home, parental information service, activity-week event (2) Usual school curriculum</td>
<td></td>
<td>(1) Intervention schools x 4 (2) Control schools x 2</td>
<td>Mean age NR (Grades 4,5, &amp; 6) Co-ed</td>
<td>PA (SR) 12 months (PI)</td>
</tr>
<tr>
<td>McKenzie et al (1996) USA</td>
<td>RCT</td>
<td>USA</td>
<td>n=5106</td>
<td>2.5 years</td>
<td>(1) <strong>Child and Adolescent Trial for Cardiovascular Health (CATCH) intervention</strong> – PE curriculum and materials, teacher PD, on-site teacher consultation service (2) Usual school curriculum</td>
<td></td>
<td>(1) Intervention schools x 28 (2) Control schools x 40</td>
<td>Mean age 8.76yrs Co-ed</td>
<td>PA (DO, SR) 2.5 years (PI)</td>
</tr>
<tr>
<td>McKenzie et al (2004) USA</td>
<td>RCT</td>
<td>USA</td>
<td>n=approx 25000</td>
<td>2 years</td>
<td>(1) <strong>Middle School Physical Activity and Nutrition (M-SPAN) intervention</strong>- consisted of a voluntary PD program for PE teachers to use sample and revise existing PE materials, revise instructional strategies to increase MVPA and improve class management (2) Usual school curriculum</td>
<td></td>
<td>(1) Intervention schools x 12 (2) Control schools x 12</td>
<td>Mean age NR (Grades 6 to 8 Middle schools) Co-ed</td>
<td>PA (DO) 2 years (PI)</td>
</tr>
<tr>
<td>Naylor et al. (2006) Canada</td>
<td>RCT</td>
<td>Canada</td>
<td>n=42 teachers</td>
<td>11 months</td>
<td>(1) <strong>Action Schools BC intervention</strong> - generalist teachers with training and resources. (1) <strong>Champion Schools (CS)</strong> were given PE resources, initial training and support to ‘champion’ teacher. Support was not provided to each classroom in CS. (2) <strong>Liaison schools</strong> had weekly contact in the classroom with PE specialist to provide mentorship and demonstrate activities to the teacher. Also, PE resources were enhanced with specific resources as requested. (3) Usual PE or PA curriculum</td>
<td></td>
<td>(1) Intervention [Champion] schools x 3 (2) Intervention [Liaison] schools x 4 (3) Control schools x 3</td>
<td>Mean age of students NR (Teachers reporting on grades 4-6 classes) Co-ed</td>
<td>PA (SR) 11 months (PI)</td>
</tr>
</tbody>
</table>

*PI = Pretest, DO = Do, SR = Standard Reference*
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Type</th>
<th>Sample Size</th>
<th>Duration</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Intervention Details</th>
<th>Outcome Measures</th>
<th>Analysis</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neumark-Sztainer et al. (2003)</td>
<td>USA</td>
<td>RCT</td>
<td>n=201</td>
<td>5 months</td>
<td>Intervention schools x 3</td>
<td>Control schools x 3</td>
<td>(1) New Moves intervention - substituted existing PE with PA sessions 4 times p/w, and nutrition and social support sessions every 2nd week. Community guests, strength training, and a variety of activities selected by the PE teacher. PA sessions promoted life-long activities for girls within a non-competitive environment. (2) Control schools received a minimal intervention of written materials on health and PA at the baseline assessment.</td>
<td>PA (SR) 5 months (PI)</td>
<td>8 months (FU)</td>
<td>PI &amp; FU: (1) &gt; (2) PA min p/w</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Pangrazi et al (2003)</td>
<td>USA</td>
<td>CT</td>
<td>n=606</td>
<td>12 weeks</td>
<td>PLAY Only (Int) schools x 9</td>
<td>PLAY + PE (Int) schools x 10</td>
<td>PE only (Con) schools x 10</td>
<td>No treatment (Con) schools x 6</td>
<td>Promoting Lifestyle Activity for Youth (PLAY) intervention - focuses on PA and does not teach physical skills; it was not intended to replace a PE program. PLAY supplements a daily PE program. Places responsibility for PA on the classroom teacher, who becomes a model for helping children develop active lifestyles.</td>
<td>PA (PM) 12 weeks (PI)</td>
<td>PI: (1) &gt; (4) steps per day (All)</td>
<td>PI: (2) &gt; (4) steps per day (All)</td>
</tr>
<tr>
<td>Pate et al (2005)</td>
<td>USA</td>
<td>RCT</td>
<td>n=2744</td>
<td>12 months</td>
<td>Intervention schools x 12</td>
<td>Control schools x 12</td>
<td>(1) Lifestyle Education Activity Program (LEAP) intervention - included gender-specific PE, choice-based instructional program to build activity skills and reinforce participation in PA. Activities included aerobics, dance, walking, self-defence, martial arts, and weight training in addition to competitive sports and traditional PE. Headed by ‘Champion’, who was responsible for girls’ PE. PD and instructional materials provided. (2) Usual school PE program</td>
<td>PA (SR) 12 months(PI)</td>
<td>PI: (1) had 1 more block of VPA/day than (2)</td>
<td>PI: (1) had 2 more blocks of VPA/day than (2)</td>
<td>p&lt;0.05</td>
<td>NS</td>
</tr>
<tr>
<td>Sallis et al (1997)</td>
<td>USA</td>
<td>RCT</td>
<td>n=955</td>
<td>2 years</td>
<td>Intervention schools (PE Specialist-led) x 2</td>
<td>Intervention schools (Trained classroom teacher led) x 2</td>
<td>Control schools x 3</td>
<td>Sport, Play, Activity, and Recreation for Kids (SPARK) PE intervention - 30 min of PE (15 min of health-fitness activities/15 min of skill-fitness activities) at least 3 days p/w. Also includes homework, newsletters and a student self-management program (1) PE specialist-led: PE teachers taught PE and self-management whilst receiving ongoing PD and supervision from investigators. PE teacher received regular feedback and videotaped lessons (2) Trained classroom teacher-led: Classroom teachers received PD in PE curriculum, class management and instructional techniques. 32 hrs of professional development. Feedback from investigators on supervised lessons (3) Usual school PE curriculum</td>
<td>PA (DO-class level) 2 years(PI)</td>
<td>PI: (1) &gt; (2) &gt; (3) in PE MVPA (DO)</td>
<td>PI: (1) &gt; (2) &gt; (3) minutes of PE per week</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>n</td>
<td>Intervention details</td>
<td>Primary Outcome Measures</td>
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<tr>
<td>Salmon et al (2008) Australia RCT</td>
<td>n=311 3 months</td>
<td>(1) Intervention class (BM) x 3 classes (66 students) (2) Intervention class (FMS) x 3 classes (74 students) (3) Intervention class (BM+FMS) x 3 classes (93 students) (4) Control class x 3 classes (62 students)</td>
<td>Switch Play intervention - adapted from SPARK PE, Planet Health and the Victorian Fundamental Motor Skills programme. Delivered in addition to SS and PE (1) Behaviour modification (BM): Aimed to reduce the time spent on TV viewing. Comprised 19 sessions of 40–50 min duration taught across 3 school terms by PE teacher. (2) Fundamental Movement Skills (FMS): Comprised 19 sessions of 40–50 min duration taught across 3 school terms by PE teacher that delivered the BM intervention. Focused on six skills, 3 object control skills (overhand throw, kick and strike) and 3 locomotor skills (run, dodge and vertical jump). (3) BM plus FMS group: Received both interventions (4) Usual school PE curriculum</td>
<td>PA (AC) 6 month (PI) 12 month (FU) PI &amp; FU: (1) &amp; (2) increase in PA counts per day for boys PI &amp; FU: (2) p &lt;0.001</td>
<td></td>
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<tr>
<td>Simons-Morton et al (1993) USA CT</td>
<td>Number of participants NR Mean age NR (3rd &amp; 4th grade)</td>
<td>(1) Intervention schools x 2 (2) Control schools x 2</td>
<td>(1) Go for Health intervention - based on Go for Health and Children’s Active Physical Education curriculum. Teacher’s received PD in implementing the intervention. (2) Usual daily PE curriculum</td>
<td>PA (DO) 3 years (PI) PI: (1) &amp; (2) increase mean minutes of MVPA during PE (1) p&lt;0.05 (2) NS</td>
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<tr>
<td>van Beurden et al (2003) Australia RCT</td>
<td>n=1045 18 months</td>
<td>(1) Intervention schools x 9 (2) Control schools x 9</td>
<td>(1) Move it groove it (MIGI) intervention - consisted of school project teams in order to have a “whole school approach”, buddy program involving classroom teachers partnered with pre-service PE teachers, teacher PD, web site containing lesson plans and FMS activities, funding for PE equipment ($AU375.00) (2) Usual school PE curriculum</td>
<td>PA (DO) 18 months (PI) PI: (1) &gt; (2) in MVPA during PE NS</td>
<td></td>
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<tr>
<td>Webber et al (2008) USA RCT</td>
<td>n=1721 at baseline n=3504 at PI Mean age NR (6th Grade at baseline, 8th grade at PI) Girls</td>
<td>(1) Intervention schools x 18 (2) Control schools x 18</td>
<td>(1) Trial of Activity for Adolescent Girls PE (TAAG) intervention - promoted MVPA for at least 50% of class time and encouraged teachers to promote PA outside of class. PE teachers were trained in class management strategies, skill-building activities, the importance of engaging girls in MVPA during class, and the provision of appropriate equipment and choices of PA. (2) Usual PE curriculum</td>
<td>PA (DO) 2 years (PI) PI: (1) &gt; (2) in MVPA during PE p&lt;0.05</td>
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</tbody>
</table>

## Table 2.3: Description of curriculum-based interventions targeting movement skills

<table>
<thead>
<tr>
<th>Author, Year, Country</th>
<th>Design</th>
<th>Sample</th>
<th>Treatment Length</th>
<th>Intervention Groups</th>
<th>Treatment Content</th>
<th>Outcomes (Relevant for review)</th>
<th>Post-Intervention &amp; Follow-Up Duration</th>
<th>Results (MS)</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>McKenzie et al (1998) USA RCT</td>
<td>n=709 Mean age not reported (Grades 4 &amp; 5)</td>
<td>Co-ed</td>
<td>6 months</td>
<td>(1) Intervention students (PE Specialist-led) x 201 (2) Intervention students (Trained classroom teacher led) x 242 (3) Control students x 266</td>
<td>SPARK PE intervention as discussed in Table 1 earlier for (1) and (2) (3) Usual PE curriculum</td>
<td>MS (3 skills)</td>
<td>3 months (PI)</td>
<td>PI: (1) &amp; (2) &gt; (3) in kick PI: (1) &amp; (2) &gt; (3) in catch &amp; throw</td>
<td>p&lt;0.005 (Catch) p=0.008 (Throw)</td>
</tr>
<tr>
<td>Pieron et al (1996) Belgium CT</td>
<td>n=1131 Mean age not reported (Grades K-6)</td>
<td>Co-ed</td>
<td>3 years</td>
<td>(1) Intervention students x 635 (2) Control students x 496</td>
<td>(1) Daily PE Intervention - received daily PE classes from a prescribed curriculum. Collaboration between classroom teacher and PE specialists. (2) Usual PE curriculum</td>
<td>MS (36 skills)</td>
<td>3 years (PI)</td>
<td>PI: (1) &gt; (2) in catching, rotation, and throwing (Grades K-4) PI: (2) &gt; (1) in handstand (Grade 4)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Salmon et al (2008) Australia RCT</td>
<td>n=311 Mean age 10.8</td>
<td>Co-ed</td>
<td>6 months</td>
<td>(1) Intervention class (BM) x 3 classes (66 students) (2) Intervention class (FMS) x 3 classes (74 students) (3) Intervention class (BM+FMS) x 3 classes (93 students) (4) Control class x 3 classes (62 students)</td>
<td>Switch Play intervention as discussed previously in Table 1 for (1), (2), &amp; (3) (4) Usual PE curriculum</td>
<td>MS (6 skills)</td>
<td>6 month (PI) 12 month (FU)</td>
<td>PI &amp; FU: (1) +ve effect &gt; (2), (3) &amp; (4) +ve effect on FMS z-scores PI &amp; FU: (1) &amp; (2) +ve effect &gt; (3) &amp; (4) on FMS z-scores among girls</td>
<td>(1) p&lt;0.05 (2) p&lt;0.01</td>
</tr>
<tr>
<td>van Beurden et al (2003) Australia RCT</td>
<td>n=1045 Mean age not reported (Grades 3 &amp; 4)</td>
<td>Co-ed</td>
<td>18 months</td>
<td>(1) Intervention schools x 9 (2) Control schools x 9</td>
<td>(1) MIGI intervention as discussed previously in Table 1 (2) Usual PE curriculum</td>
<td>MS (8 skills)</td>
<td>18 month (PI)</td>
<td>PI: (1) &gt; (2) improvement in all skills for boys and girls (1) &gt; (2) in master + near mastery in sprint, side gallop, kick, throw, jump, catch for boys (1) &gt; (2) in master + near mastery in side gallop, kick, throw, jump, hop, catch for girls</td>
<td>p&lt;0.0001 p=0.034 p=0.042</td>
</tr>
</tbody>
</table>

CT: Controlled trial, RCT: Randomised controlled trial, Co-ed: Both boys and girls, PE; Physical education, PA: Physical activity, MS/FMS: Movement skills, PI: Post-intervention, FU: Follow-up, NS: Not significant
Table 2.4: Description of curriculum-based interventions targeting an enjoyment outcome

<table>
<thead>
<tr>
<th>Author, Year, Country</th>
<th>Design</th>
<th>Sample</th>
<th>Treatment Length</th>
<th>Intervention Groups</th>
<th>Treatment Content</th>
<th>Outcomes (Relevant for review)</th>
<th>Post-Intervention &amp; Follow-Up Duration</th>
<th>Results (Enjoyment of PE or PA)</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christodoulidis et al (2001) Greece</td>
<td>CT</td>
<td>n=634 Mean age NR (Grade 10) Co-ed</td>
<td>9 months</td>
<td>(1) Intervention students x 105 (2) Control students x 529</td>
<td>(1) TARGET intervention - PE teacher PD, cooperative activities, student goal setting, using different TS in PE lessons. (2) Usual school curriculum</td>
<td>Enjoyment of PE (5-point LS – 10 items)</td>
<td>9 months (PI) 19 months (FU)</td>
<td>No change</td>
<td>N/A</td>
</tr>
<tr>
<td>Digelidis et al (2003) Greece</td>
<td>CT</td>
<td>n=782 Mean age 12.0 yrs Co-ed</td>
<td>9 months</td>
<td>(1) Intervention students x 262 (2) Control students x 520</td>
<td>(1) Greek High School intervention - PE teacher PD, cooperative activities, student goal setting, health and exercise curriculum integration, increasing student interactions, using TS in PE lessons. (2) Usual school curriculum</td>
<td>Enjoyment of PE (5-point LS – 10 items)</td>
<td>9 months (PI)</td>
<td>No change</td>
<td>N/A</td>
</tr>
<tr>
<td>Dudley et al (2010) Australia</td>
<td>RCT</td>
<td>n=38, Mean age 16.5 yrs, Girls</td>
<td>11 weeks</td>
<td>(1) Intervention students x 17 (2) Control students x 21</td>
<td>(1) NSW School Sport intervention as discussed previously in Table 1 (2) Usual school sport sessions with or without a PE teacher</td>
<td>Enjoyment of PA (5 point LS – 12 items)</td>
<td>11 weeks (PI)</td>
<td>PE (1) &gt; (2) enjoy of PA</td>
<td>NS</td>
</tr>
<tr>
<td>Jamner et al (2004) USA</td>
<td>CT</td>
<td>n=47 Mean age 14.9 yrs Girls</td>
<td>4 months</td>
<td>(1) Intervention students x 25 (2) Control students x 22</td>
<td>(1) Project FAB intervention school as discussed previously in Table 1 (2) Usual school PE curriculum</td>
<td>Enjoyment of PA (5 point LS – 18 items)</td>
<td>4 months (PI)</td>
<td>No change</td>
<td>N/A</td>
</tr>
<tr>
<td>McKenzie et al (2004) USA</td>
<td>RCT</td>
<td>n=1578 Mean age NR (Grades 6 to 8) Co-ed</td>
<td>2 years</td>
<td>(1) Intervention schools x 12 (2) Control schools x 12</td>
<td>(1) M-SPAN intervention as discussed previously in Table 1 (2) Usual school curriculum</td>
<td>Enjoyment of PE (5 point LS – 1 item)</td>
<td>2 years (PI)</td>
<td>No change</td>
<td>N/A</td>
</tr>
<tr>
<td>Neumark-Sztainer et al. (2003) USA</td>
<td>RCT</td>
<td>N=201 Mean age 15.4 yrs Girls</td>
<td>5 months</td>
<td>(1) Intervention schools x 3 (2) Control schools x 3</td>
<td>(1) New Moves intervention schools as discussed previously in Table 1 (2) Control schools as discussed previously</td>
<td>Enjoyment of PA (4 point LS - 4 items)</td>
<td>5 months (PI) 8 months (FU)</td>
<td>PE (1) &gt; (2) enjoy of PA at PI and FU</td>
<td>NS</td>
</tr>
<tr>
<td>Salmon et al (2008) Australia</td>
<td>RCT</td>
<td>n=311 Mean age 10.8 yrs Co-ed</td>
<td>6 months</td>
<td>(1) Intervention class (BM) x 3 classes (66 students) (2) Intervention class (FMS) x 3 classes (74 students) (3) Intervention class (BM+FMS) x 3 classes (93 students) (4) Control class x 3 classes (62 students)</td>
<td>Switch Play intervention as discussed previously in Table 1 for (1), (2), &amp; (3) (4) Usual school PE curriculum</td>
<td>Enjoyment of PA (5 point LS – 36 items)</td>
<td>6 months (PI) 12 months (FU)</td>
<td>PI &amp; FU: (2) ++ve (1), (3) &amp; (4) vs –ve on PA enjoy PI &amp; FU: (2) +++ve &gt; (1), (3) &amp; (4) vs +ve on PA enjoy p&lt;0.05 p&lt;0.01</td>
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</tbody>
</table>

CT: Controlled trial, RCT: Randomised controlled trial, NR: Not reported, Co-ed: Both boys and girls, PD: Professional development, TS: Teaching styles; PE: Physical education, PA: Physical activity, LS: Likert Scale, PI: Post-intervention, FU: Follow-up,
2.3.2 Methodological quality assessment

The methodological quality of the included studies is presented in Table 2.5. The scoring of the 23 publications led to an overall initial disagreement between the reviewers of 10%. Most disagreements were on the ‘Intention to treat’ item (criterion 7) and resulted from incomplete description or interpreting errors. The three reviewers reached consensus on all initial disagreements.
### Table 2.5: Publication criterion and quality

| Paper No. | Paper authors and year – *Paper title* | 1 Key baseline characteristics are presented separately for treatment groups | 2 Randomisation procedure clearly and explicitly described and adequate | 3 Validated measures | 4 Drop out described | 5 Blinded assessments | 6 Min 6-month post test | 7 Intention to treat analysis | 8 Confounders accounted for | 9 Summary of results + treatment effect + its precision | 10 Power calculation reported | Methodological quality score | Agreement % |
|-----------|----------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------|--------------------|----------------------|----------------------|----------------------|-----------------------------|--------------------------------|---------------------|-------------|
| 1         | Dudley et al, (2010)                    | Y                                                | Y                                               | Y                 | Y                  | N                    | Y                    | Y                     | Y                           | Y                               | N                   | 7           |
| 2         | Salmon et al, (2008)                    | N                                                | Y                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 7           |
| 3         | van Beurden et al, (2003)               | Y                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 7           |
| 4         | Jamner et al., (2004)                   | Y                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 7           |
| 5         | McKenzie et al., (2004)                 | N                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 7           |
| 6         | Neumark-Sztainer et al, (2003)          | N                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 7           |
| 7         | Fairclough & Stratton, (2006)           | N                                                | N                                               | Y                 | N                  | N                    | N                    | N                     | Y                           | N                               | 2                   | 90          |
| 8         | Gorely et al, (2009)                    | Y                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 7           |
| 9         | Gortmaker et al., (1999)                | N                                                | N                                               | N                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 4           |
| 10        | Gortmaker et al., (1999)                | Y                                                | Y                                               | Y                 | Y                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 9           |
| 11        | Harrell et al., (1996)                  | Y                                                | N                                               | N                 | N                  | N                    | N                    | N                     | Y                           | Y                               | N                   | 3           |
| 12        | Jurg et al, (2006)                      | Y                                                | N                                               | N                 | N                  | N                    | Y                    | N                     | Y                           | Y                               | N                   | 5           |
| 13        | McKenzie et al., (1996)                 | N                                                | N                                               | N                 | N                  | N                    | Y                    | N                     | Y                           | Y                               | N                   | 5           |
| 14        | Naylor et al, (2006)                    | N                                                | N                                               | N                 | N                  | N                    | Y                    | N                     | N                           | Y                               | N                   | 2           |
| 15        | Pangrazi et al, (2003)                  | N                                                | N                                               | N                 | N                  | N                    | N                    | N                     | Y                           | Y                               | N                   | 2           |
| 16        | Pate et al, (2005)                      | Y                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 6           |
| 17        | Sallis et al, (1997)                    | Y                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 6           |
| 19        | Webber et al, (2008)                    | N                                                | N                                               | Y                 | N                  | Y                    | Y                    | Y                     | Y                           | Y                               | N                   | 6           |
| 20        | McKenzie et al, (1998)                  | Y                                                | N                                               | N                 | N                  | Y                    | N                    | Y                     | Y                           | Y                               | N                   | 4           |
| 21        | Pieron et al, (1996)                    | N                                                | N                                               | N                 | N                  | Y                    | N                    | N                     | Y                           | Y                               | N                   | 1           |
| 22        | Christodoulidis et al, (2001)           | N                                                | N                                               | Y                 | N                  | N                    | Y                    | N                     | Y                           | Y                               | N                   | 3           |
| 23        | Digelidis et al, (2003)                 | N                                                | N                                               | Y                 | N                  | N                    | N                    | Y                     | Y                           | Y                               | N                   | 4           |
| **Papers with +ve score (% of papers)** | **10 (43%)** | **3 (13%)** | **17 (74%)** | **9 (39%)** | **2 (9%)** | 16 (70%) | 18 (78%) | 9 (39%) | 16 (70%) | 18 (78%) | 1 (4%) |

- Controlled trials with score > than 5: 2
- Randomised controlled trials with a score > 6: 6
The quality score of the publications ranged from one to nine. Based on the assessment scale used, two (20%) of the 10 controlled trials had a score of more than five \cite{8,12} and were thus considered to be of high methodological quality. Six (46%) of the 13 randomised controlled trials had a score of more than six \cite{1,2,10,16,17,19}. The percentages on each criterion are reported in Table 2.5.

### 2.3.3 Comparing results

To facilitate comparison between studies, we extracted the following data from each article: (a) design, including randomization procedures and settings; (b) methodological quality; (c) intervention components, including sample size, length of the intervention, and curriculum medium; and (d) effectiveness of the intervention (i.e. having a positive influence on the targeted outcome(s)) immediately after intervention and at subsequent follow-up (if any).

#### 2.3.3.1 PE interventions which had physical activity as an outcome

**2.3.3.1.1 Methodological Quality**

Agreement was 89% on the 190 items (19 published articles x 10 items used to assess methodological quality for each article). Two of the controlled trials \cite{8,12} and six of the randomized controlled trials \cite{1,2,10,16,17,19} had high methodological quality. Of the 10 items assessed for methodological quality, four were consistently present: a minimum of six months elapsing before post-testing conducted (68%), accounting for confounders in the analyses (68%), the use of validated measures (74%), and providing a summary of results that included treatment effect and precision (84%). Only three (16%) studies \cite{1,2,10} adequately and
explicitly described the randomization procedure. Two (11%) studies\cite{10,19} conducted blinded assessments and one (5%) study\cite{2} performed a power calculation.

### 2.3.3.1.2 Description of Interventions

The sample sizes varied considerably across the studies (38–25000 participants) as did the instruments used to assess physical activity. Eleven (58%) studies \cite{1,2,3,5,7,8,13,15,17,18,19} used objective measures of physical activity (seven used direct observation, two used accelerometry, two used pedometers) and nine (47%) studies \cite{4,6,9,10,14,16} used self-report measures (Note: McKenzie et al., 1996)\cite{13} used both objective and self-report measures). Thirteen (68%) studies \cite{2,3,5,6,8,9,10,12,13,14,17,18,19} had a treatment period of 6 months. Thirteen (68%) studies \cite{2,3,5,8,10-15,17,18} were co-educational and five (26%) studies \cite{1,4,6,7,16} involved only girls.

In regard to the curriculum medium used for the interventions, 12 (63%) of the studies \cite{3-7,10,11,13,16-19} were conducted as part of school PE, one (5%) study\cite{1} as part of the school sport curriculum, four (21%) \cite{8,9,12,14} adopted a cross-curricular approach, and two (11%) \cite{2,15} were conducted in addition to existing PESS during curriculum time. Twelve (63%) studies \cite{2,3,8-15,17,18} were conducted in primary schools and seven (37%) in secondary schools \cite{1,4-7,16,19}.

Pedagogically, all (95%) studies \cite{1,3-19} with the exception on one \cite{2} were delivered by trained classroom teachers or specialist PE teachers and ten (53%) of these \cite{3,5,8,10,13,14,16-19} provided ongoing professional development and support for teachers in their delivery of the
intervention. The other study \textsuperscript{[2]} used an external PE teacher in the delivery of the curriculum without any professional development being provided to the school or teachers. Thirteen (68\%) \textsuperscript{[2-7, 10, 11, 13, 16-19]} provided a prescribed curriculum to be taught. Two (11\%) \textsuperscript{[1, 4]} adopted a negotiated approach to the PESS curriculum (Note: Jamner et al., 2004 \textsuperscript{[4]} used a combination of prescribed and negotiated PESS curriculum). Six (32\%) \textsuperscript{[2, 3, 5, 10, 13, 17]} stated that direct or explicit teaching strategies were used in the intervention or were based on models that had used direct/explicit teaching strategies. Finally, three (16\%) studies \textsuperscript{[3, 8, 13]} provided Web-based support for teachers in the form of activities and lesson plans.

2.3.3.1.3 Intervention Efficacy

Fifteen (79\%) studies were effective in increasing physical activity participation and 13 (68\%) reported statistically significant findings (see Table 2.2). Four (21\%) reported results separately for both boys and girls. The two (11\%) studies \textsuperscript{[2, 6]} that included follow-up measures post-intervention reported differences between the intervention group and the control group at both time points but only one showed statistically significant differences at both time points \textsuperscript{[2]}.

2.3.3.2 PE interventions with movement skills as an outcome

2.3.3.2.1 Methodological Quality

Agreement was 93\% on the 40 items (4 published articles x 10 items used to assess methodological quality for each article). None of the controlled trials and only 1 of the randomized controlled trials \textsuperscript{[2]} had high methodological quality. Of the 10 items assessed for
methodological quality, only 2 were consistently present: minimum post-test period of > 6 months (100%) and accounting for confounders in the analyses (75%). The study by Salmon, Ball, Hume, Booth, and Crawford (2008) [2] was the only one that reported using an intention-to-treat analysis, described participant drop out and the randomization procedure adequately, and reported a power calculation. Three quarters (75%) of the studies [2, 3, 20] compared baseline characteristics between groups. Half (50%) of the studies [2, 3] used validated measures or presented a summary of results that included treatment effect and precision [3, 20].

2.3.3.2.2 Description of Interventions

The sample sizes varied across the studies (311–1131 participants) as did the number of movement skills assessed (3, 6, 8, and 36). All four (100%) studies [2, 3, 20, 21] had a treatment period of 6 months or longer and a co-educational sample.

In regard to the curriculum medium used for the interventions, three of the studies (75%) were conducted as part of school PE [3, 20, 21] and one (25%) study [2] was conducted in addition to existing PESS during curriculum time. All four (100%) studies [2, 3, 20, 21] were conducted in primary schools.

Pedagogically, all four (100%) studies [2, 3, 20, 21] provided a prescribed curriculum to be taught with three of them [3, 20, 21] being delivered by classroom teachers or specialist PE teachers receiving ongoing professional development and support in the delivery of the curriculum. The fourth study [2] used an external PE teacher in the delivery of the curriculum without any professional development being provided to the school or teachers. Three (75%) studies [2, 3,
stated that the intervention used direct or explicit teaching strategies. Finally, one (25%) study provided web-based support for teachers in the form of activities and lesson plans.

2.3.3.2.3 Intervention efficacy

All four (100%) studies were efficacious in improving movement skill proficiency and reported statistically significant findings. The one study that included follow-up measures post-intervention, reported no differences between the intervention group and the control group at 6-month post-intervention and 12-month follow-up, however, it did report statistically significant changes among girls only at both time points. Three quarters (75%) of the studies reported the results separately for boys and girls (See Table 3).

2.3.3.3 PE interventions with an enjoyment of physical activity as an outcome

2.3.3.3.1 Methodological Quality

Agreement was 89% on the 70 items (7 published articles x 10 items used to assess methodological quality for each article). None of the controlled trials and only two of the randomized, controlled trials had high methodological quality. Of the 10 items assessed for methodological quality, only two were consistently present: the use of validated measures (100%) and accounting for confounders (71%). There were three (57%) studies that used intention-to-treat analysis and described the drop-outs from the study. Only two studies described the randomization procedure adequately and compared baseline
characteristics between groups \cite{1,4}. These were also the only studies deemed by the reviewers to have adequately described and explained the randomization procedure \cite{1,2}.

**2.3.3.3.2 Description of Interventions**  
The sample sizes varied considerably across the studies (38–1578 participants) as did the intervention length provided to participants and the number of enjoyment items assessed.

Three (43\%) of the studies \cite{1,4,6} had less than six month treatment periods. The other four (57\%) studies \cite{2,5,22,23} had treatment periods of six months or longer. Three (43\%) of the studies \cite{2,4,22} had follow-up periods at least three months post intervention, four studies were co-educational samples \cite{2,5,22,23} and three studies were single-sex \cite{1,4,6}.

Regarding the curriculum medium used for the interventions, five (71\%) of the studies \cite{4,5,6,22,23} were conducted as part of school PE, one (14\%) study \cite{1} as part of the school sport program and one (14\%) \cite{2} was conducted in addition to PESS during curriculum time. Six (86\%) \cite{1,4,5,6,22,23} were based in secondary schools and one (14\%) study \cite{2} in a primary school.

Pedagogically, six (86\%) studies \cite{1,4,5,6,22,23} used a specialist PE teacher in delivering the intervention. The other study \cite{2} used an external PE teacher in the delivery of the curriculum without any professional development being provided to the school or teachers. Six studies \cite{2,4,5,6,22,23} provided a prescribed curriculum for teachers to follow. Two (29\%) studies \cite{1,4} developed a negotiated curriculum with the study participants (Note: Jamner et al., 2004 \cite{4} used a combination of prescribed and negotiated PESS curriculum). Likewise, two studies \cite{22,23} stated that one or more of Mosston and Ashworth’s (1986) teaching styles were
deliberately used by the PE teachers in the intervention. Two other studies \[^{[2,6]}\] adopted direct or explicit teaching approaches in their intervention delivery or were based on a direct instruction model. Finally, three (43\%) studies \[^{[1,4,6]}\] highlighted having a non-competitive learning environment as a focus of their intervention and targeted only female participants.

### 2.3.3.3 Intervention Efficacy

Three (43\%) studies reported to improve enjoyment in physical activity but in only one (14\%) of these studies was the improvement significant (See Table 2.4). The one study \[^{[2]}\] that included follow-up measures post-intervention reported significant differences between the intervention and the control group at 6-month post-intervention and 12-month follow-up, but only among boys at both collection intervals. Four (57\%) studies reported that the intervention had no effect on enjoyment (See Table 2.4).

### 2.4 Discussion

Fifteen studies reported a statistically significant intervention effect on physical activity participation \[^{[2-5,7,8,11-19]}\]. Four studies reported a statistically significant intervention effect on movement skill development \[^{[2,3,20,21]}\] and one study reported a statistically significant effect on enjoyment of physical activity \[^{[2]}\].

In the interventions that targeted physical activity and movement skills outcomes, the evidence suggests that those that adopted direct or explicit teaching strategies were most effective. This finding is consistent with research by Rink and Hall (2008) that state effective physical education programs will target the development of a physically
active lifestyle and motor skill development directly. Concurrently, a recent synthesis of meta-analysis of educational literature suggests that direct-instruction has a medium effect size on student achievement (Hattie, 2009). In many cases, direct instruction provides very specific learning targets and outcomes and is a classic process-product teaching model. It clearly distinguishes between process variable (in this case, the teaching method) and affords a great deal of teacher influence in manipulating the product variable being examined (in this case, physical activity participation, movement skill competency, and even enjoyment of physical activity). Almost all experimental studies, reviews and meta-analysis of school, teacher, and teacher effectiveness, have been based on a process-product model (Siedel & Shavelson, 2007), which may go some way to explaining their efficacy in this review.

Another component of the most effective interventions that targeted physical activity and movement skills was the provision of professional development programs for teachers using a well-designed and prescribed PE curriculum for increasing PA participation and improving movement skill proficiency. The prescribed PESS curriculum was often supported with additional resources such as PE equipment, lesson plans, web-support and, in the case of primary schools, mentors or in-school consultants. These features all appear to be consistent with improving the effectiveness of physical education in achieving health outcomes (Lee et al., 2007) and improve the efficacy of interventions in general. Hattie (2009) suggests that professional development programs also have a medium effect size on student achievement. Professional development programs work when they create expert teachers rather than selling the latest fad or gimmick in physical education. An expert teacher (PE or otherwise) becomes so in the way they present the learning experience to the student,
the degree of challenges they present, and the depth of processing that their students attain (Hattie, 2003). Furthermore, Armour and Yelling (2007) claim for professional development of teachers involved in the delivery of PESS curriculum to be founded on an understanding of teacher learning in order to have an impact on student learning. In other words, there needs to be a ‘learning space’ for teachers and professional development should not be seen as a ‘bolted on’ aspect of teaching practice. Professional development of this nature combined with the resources and support to deliver a PESS curriculum appear highly effective.

The lack of efficacious studies targeting enjoyment of physical activity or PE as an outcome makes it difficult to draw conclusions about the attributes of an effective PESS intervention capable of influencing this outcome. This is consistent with literature that discusses the subjective interpretations of what is described as enjoyable physical activity as the construct is frequently used interchangeably with other constructs such as interest, fun, liking, and intrinsic motivation (Wiersma, 2001). This limits our understanding of the construct of enjoyment of physical activity, and more importantly, our ability to measure it as exemplified in this review.

2.4.1 Strengths and Limitations

There are four main strengths to this review. Firstly, published studies were retrieved over a 20-year period. Secondly, to allow comparison between studies, we extracted an extensive range of detailed information from each article. Thirdly, three different outcome variables pertinent to PESS were reviewed. Finally, the inclusion criteria allowed for the inclusion of
studies from a variety of countries and for studies with a range of experimental methodological designs.

Several limitations of the review are also acknowledged. Only studies published in English, based in schools and involved curricula, and that included a control group were reviewed. Also, we were only able to compare the studies broadly; we were not able to determine whether physical activity participation, movement skill proficiency and enjoyment of physical activity were differentially affected by the interventions. Direct comparison, calculating an effect size via meta-analysis or conducting a mediation analysis between quantitative data was not possible because a diverse range of physical activity, movement skill and enjoyment instruments were used. Moreover, studies that used similar instruments reported different outcomes. Finally, enjoyment of physical activity and enjoyment of PE were both used as interchangeable concepts in this review as they were both a focus in studies that had enjoyment outcomes.

As discussed earlier, experimental and quasi-experimental studies are considered to provide the highest quality of scientific evidence in education (Davies, 1999). However, a counter commentary argues that scientific experimentation alone is not appropriate in educational research due to problems associated with matching of experiment groups with controls and potential isolating effects of programs on control groups (Kemper, 1990; Tinning & Kirk, 1991; Sparkes, 1992). As such, whilst not strictly a limitation of this review, it is important to note that qualitative and non-experimental studies may also provide some relevant information into the pedagogy, practice and future research of PESS.
2.4.2 Recommendations for Pedagogy, Practice and Future PESS Intervention Research

In light of this review, several recommendations can be made in relation to pedagogy, practice and future PESS intervention research.

2.4.2.1 Pedagogy

In terms of pedagogy, it is clear from this review and other research that movement skill development needs to remain a key focus of PE curriculum in order for children and adolescents to acquire the movement skills necessary to lead physically active lives (Sallis and McKenzie, 1991; Pate et al., 1995). Three of the four movement skill interventions also reported significant increases in physical activity participation in the same or separate papers (McKenzie, Alcaraz, Sallis, & Faucette, 1998; van Beurden et al., 2003; Salmon et al., 2008). In this light, movement skill competency in conjunction with physical activity participation and enjoyment should be used as indicators of an effective PE curriculum and pedagogy.

In terms of pedagogically effective teaching strategies, direct and explicit teaching strategies when combined with a detailed curriculum, are capable of increasing physical activity participation and movement skill proficiency in children and adolescents. However, it is commonly accepted within the PE teaching and research community that focusing solely on direct instruction teaching strategies could be potentially problematic when seeking to develop wider learning skills and independent learning. Therefore, more research is needed into which teaching strategies are capable of improving physical activity, movement skill development and student enjoyment of physical activity. The absence of popular PE
curriculum instruction/pedagogical models that advocate teaching strategies other than direct instruction such as Teaching Games for Understanding (Bunker & Thorpe, 1982), Sport Education (Siedentop, 1994) and other constructivist-based PE curriculum models from this review invite the opportunity for further research that can investigate their effects on physical activity, movement skill and enjoyment using experimental designs.

### 2.4.2.2 Practice

In terms of PESS practice, given there were five effective physical activity interventions adopting cross-curricular approaches implemented in primary schools, it may be pertinent for education and health decision makers to view physical activity in primary schools through a whole-school approach. In other words, share the responsibilities of physical activity across the entire school community and across the curriculum. Much in the same way numeracy and literacy are areas of focus in Mathematics and English, respectively, these areas of learning are also cross-curricular in nature and can/have been explored in other curriculum areas. Advocating for a whole-school approach to physical activity is by no means a new concept and has been supported by numerous studies (Sallis & Owen, 1999; Cale, 2000; Biddle et al., 2004). The absence of PESS curriculum that explicitly adopt whole-school approaches to physical activity or provide training to teachers in how to do so suggest that the recommendations proposed in the previous studies have gone unheeded.

This review also shows that substantial and quality professional development for teachers should be included in PESS programs. In accordance with numerous other studies (Sallis et al., 1997; McKenzie et al., 2003; McKenzie et al., 2004; Armour & Yealling, 2007; Jago et al., 2009; Armour et al., 2010), ongoing teacher professional development and support is a
key element of an effective PESS curriculum. Given their appearance in the reviewed papers, more interventions could be conducted into the use of web-based professional development and teacher support that provide lessons plans and teaching strategies employed in PESS classes.

2.4.2.3 Design of future PE interventions

In terms of design and methodology for future PESS research, the review findings reaffirm that sample size calculations should be completed before recruitment to ensure that studies are adequately powered to detect statistically significant differences between groups. Whole schools or even school districts may need to be recruited to maximise sample size or group.

Physical education and school sport interventions that focus on physical activity, movement skill or enjoyment outcomes should also be methodologically sound and follow well established guidelines to ensure transparent reporting (e.g. CONSORT 2010 (Moher et al., 2010) and TREND (Des Jarlais et al., 2004) statements). Attention should be given to longer interventions and follow-up periods, randomisation procedures, and using assessors who are blind to group allocation.

Furthermore, movement skill interventions that focus on secondary school PESS curriculum are needed, especially in early secondary school. Their absence from the literature limits education and health policymakers from justifying the compulsory inclusion of PESS in secondary curriculum. In addition, more experimental studies testing the effectiveness of school sport in secondary schools are needed to ascertain whether this aspect of the
curriculum can affect physical activity participation, movement skill proficiency, and enjoyment of physical activity. The lack of statistical power in studies conducted during school sport make it difficult to substantiate its contribution to these outcomes. This premise is supported by Bailey’s (2006) review that the scientific evidence does not support that the claimed effects of PESS curriculum occur automatically. More scientific evidence is needed to ascertain the contribution that positive PESS experiences, characterised by enjoyment, diversity, engagement, and well trained teachers with sufficient and ongoing professional development can make to achieve the claim benefits of a PESS curriculum.

Finally, given that 13 of the 23 studies included in this review were conducted in the United States, there is a strong case for more experimental studies to be conducted in other developed and developing nations.

2.4.2.4 Summary of recommendations for PE-based on this review

Evidence was found that the most effective teaching strategy to increase children’s levels of physical activity and improve movement skill proficiency in primary schools was direct instruction, a prescribed curriculum, adopting a whole-school approach to physical activity and providing teachers with sufficient, ongoing professional development in using PE instruction methods and curriculum. For secondary schools, using a combination of prescribed PESS curriculum with elements of student choice and substantial teacher professional development combined with sufficient teaching resources have the potential to make important differences to levels of physical activity participation and should be promoted.
2.5 Conclusions

During the primary and secondary years of education, it is important to promote movement skill development and physical activity participation through PE and school sport programs. It is clear from the evidence presented in this review that primary school classroom teachers and PE specialist teachers alike are capable of making substantial improvements in these outcomes. Yet, a lack of high quality evaluations and adequate statistical power hampers conclusions concerning the effectiveness of interventions to improve enjoyment of physical activity in PESS. PE teachers, researchers, and education and health policy makers need more evidence on how the diverse nature of PESS practice and pedagogy can play a central role in positively influencing young people’s physical activity participation, movement skill proficiency and enjoyment of physical activity which in turn may then be capable of influencing health and educational policy internationally.

2.6 References


Des Jarlais, D.C., Lyles, C., Crepaz, N., & the TREND Group. (2004). Improving the reporting of quality of nonrandomized evaluations of behavioural and public health


U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health. (2010). Strategies to Improve the Quality of Physical Education. United States Government: Washington D.C.


2.6.1 Papers included in this review and assigned code numbers for referencing purposes in-text


3.1 Introduction

Physical activity (PA) is associated with a number of health benefits in adolescents. These include reduced anxiety and depression symptoms, increased perceptions of global and physical self-concept, reduced adiposity, improved skeletal health, improved psychosocial health, and improved academic performance (Strong et al., 2005). Recent data show that only 15% of Australian adolescents participate in adequate amounts of PA (National Heart Foundation and Cancer Council, 2011). One domain in which PA can occur is school-based physical education (PE). The role of PE in promoting health-enhancing physical activity is well established (Pate, Davis, Robinson, Stone, McKenzie, & Young, 2006) and the Centres for Disease Control and Prevention (CDC) (USDHHS, 2010) recommend that 50% of PE class time should engage students in moderate to vigorous physical activity (MVPA). In Australia, two recent publications have called for closer examination of the role of PE in promoting PA. The National Preventative Health Taskforce report (2010) and The Future of Sport in Australia “(Crawford)” report (2009) both argued for adequate time and resources to promote PA participation within PE as a way of improving the nation’s health. Unfortunately,
little is known about the physical activity levels of Australian students during PE and what proportion of PE classes are meeting the CDC recommendation of 50% of class time spent in MVPA.

Developing movement skill proficiency is important for promoting PA and a key aim of PE curricula (CDC, 1997; USDHHS, 2010). Physical education lessons that devote adequate time to skill development have higher levels of MVPA among students (Sallis et al., 1997; McKenzie et al., 2001; van Beurden et al., 2003). In addition, the social support for PA that adolescents receive from significant others is a key correlate of PA participation (Sallis, Prochaska, Taylor, Hill, & Geraci, 1999). Teachers have opportunities in PE to provide social support for students to be physically active in class. However, the extent to which PE teachers provide social support that promotes PA and spend time in the differing lesson contexts (especially movement skill instruction) in secondary schools in Australia is also not known.

The purpose of this study was to examine the PA levels of secondary school students during PE. In addition the percentage of class time spent in different lesson contexts was examined to determine PE instruction patterns. The final aim was to investigate the amount of class time teachers spent providing social support (in the form of verbal and non-verbal promotion of PA) during their PE lessons.
3.2 Method

3.2.1 Design

This chapter reports on the baseline cross-sectional data from the Physical Activity in Linguistically Diverse Communities (PALDC) project. The procedures for this study were approved by the University of Wollongong Human Research Ethics Committee (Appendix B, HE 07/062).

3.2.2 Setting and participants

Six secondary schools from south-western Sydney, Australia were identified by the New South Wales Department of Education and Communities (NSW DEC) as having a high proportion of students from culturally and linguistically diverse (CALD) backgrounds. All six schools were invited to participate in the study. Four of the schools were single-sex (two all boys’ and two all girls’ schools) and two were co-educational. In each school, all enrolled Year 7 students (first year of high school in NSW) were invited to participate.

3.2.3 Variables

Primary outcome variables for this study were PA levels, lesson instruction context and teacher promotion of PA within PE. Covariates included the length of the PE lesson and school type. Demographic data included sex, age, cultural background (based on language most spoken at home) and socioeconomic status (based on postcode of residence).
3.2.4 Measurement

Physical activity levels, lesson instruction and teacher promotion of PA were measured using direct observation of three randomly scheduled PE lessons on three separate days for each class at each school over a five-month period from July to December 2008. The System for Observing Fitness Instruction Time (SOFIT) (McKenzie, Sallis, & Nader, 1991) was used to obtain simultaneous recordings of these variables. In brief, the physical activity levels of four randomly selected students, the lesson context, and teacher interactions in relation to promoting PA were coded every 20 seconds (behaviour observed for 10 seconds followed by 10 seconds of recording data) throughout the PE lesson on a rotational basis. The activity codes in SOFIT have been calibrated using heart rate monitoring (McKenzie, Sallis, & Nader, 1991; Rowe, Schuldheisz, & van der Mars, 1997) and validated using accelerometers (McKenzie, Sallis, & Armstrong, 1994). Observations for a PE lesson began when 51% of students in the class were changed into their PE uniforms and reported to the teaching area and ended when 51% left the teaching area to get changed back into their regular school uniform. This time period was recorded as useable PE class time. Students not physically participating in the PE lesson due to injury or illness were not included in the observations.

Coding of the activity levels, lesson context, and teacher interaction occurred at the end of each 10-second observation interval. Regarding lesson context, a decision was then made whether class time was being allocated for general content (such as management) or for subject matter (PE) content. If substantive PE content was occurring, an additional decision was made whether the focus was on knowledge content (coded as either general knowledge or physical fitness knowledge) or on motor content (physical activity). If motor content was
occuring, a further coding of whether the context was one of fitness, skill practice, game play or free play was made (McKenzie, Sallis, & Nader, 1991).

Classifying PA levels was made by observing the randomly selected students (one at a time) and determining their level of PA (or active engagement level). The PA/active engagement level provides an approximate intensity of a student's PA. The PA/active engagement levels of 1 to 3 are used to describe the body position of the student (lying down, sitting, standing). Intensity of PA is coded as a 4 if walking is observed. The highest activity intensity of 5 (very active/vigorous) describes when the student is expending more energy than they would during normal walking. Physical Activity coding is based on the observed activity intensity of the target student at the moment the observation interval ends (McKenzie, Sallis, & Nader, 1991).

Teacher interaction was classified into one of two categories. The first category ‘promotion of physical activity’, related to the teacher verbally or by physically encouraging the student to be active. It also included the teacher demonstrating an activity or skill and participating with a student in a way that was perceived as supporting them to be active. The second teacher interaction category was no promotion of physical activity and referred to when none of the previously mentioned teacher behaviours were being observed in the teacher’s interaction with their students (McKenzie, Sallis, & Nader, 1991). Both the lesson context and teacher interaction categories of SOFIT were derived from definitions commonly used in both PE teacher training and PE pedagogy (Darst, Zakrajsek, & Mancini, 1989; Stewart, 1989; Siedentop, 1991).
Four research assistants were trained as SOFIT observers and conducted the observations. Their training included lectures, video assessment, and live field practice. On completion of the training, the observers were only allowed to commence the observations for this study when an interrater agreement of 85% or more on all variables on pre-recorded “gold-standard” DVDs and during live field practice was reached. On completing each lesson, observers checked all recording forms for missing data. The author entered interval-by-interval codes into a computer for storage and analysis. Accuracy of data entry was maintained by cross checking 100% of raw data points with corresponding cases in the data file until entry was 100% correct. All (100%) of cases were cross-checked.

Eight field-based interrater reliability checks were conducted during the six-month observation period. During reliability checks, two observers independently coded the same students in the same PE lesson while being paced by synchronised MP3 players. A percentage of interrater agreement (IRA) was calculated for each variable using the following formula: $\frac{\#\text{agreements}}{\#\text{agreements} + \#\text{disagreements}} \times 100$. During the assessment period, eight lessons (10% of the total observations) were observed for reliability with minimum IRAs for student activity levels being 90%, 87% for lesson context, and 96% for teacher behaviour.

### 3.2.5 Demographic data

Language most spoken at home was collected on each student from enrolment records. Cultural background was categorised according to region based on the Australian Standard Classification of Languages (ABS, 2005). Categorisations included in this study were Northern European including English, Southern European, Eastern European, African, Middle-eastern, Southern-Asian, South-east Asian, East Asian, and Pacific Islands. Enrolment
records were also used to ascertain a measure of socioeconomic status based on postcode of residence using the Index of Relative Socio-Economic Disadvantage (IRSD) (ABS, 2006). To categorise SES, an IRSD score was allocated to each student and then compared with the decile stratifications of the Australian population. Deciles scoring 1 indicated the greatest socio-economic disadvantage and deciles scoring 10 indicated the greatest socio-economic advantage.

3.2.6 Efforts to minimise bias

SOFIT observers were recruited from pre-service PE teacher courses from two Australian universities. At no stage were the observers made privy of the objectives of the study and observers were required to undertake SOFIT observations at all six schools. This was done in order to prevent bias of observer observation and variety of interpretations across the schools. Inter-rater reliability checks on 5% of the SOFIT observations were randomised in order to prevent possible collusion. Cultural background data (language spoken at home) were sourced from student enrolment records which were completed prior to recruitment into the study. PE lesson observations were randomly selected and teachers were given limited notice of when an observation was going to occur (usually less than one week). Teachers were asked to teach to their existing PE programs and not alter them because they were being observed.

Informed consent was provided by the school principals, teachers, students and their parents. Consent was obtained via written consent or if language was not English, New South Wales Department of Education language staff followed up for parental and student consent via a telephone call to the family’s home (Appendix C and D).
3.2.7 Quantitative variables

SOFIT was designed as a lesson-level measure. For basic descriptive statistics the unit of analysis was a single lesson. For all other analyses, elemental observations made at 10-sec intervals were aggregated and lesson context specific summaries were made of each lesson. This yielded up to 18 cases per observed lesson (3 school types x 6 lesson contexts).

The variables reported in this paper include: class factors, student activity levels, lesson context, and teacher interaction. Class factors were lesson length, and school-type. Student activity levels were the proportion of time spent in each of the activity levels. Time spent in MVPA was obtained by summing the proportion of lesson time spent in the “walking” and “very active” categories. Lesson context variables included the proportion of time spent in the six lesson contexts. Teacher interaction variables were the proportion of time spent in two teacher interaction categories (PA promotion and no PA promotion).

3.2.8 Statistical methods

Percentages were calculated for all SOFIT data (student PA level, lesson context, and teacher interaction) for the entire sample and then stratified by school-type (all girls, all boys, and coeducational). Pearson and point bi-serial correlations were then calculated for PA intensity, lesson length, lesson context, and teacher interaction based on school type. This was done to ascertain the relationship between the outcome variables and the covariates at the smallest discernable level. Individual schools and classes were not included because of the variability
in the number of classes, teachers, and class size in each of the different schools. All data were analysed using Statistical Package for Social Science (SPSS) version 14.

### 3.3 Results

#### 3.3.1 Participants

All PE teachers who taught Year 7 in the six schools consented to having at least three PE lessons observed. There were 27 Year 7 PE classes across the six schools which resulted in a total of 81 lessons observed (27 classes x 3 observations). This equated to 16% of the total PE lessons that were timetabled over the data collection period (81/513). The average class size was 24 students (range 14-27).

A total of 658 Year 7 students were enrolled in the six schools. 586 students (Boys, n=266; Girls, n=320; 89% of those enrolled) consented to demographic data being collected from school enrolment records.

#### 3.3.2 Descriptive data

Slightly more participants were girls (55%) with the all girls’ schools contributing the largest proportion (40%) (See Table 3.1). The mean age of participants was 12.8 years (0.5 SD).

Whilst English was the most common language spoken at home (38%), it was well below the national average of 84% (Australian Bureau of Statistics, 2010). Middle-Eastern and East Asian dialects were the next most common language spoken at home (36% and 7%
respectively) and were well above the national average of 1.2% and 2.3% respectively (ABS, 2010). Based on postcode of residence, nearly 60% of participants resided in suburbs in the five deciles of greatest socio-economic disadvantage (ABS, 2006).
### Table 3.1: Characteristics of the PALDC study after consent

<table>
<thead>
<tr>
<th>Sex (%)</th>
<th>Male</th>
<th>266 (45%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>320 (55%)</td>
</tr>
</tbody>
</table>

| Mean age (SD) | 12.8 (0.5) |

<table>
<thead>
<tr>
<th>Participants by school type (%)</th>
<th>Co-educational</th>
<th>199 (34%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All girls</td>
<td>235 (40%)</td>
<td></td>
</tr>
<tr>
<td>All boys</td>
<td>152 (26%)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Language spoken at home (%)</th>
<th>English or Northern European</th>
<th>223 (38%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Middle Eastern</td>
<td>212 (36%)</td>
</tr>
<tr>
<td></td>
<td>East Asian</td>
<td>42 (7%)</td>
</tr>
<tr>
<td></td>
<td>Eastern European</td>
<td>38 (6%)</td>
</tr>
<tr>
<td></td>
<td>South East Asian</td>
<td>21 (4%)</td>
</tr>
<tr>
<td></td>
<td>Pacific Islands</td>
<td>19 (3%)</td>
</tr>
<tr>
<td></td>
<td>Southern Asian</td>
<td>16 (2%)</td>
</tr>
<tr>
<td></td>
<td>African</td>
<td>10 (2%)</td>
</tr>
<tr>
<td></td>
<td>Southern European</td>
<td>5 (&gt;1%)</td>
</tr>
<tr>
<td></td>
<td>English or Northern European</td>
<td>223 (38%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index of Relative Social Disadvantage Deciles* (%) based on postcode of residence</th>
<th>1</th>
<th>6 (1%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>4 (&gt;1%)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1 (&gt;1%)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>276 (47%)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>56 (10%)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>40 (7%)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>3 (&gt;1%)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>15 (3%)</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>63 (11%)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>122 (21%)</td>
</tr>
</tbody>
</table>

*Lower IRSD deciles indicate greater socio-economic disadvantage
3.3.3 Main results

The mean proportion of time spent in MVPA during PE was just under 60% and just over one-quarter (25.3%) of class time was spent sitting (See Table 3.2). In terms of lesson context, the majority of PE class time was spent in game play (43.5%) followed by management (30.8%). Just over 6% of PE class time was spent in skill practice or explicit skill instruction. This equates to only 3.6 minutes of skill instruction and practice during the average class (59 minutes). Regarding teacher interaction and promotion of student activity, teachers spent nearly one-third of PE class time encouraging and promoting their students to be physically active.
Table 3.2: Unadjusted means and standard deviations for class factors and the lesson proportion number of minutes for student activity level, lesson context, and teacher interaction

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage of lesson (n=81)</th>
<th>Minutes (n=81)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Student Activity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying down</td>
<td>0.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Sitting</td>
<td>25.5</td>
<td>16.4</td>
</tr>
<tr>
<td>Standing</td>
<td>17.5</td>
<td>11.0</td>
</tr>
<tr>
<td>Walking</td>
<td>36.1</td>
<td>14.4</td>
</tr>
<tr>
<td>Very active</td>
<td>20.8</td>
<td>11.1</td>
</tr>
<tr>
<td>MVPA^</td>
<td>56.9</td>
<td>18.7</td>
</tr>
<tr>
<td><strong>Lesson Context</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>30.8</td>
<td>13.2</td>
</tr>
<tr>
<td>Knowledge</td>
<td>9.5</td>
<td>8.1</td>
</tr>
<tr>
<td>Fitness</td>
<td>7.1</td>
<td>11.4</td>
</tr>
<tr>
<td>Skill practice</td>
<td>6.2</td>
<td>10.9</td>
</tr>
<tr>
<td>Game play</td>
<td>43.5</td>
<td>24.2</td>
</tr>
<tr>
<td>Other (free play)</td>
<td>2.8</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Teacher interaction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promotion of PA</td>
<td>30.8</td>
<td>19.4</td>
</tr>
<tr>
<td>No promotion of PA</td>
<td>68.9</td>
<td>19.4</td>
</tr>
</tbody>
</table>

Range of usable PE class time^ in minutes 19-110

Number of lessons with
- >50% MVPA (%) 49 (60.5)
- >25% Skills practice (%) 8 (9.9)
- >35% Promotion PA (%) 27 (33.3)

^ MVPA is the sum of the walking and very active categories

^ Usable PE class time defined as when 51% of students arrive in the instruction area to when 51% of students depart instruction area
Of the 81 lesson observations, 49 (60.5%) met the CDC recommendation of spending at least 50% of class time in MVPA. Whilst no formal guidelines exist for skill instruction and practice or teacher promotion of PA, other studies (Sallis et al., 1997; van Beurden et al., 2003) measuring these variables score their minimum means prior to any intervention at 25% and 35%, respectively. Only 8 (9.9%) lessons spent more than 25% of class time engaged in skill instruction and practice and in only 27 (33%) of the lessons did the teacher spend more than 35% of the lesson promoting PA. The amount of useable PE lesson time varied considerably from 19 to 110 minutes (Mean= 59 minutes).

Table 3.3 reports the adjusted means, standard deviations, and p values for the main effect of the physical activity coded variables, lesson context, and teacher interaction stratified by school type. There were statistically significant differences in student activity levels between school types with all girls’ schools spending significantly more time sitting and standing and less time walking, being very active and engaging in MVPA than the coeducational and all boys’ schools. All boys’ schools spent significantly less time in fitness and skill practice than the all girls’ and coeducational schools. There were no statistically significant differences between school types in the percentage of PE class time that the teachers spent promoting physical activity.
Table 3.3: Adjusted means, standard deviation, and $p$ values for main effects for physical activity coded variables, lesson context, and teacher interaction stratified by school type

<table>
<thead>
<tr>
<th>Category</th>
<th>Co-ed school observations (n=24)</th>
<th>All girls’ school observations (n=33)</th>
<th>All boys’ school observations (n=24)</th>
<th>$p$ main effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Activity (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying down</td>
<td>M=0.2, SD=0.9</td>
<td>M=0.1, SD=0.2</td>
<td>M=0.3, SD=0.6</td>
<td>$p=.650$</td>
</tr>
<tr>
<td>Sitting</td>
<td>M=23.1, SD=16.3</td>
<td>M=31.2, SD=16.9</td>
<td>M=19.9, SD=13.6</td>
<td>$p=.047$</td>
</tr>
<tr>
<td>Standing</td>
<td>M=17.2, SD=10.9</td>
<td>M=23.4, SD=10.3</td>
<td>M=9.6, SD=6.4</td>
<td>$p&lt;.000$</td>
</tr>
<tr>
<td>Walking</td>
<td>M=37.3, SD=15.1</td>
<td>M=30.0, SD=11.7</td>
<td>M=43.3, SD=13.9</td>
<td>$p=.005$</td>
</tr>
<tr>
<td>Very active</td>
<td>M=22.1, SD=11.9</td>
<td>M=15.3, SD=7.5</td>
<td>M=27.0, SD=11.1</td>
<td>$p&lt;.000$</td>
</tr>
<tr>
<td>MVPA</td>
<td>M=59.5, SD=19.6</td>
<td>M=45.3, SD=12.1</td>
<td>M=70.2, SD=15.4</td>
<td>$p&lt;.000$</td>
</tr>
<tr>
<td>Lesson Context (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>M=26.3, SD=13.1</td>
<td>M=33.9, SD=11.3</td>
<td>M=31.2, SD=14.9</td>
<td>$p=.146$</td>
</tr>
<tr>
<td>Knowledge</td>
<td>M=12.0, SD=10.8</td>
<td>M=9.9, SD=6.2</td>
<td>M=6.6, SD=6.8</td>
<td>$p=.099$</td>
</tr>
<tr>
<td>Fitness</td>
<td>M=7.0, SD=14.7</td>
<td>M=10.4, SD=10.6</td>
<td>M=2.7, SD=6.6</td>
<td>$p=.024$</td>
</tr>
<tr>
<td>Skill practice</td>
<td>M=11.2, SD=15.2</td>
<td>M=5.8, SD=9.3</td>
<td>M=1.9, SD=4.1</td>
<td>$p=.013$</td>
</tr>
<tr>
<td>Game play</td>
<td>M=41.2, SD=27.6</td>
<td>M=38.5, SD=23.7</td>
<td>M=52.7, SD=19.2</td>
<td>$p=.158$</td>
</tr>
<tr>
<td>Other (free play)</td>
<td>M=2.2, SD=3.1</td>
<td>M=1.6, SD=3.5</td>
<td>M=5.0, SD=7.4</td>
<td>$p=.098$</td>
</tr>
<tr>
<td>Teacher interaction (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promotion of PA</td>
<td>M=34.5, SD=16.1</td>
<td>M=32.4, SD=20.8</td>
<td>M=24.8, SD=19.5</td>
<td>$p=.171$</td>
</tr>
<tr>
<td>No promotion of PA</td>
<td>M=65.2, SD=16.2</td>
<td>M=67.2, SD=20.8</td>
<td>M=75.0, SD=19.7</td>
<td>$p=.162$</td>
</tr>
</tbody>
</table>
Table 3.4 shows the correlation of varying lesson contexts and lesson length with MVPA by school type. Significant positive correlations were found between MVPA and game play in all boys’ and coeducational schools and also for MVPA and free play in all girls’ and boys’ schools. Significant negative correlations were reported between MVPA and time spent in management and knowledge instruction in all boys’ schools and between time spent in knowledge and MVPA in all girls’ and coeducational schools. The longer observed lesson lengths of between 50 to 110 minutes were also negatively correlated with MVPA in all boys’ schools.
Table 3.4: Correlation of varying lesson contexts and lesson length with MVPA by school type

<table>
<thead>
<tr>
<th>Fixed effect</th>
<th>Category</th>
<th>Co-ed school observations (n=24)</th>
<th>All girls’ school observations (n=33)</th>
<th>All boys’ school observations (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PC p value</td>
<td>PC p value</td>
<td>PC p value</td>
</tr>
<tr>
<td>MVPA</td>
<td>Lesson Context</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Management</td>
<td>-.218 p=.306</td>
<td>-.274 p=.123</td>
<td>-.665 p=.000</td>
</tr>
<tr>
<td></td>
<td>Knowledge</td>
<td>-.579 p=.003</td>
<td>-.374 p=.032</td>
<td>-.467 p=.021</td>
</tr>
<tr>
<td></td>
<td>Fitness</td>
<td>-.067 p=.755</td>
<td>-.189 p=.293</td>
<td>-.191 p=.372</td>
</tr>
<tr>
<td></td>
<td>Skill practice</td>
<td>-.288 p=.176</td>
<td>-.146 p=.417</td>
<td>-.193 p=.365</td>
</tr>
<tr>
<td></td>
<td>Game play</td>
<td>.518 p=.010</td>
<td>.296 p=.095</td>
<td>.556 p=.005</td>
</tr>
<tr>
<td></td>
<td>Other (free play)</td>
<td>.061 p=.778</td>
<td>.515 p=.002</td>
<td>.613 p=.001</td>
</tr>
<tr>
<td></td>
<td>Lesson length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 - 110 minutes</td>
<td>PBC p value</td>
<td>PBC p value</td>
<td>PBC p value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-.152 p=.477</td>
<td>.013 p=.941</td>
<td>-.416 p=.043</td>
</tr>
</tbody>
</table>

PC= Pearson correlation, PBC= Point Bi-serial correlation
3.4 Discussion

The purpose of this study was to describe the levels of PA, lesson context and teacher interaction secondary school students receive during PE in New South Wales. This is the only known study to examine the PA, lesson context, and teacher interaction simultaneously during PE in Australian secondary schools.

3.4.1 Physical activity levels during PE

The main findings were that students spent the majority of PE time in MVPA but very little of that time was spent engaging in skill instruction or practice. When examining the data by school-type, all girls’ schools spent less time than co-educational and all boys’ schools in MVPA and all boys’ and all girls’ schools spent less time in skill instruction than coeducation schools. Finally, positive correlations were found between MVPA and game play in all boys’ and coeducational schools but negative correlations were reported between MVPA and time spent in management, knowledge, and as lesson length increased in all boys’ schools.

Similar international studies using the same data collection instruments on similarly aged students report around 35% of PE class time engaged in MVPA (McKenzie et al., 2006; Chow, McKenzie, & Louie, 2009). One cross sectional study conducted in Victoria, Australia reported that Year 10 students also spend an average of 35% of their PE class time engaged in MVPA (Brown & Holland, 2005). The higher proportions of MVPA found in this study suggest that students in these schools relish the opportunities to be physically active during school-based PE. Given that for these students, secondary school will likely be their first
experience with structured PE and trained PE teachers, their willingness to engage in MVPA may still be novel. It may also be safe to assume that the infrastructure (both environmental and curricular) in these schools is capable of facilitating MVPA participation in accordance with the CDC recommendation (CDC, 2010). As game play comprised nearly half of the lesson time, it can be assumed that games were a major contributor to this high proportion of time spent in MVPA. Whilst this is good from a public health perspective, it presents a conundrum from a pedagogical perspective. Furthermore, whilst game play participation and teaching the necessary skills, tactics, and strategy of games may not be mutually exclusive, there is a chance they could be and this may be detrimental from a pedagogical perspective (Bunker & Thorpe, 1982). Furthermore, direct observation instruments, such as SOFIT, may not be sensitive enough to detect when changes in pedagogy occur.

This study also found that in 60% of lessons, students spent more than 50% of PE class time engaged in MVPA. Whilst these data are not reported in other studies, it does show that there are still 40% of lessons where the MVPA recommendations are not being met.

### 3.4.2 Movement skill instruction during PE

Students in this study spent 6.2% of PE class time in skill instruction and practice. In only 8 (9.9%) of the 81 observations was skill instruction and practice greater than 25% of the lesson. One other international study showed that 25% of PE class time was spent in skill instruction and practice (Chow, McKenzie, & Louie, 2009). A Victorian (Australia) cross sectional study of Year 6 children also showed that skill instruction comprised over 20% of the lesson context during PE (Brown & Holland, 2005). The markedly lower movement skill
instruction and practice occurring in these schools is of concern, given that longitudinal data show that developing a high level of competence in movement skills, especially object control skills, during adolescence is associated with higher PA levels in adulthood (Barnett, Morgan, van Beurden, & Beard, 2008). The reasons for these low levels of time spent in skill instruction are speculative but it may be due to a lack of teacher competence or that teaching movement skills to adolescents is more difficult that it is in younger children or that teachers perceive that it may be too late to make meaningful differences to movement skills when students reach secondary school. In any case, given the link between movement skill development in adolescence and PA in adulthood, future research will need to ascertain whether this lack of movement skill instruction and practice time in PE has an adverse affect on PA levels of students as they progress through their secondary education.

3.4.3 Other lesson contexts during PE

The data also showed that a substantial proportion of PE instruction time was spent in management (30.8%). These findings are comparable with other studies in the United States that report around 26% of PE time spent in management (McKenzie, Marshall, Sallis, & Conway, 2000; McKenzie et al., 2006). Having almost one-third of PE lessons spent organising students and managing behaviour appears to be excessive and the reasons for it being so are unknown. It may be that teachers require training in order to be more efficient with the time allocated to them or that adolescents are increasing difficult to manage during PE. In any case, the rates of management in the US studies were sufficient to warrant specialised intervention and similar responses would be prudent in the schools in this study.
3.4.3.1 Teacher promotion of PA during PE

This study showed that teachers spent just under one-third of PE class time promoting physical activity with one-third of lessons showing more than 35% of class time promoting physical activity. Whilst not statistically significant, variations between school types in teacher promotion of PA ranged from 35% in coeducational schools to 25% in all boys’ schools. Promotion of PA by teachers during PE in a previous international study (McKenzie, Marshall, Sallis, & Conway, 2000) was around 35% of class time. The schools in our study showed slightly lower levels of PA promotion by teachers with substantially less PA promotion occurring in all boys’ schools. This may indicate that teachers in NSW secondary schools feel students do not need encouragement to be active if they perceive them to already be sufficiently active. Whilst it is difficult to explain the discrepancy in promotion time between all boys’ and other schools, it may be due to them spending more time in MVPA, meaning teachers do not need to spend as much time promoting in-class PA to these students.

3.4.3.2 School type relationships

The discrepancy between school types was evident. All girls’ schools spent significantly more time sitting (31.2%) and significantly less time in MVPA (45.2%) during PE compared with co-educational and all boys’ schools. Compared with international studies the mean times for these intensities of activity were 17.2% (McKenzie, Marshall, Sallis, & Conway, 2000) for sitting and 48% (McKenzie, Marshall, Sallis, & Conway, 2000; McKenzie et al., 2004) for MVPA in early high school-aged students. The results however, are consistent with a study of girls PE using the SOFIT instrument (McKenzie et al., 2006). This US study showed girls sitting and MVPA during PE was 32% and 38%, respectively. Whilst there is no evidence to
suggest why this is the case, an explanation of why sitting was higher and MVPA was lower in all girls’ schools may be attributed to the way in which teachers in these schools manage students between activities. It may be that girls are easily managed and demonstrated to whilst they are sitting. Boys on the other hand appear to be less willing to sit and simply want to continue playing games or participating in the activities of the lesson.

In terms of skill instruction, other studies report between 5% and 12% of PE time spent in this context (McKenzie, Marshall, Sallis, & Conway, 2000; McKenzie et al., 2004; McKenzie et al., 2006). By these figures, it would appear that both all girls’ and co-educational schools are within what might be expected in a PE lesson. However, all boys’ schools spending only 2% of PE time in skill instruction and practice is very low in comparison with these other studies (McKenzie, Marshall, Sallis, & Conway, 2000; McKenzie et al., 2004; McKenzie et al., 2006). An explanation of why this may occur is that all boys’ schools spend the majority of class time in game play, are more engaged in more MVPA than other school types, and game play is significantly correlated with MVPA. At this age it may be that boys just ‘want to play the game’ and not worry about learning the skills. As such, PE teachers may be reluctant to interrupt student engagement in MVPA and game play in order to teach movement skills. Further research may be needed to ascertain whether specific programming variables of PE might explain these results.

The correlation data reinforces the need to investigate the efficacy of PE curriculum, pedagogy, and timetabling in the early years of secondary school in NSW. Negative correlations between MVPA across all school sectors during skill practice, whilst not statistically significant, invites further research into PE pedagogy and professional development strategies at a school level. Negative correlations with lesson length greater than
50 minutes and with MVPA in all boys’ schools may have important implications for school executives during timetabling of classes and the programming of appropriate lesson content. It is anecdotally accepted within the PE teaching profession that longer lessons are more desirable because they allow teachers to be less concerned with the time lost at the beginning and end of a lesson with administrative tasks such as marking the roll and having students get changed into sport uniforms.

3.4.4 Strengths and limitations

A strength of this study was that it was the first known to objectively quantify PA, instruction time and teacher promotion of PA simultaneously in Australian high schools. Another strength was the success in recruiting a large sample from this culturally diverse population, with more than 99% of the Year 7 students in the six schools consenting to participate in the study. These results compare favourably with other published literature on recruiting CALD populations for health promotion research (Corbie-Smith, Thomas, & St George, 2002; Levkoff & Sanchez, 2003; Dudley, Okely, Pearson, & Peat, 2010) where the average consent rate is around 60%.

The main limitation of this study was that it reports findings from a small number of schools. Future studies need to recruit more schools and with samples more indicative of Australian population demographics. Other limitations are that it reports on cross-sectional data. Further longitudinal research is needed to ascertain whether any trends in MVPA, skill instruction and practice time, and teacher promotion of PA exist as students’ progress through high school. Another limitation is that data were only collected over half an academic year. It was unable
to be determined with these data if annual seasonal issues, such as weather and PE program choices, influenced the findings. Furthermore, teachers were asked to teach their pre-scheduled PE lessons but there is a possibility that being observed during lessons may have altered their teaching behaviour. Collecting data on a convenience sample within a CALD community was considered sensitively and not without limitations. Whilst it was believed that the data collected on this sample is indicative of wider PE behaviour across urban Australian communities, the findings may be specific to CALD populations.

3.5 Conclusion

Although it appears NSW schools are able to provide adequate amounts of MVPA during PE, it is apparent that the amount of MVPA being received also varies considerably across schools and the lack of time spent in skill instruction and practice during the early years of high school is of concern. Physical education may be the only setting in which some students, especially those from CALD and low-SES backgrounds, can accrue MVPA and learn the important movement skills needed to be physically active beyond school. This study identifies specific areas of PE instruction that could be improved in these schools including focussing on skill instruction, improving PE pedagogy, allocating more useable time to PE, improving management efficiency, and increasing teacher promotion of PA.

3.6 References


CHAPTER 4

Changes in Physical Activity Levels, Movement Skill Instruction, and Teacher Interaction during Physical Education from Year 7 to Year 8


4.1 Introduction

Recent data show that only 15% of Australian adolescents participate in adequate amounts of physical activity (National Heart Foundation and Cancer Council, 2011). Schools have been recognised as the most widely used and cost-effective setting for promoting physical activity (PA) among children and adolescents (van Sluijs, McMinn, & Griffin, 2007; Wu, Cohen, Shi, Pearson, & Sturm, 2011) and one domain within schools where PA can occur regularly is during school physical education (PE).

In terms of physical activity participation during PE, no formal guidelines exist in Australia on levels of student PA during PE. However, the US Centres for Disease Control and Prevention (United States Department of Health & Human Services, 2010) recommend that 50% of PE class time should engage students in moderate to vigorous physical activity (MVPA). Australian physical activity guidelines call for 60 minutes of MVPA per day and
that this should be accrued through a variety of avenues, including PE (Department of Health and Ageing, 2004). Unfortunately, little is known about the physical activity levels of Australian students during PE and whether they are meeting the recommendation of 50% of class time spent in MVPA and whether these levels of MVPA change as students’ progress through their secondary schooling.

Promoting PA participation is a key aim of PE curricula (CDC, 1997; 2011; USDHHS, 2010). To achieve this, PE lessons should dedicate sufficient time to skill development and fitness, whilst reducing the amount of time spent managing students (McKenzie et al., 2001; Sallis et al., 1997; van Beurden et al., 2003). Additionally, the social support adolescents receive from their peers, parents and teachers is a key correlate of PA participation (Sallis, Prochaska, & Taylor, 2000). Teachers have the opportunity during their PE classes to provide social support for their students to be physically active in class via the interaction they have with them.

However, the extent to which Australian PE teachers promote PA and spend time providing fitness, movement skill and specific game play instruction, and their changes over time, is not known.

In the absence of longitudinal studies, examining changes within control groups in quasi-experimental studies provides the best available evidence of how student activity and lesson context prospectively change in PE. In the Middle School Physical Activity and Nutrition (M-SPAN) study (McKenzie et al., 2004), 430 PE lessons were observed at baseline (Year 6), 711 at 12-month follow-up (Year 7), and 708 at 24-months (Year 8) in the 12 control schools. In Year 6, 49% of PE class time was engaged in MVPA and 6% in skill instruction or practice. Both MVPA and skill instruction or practice declined slightly (by around 1%) at 12-and 24-month follow-ups indicating that, in these schools, student activity and lesson context
factors remain stable throughout middle school. Teacher promotion of PA was not reported in this study. No Australian studies have examined student physical activity participation, the time spent in key lesson contexts, and the social support for participation in PE over time. The purpose of this study was to examine the percentage of class time spent in participating in physical activity, lesson context and teacher interaction during secondary school PE and how these variables changed over time from Year 7 to Year 8.

4.2 Methods

4.2.1 Design

The procedures for this study were approved by the University of Wollongong Human Research Ethics Committee (Appendix B, HE 07/062). This paper reports on the longitudinal data from the Physical Activity in Linguistically Diverse Communities (PALDC) project. The STROBE Statement (Strengthening the Reporting of Observational Studies in Epidemiology) (von Elm et al., 2008) was followed to ensure the transparent reporting of the study.

4.2.2 Setting and participants

Six secondary schools from south-western Sydney, Australia were identified by the New South Wales Department of Education and Communities (NSW DEC) as having a high proportion of students from culturally and linguistically diverse (CALD) backgrounds. All six schools were invited to participate in the study. Four of the schools were single-sex (two all boys’ and two all girls’ schools) and two were co-educational. In each school, all enrolled
Year 7 (first year of high school in NSW) students were invited to participate. Year 7 PE lessons were observed as baseline data with follow-up data collected 12-months later when the same students were in Year 8. The follow-up PE lesson observations were conducted in the same six schools in the same half of the school year when the baseline Year 7 students were enrolled in Year 8.

### 4.2.3 Variables

Primary outcome variables for this study were PA levels, lesson instruction context and teacher promotion of PA within PE. As this was a descriptive study, predictors such as age, gender, and school-type were not accounted for however, the sample was stratified by school type to examine differences in the data at the smallest discernable level. Individual participant demographic data were collected at baseline only and included sex, age, cultural background (based on language most spoken at home) and socioeconomic status (based on postcode of residence).

### 4.2.4 Measurement

Physical activity levels, lesson context and teacher promotion were measured using direct observation of randomly scheduled PE lessons (n=81 baseline, n=51 follow-up) on separate days at each school over two 6-month periods from July to December, 2008 and from July to December 2009. The System for Observing Fitness Instruction Time (SOFIT) (McKenzie, Sallis, & Nader, 1991) was used to obtain simultaneous recordings of these variables. In brief, the physical activity levels of four randomly selected students, the lesson context, and teacher interactions in relation to promoting PA, were coded every 20 seconds (behaviour observed
for 10 seconds followed by 10 seconds of recording data) throughout the PE lesson on a rotational basis. The activity codes in SOFIT have been calibrated using heart rate monitoring (McKenzie, Sallis, & Nader, 1991; Rowe, Schuldheisz, & van der Mars, 1997) and validated using accelerometers (McKenzie, Sallis, & Armstrong, 1994). Observations for a PE lesson began when 51% of students in the class were changed into their PE uniforms and reported to the teaching area and ended when 51% left the teaching area to get changed back into their regular school uniform. This time period was recorded as useable PE class time. Students not physically participating in the PE lesson due to injury or illness were not included in the observations.

Coding of the activity levels, lesson context, and teacher interaction occurred at the end of each 10-second observation interval. Regarding lesson context, a decision was then made whether class time was being allocated for general content (such as management) or for subject matter (PE) content. If substantive PE content was occurring, an additional decision was made whether the focus was on knowledge content (coded as either general knowledge or physical fitness knowledge) or on motor content (physical activity). If motor content was occurring, a further coding of whether the context was one of fitness, skill practice, game play or free play was made (McKenzie, Sallis, & Nader, 1991). Movement skill instruction/practice was only coded as such if the motor content being taught was explicitly linked to a movement skill(s). In other words, skills being executed in a game play without explicit instruction from the teacher were game play and not skill practice.

Classifying PA levels was made by observing randomly selected students (one at a time) and determining their level of PA (or active engagement level). The PA/active engagement levels of 1 to 3 are used to describe the body position of the student (lying down, sitting, standing).
Intensity of PA is coded as a 4 if walking is observed. The highest activity intensity of 5 (very active) describes when the student is expending more energy than they would during normal walking. Physical activity coding was based on the observed activity intensity of the target student at the moment the observation interval ended (McKenzie, Sallis, & Nader, 1991).

Teacher interaction was classified into one of two categories. The first category ‘promotion of physical activity’, related to the teacher verbally or physically encouraging the student to be active. It also included the teacher demonstrating an activity or skill and participating with a student in a way that was perceived as supporting them to be active. The second teacher interaction category was no promotion of physical activity and referred to when none of the previously mentioned teacher behaviours were being observed in the teacher’s interaction with their students (McKenzie, Sallis, & Nader, 1991). Both the lesson context and teacher interaction categories of SOFIT were derived from definitions commonly used in both PE teacher training and PE pedagogy (Darst, Zakrajsek, & Mancini, 1989; Siedentop, 1991; Stewart, 1989).

Four research assistants were trained as SOFIT observers and conducted all the observations. Their training included lectures, video assessment, and live field practice. On completion of the training, the observers were only allowed to commence the observations for this study when an interrater agreement of 85% or more on all variables on pre-recorded “gold-standard” DVDs and during live field practice was reached. On completing each lesson, observers checked all recording forms for missing data. The author entered interval-by-interval codes into a computer for storage and analysis. Accuracy of data entry was maintained by cross checking 100% of raw data points with corresponding cases in the data file until entry was 100% correct. All (100%) cases were cross-checked.
4.2.5 Demographic data

Language most spoken at home was collected at baseline on each student from enrolment records. Cultural background was categorised according to region based on the Australian Standard Classification of Languages (Australian Bureau of Statistics, 2005). Categorisations included in this study were Northern European including English, Southern European, Eastern European, African, Middle-Eastern, Southern-Asian, South-East Asian, East Asian, and Pacific Islands. Enrolment records were also used to ascertain a measure of socioeconomic status based on postcode of residence using the Index of Relative Socio-Economic Disadvantage (IRSD) (ABS, 2006). To categorise SES, an IRSD score was allocated to each student and then compared with the decile stratifications of the Australian population. Deciles scoring 1 indicated the greatest socio-economic disadvantage and scoring 10 indicated the greatest socio-economic advantage.

4.2.6 Efforts to minimise bias

Several steps were taken to minimise bias in this study. These steps included recruiting SOFIT observers from pre-service PE teacher courses from two different Australian universities. At no stage were the observers aware of the objectives of the study and observers were required to undertake SOFIT observations at all six schools. This was done to prevent observer bias and variety of interpretations across the schools. Ten field-based interrater reliability checks (8% of the total observations) were conducted during the 12-month observation period. During reliability checks, two observers independently coded the same
students in the same PE lesson while being paced by synchronised MP3 players. A percentage of interrater agreement (IRA) was calculated for each variable using the following formula: 
[#agreements/(#agreements + #disagreements)] x 100. During the assessment period at both baseline and follow-up, ten lessons (8% of the total observations) were observed for reliability with minimum IRAs for student activity levels being 90%, 87% for lesson context, and 96% for teacher behaviour.

Informed consent was provided by the school principals, teachers, students and their parents. Consent was obtained via written consent or if language spoken at home was not English, New South Wales Department of Education language staff followed up for parental and student consent via a telephone call to the family’s home.

4.2.7 Quantitative variables

SOFIT was designed as a lesson-level measure. For basic descriptive statistics, the unit of analysis was a single lesson. For all other analyses, elemental observations made at 20-second intervals were aggregated and lesson context specific summaries were made of each lesson. This yielded up to 18 cases per observed lesson (3 school types x 6 lesson contexts).

The variables reported in this paper included: class factors, student activity levels, lesson context, and teacher interaction. Class factors were lesson length, and school-type. Student activity levels were the proportion of time spent in each of the activity levels. Time spent in MVPA was obtained by summing the proportion of lesson time spent in the “walking” and “very active” categories. Lesson context variables included the proportion of time spent in the
six lesson contexts. Teacher interaction variables were the proportion of time spent in two teacher interaction categories (PA promotion and no PA promotion).

### 4.2.8 Statistical methods

Percentages were calculated for all SOFIT data (student PA level, lesson context, and teacher interaction) for the entire sample and then stratified by school-type (all girls, all boys, and coeducational) at baseline and follow-up. Pearson and point biserial correlations were then calculated for PA intensity, lesson length, lesson context, and teacher interaction based on school type for baseline and follow-up. This was done to ascertain the relationship between the outcome variables and the covariates at the smallest discernable level. A series of multivariate general linear models were then constructed to ascertain changes in each of the SOFIT observations over time. Individual schools and classes were not included because there was variability in the number of classes, teachers, and class size in each of the different schools. All data were analysed using Statistical Package for Social Science (SPSS) version 14.

### 4.3 Results

#### 4.3.1 Participants

All teachers at the six schools who taught Year 7 PE (n=27) consented to having at least three PE classes being observed. The average class size was 24 students (range 14-27) at baseline. At follow-up, the number of observable PE classes had dropped from 27 to 21 with an average class size of 23 students (range 14-25). This decrease in the number of classes was
due to the declining number of student enrolments in these schools which resulted in a reduction in actual number PE classes being taught. Seven classes were observed twice and two classes were only observed once. The reason three observations were not performed on classes were if the observation for that class had been cancelled (for school administration reasons) and catch up observations were not possible before the completion of the school year. There was no active withdrawal from the study by participants or the schools.

At baseline, a total of 658 Year 7 students were enrolled in the six schools. Five hundred and eighty six (586) students (Boys, n=266; Girls, n=320; 89% of those enrolled) consented to demographic data being collected from school enrolment records at baseline and to being observed during PE classes. At follow-up in Year 8, there were 504 (Boys, n=225; Girls, n=279; 77% of those enrolled at baseline) of the students still enrolled in the participating schools.

### 4.3.2 Descriptive data

Slightly more participants were female (55%) with the all girls’ schools contributing the largest proportion (40%) of participants. The mean age of participants was 12.8 years ($SD=0.5$) at baseline and 13.9 years ($SD=0.4$) at follow-up. English and Middle-Eastern dialects were the most common languages spoken at home (38% and 36%, respectively). The representation of English spoken at home was well below the national average of 84% (ABS, 2010). East Asian dialects were the next most common language spoken at home at 7% indicating that the participants from Middle-Eastern and East Asian backgrounds were represented in the sample well above national population averages (1.2% and 2.3%, respectively) (ABS, 2010).
4.3.3 Main results

The percentage of lesson time for student activity levels, lesson contexts, and teacher interactions at baseline and follow-up are reported in Table 4.1. Walking (36.1% and 39.1%) followed by sitting (31.7% and 25.5%) were the most frequent activity types students engaged in during PE at baseline and follow-up, respectively. At baseline and follow-up, students spent 17.5% and 16.3% of time during PE standing whilst 20.8% and 12.9% of student activity would be considered very active at both collection points, respectively. Most time during PE was spent in MVPA at both baseline and follow-up (56.9% and 52.1%, respectively). This slight decline in MVPA from baseline to follow-up was not statistically significant (Mean Difference \(MD\) = -4.8; \(p=.777\)) but equated to a mean loss of 2.7 minutes of MVPA per PE lesson as students progressed from Year 7 into Year 8.
| Table 4.1. Unadjusted means, standard deviations, ranges of lesson proportions (%) / mean differences (MD), p values and Partial Eta Squared values for student activity levels, lesson contexts, and teacher interactions at baseline and follow-up |
| Category | Percentage of lesson (n=81) | Percentage of lesson (n=51) | Tests of within-subjects contrasts |
| | M | SD | Range | M | SD | Range | MD | p value | Partial Eta |
| **Student Activity** | | | | | | | | | |
| Lying down | 0.2 | 0.6 | 0.0 - 4.4 | 0.2 | 1.1 | 0.0 - 8.0 | 0.0 | .818 | .001 |
| Sitting | 25.5 | 16.4 | 0.0 - 67.3 | 31.7 | 24.1 | 0.0 - 100 | 6.2 | .503 | .009 |
| Standing | 17.5 | 11.0 | 1.1 - 45.6 | 16.3 | 10.5 | 0.0 - 43.6 | -1.2 | .563 | .007 |
| Walking | 36.1 | 14.4 | 5.6 - 74.5 | 39.1 | 18.5 | 0.0 - 84.4 | 3.0 | .117 | .048 |
| Very active | 20.8 | 11.1 | 2.1 - 57.1 | 12.9 | 12.7 | 0.0 - 62.9 | -7.9 | .009 | .127 |
| MVPA^ | 56.9 | 18.7 | 22.2 - 96.3 | 52.1 | 24.1 | 0.0 - 97.9 | -4.8 | .777 | .002 |
| **Lesson Context** | | | | | | | | | |
| Management | 30.8 | 13.2 | 3.6 - 67.2 | 22.3 | 10.7 | 0.6 - 49.4 | -8.5 | <.01 | .332 |
| Knowledge | 9.5 | 8.1 | 0.0 - 44.4 | 14.2 | 24.3 | 0.0 - 96.8 | 4.7 | .242 | .027 |
| Fitness | 7.1 | 11.4 | 0.0 - 71.7 | 10.6 | 18.1 | 0.0 - 86.3 | 3.5 | <.01 | .034 |
| Skill practice | 6.2 | 10.9 | 0.0 - 44.8 | 5.2 | 14.6 | 0.0 - 75.8 | -1.0 | .644 | .004 |
| Game play | 43.5 | 24.2 | 0.0 - 94.6 | 46.6 | 28.0 | 0.0 - 99.4 | 3.1 | <.01 | .033 |
| Other (free play) | 2.8 | 5.0 | 0.0 - 27.2 | 1.3 | 3.4 | 0.0 - 14.6 | -1.5 | <.01 | .014 |
| **Teacher Interaction** | | | | | | | | | |
| Promotion of PA | 30.8 | 19.4 | 0.0 - 89.4 | 10.1 | 8.2 | 0.0 - 30.3 | -20.7 | <.01 | .475 |
| No promotion of PA | 68.9 | 19.4 | 10.6 - 100 | 89.7 | 8.6 | 65.6 - 100 | 20.8 | <.01 | .476 |

| Mean of usable PE class time^ in minutes (Range) | Baseline (2008) | Follow-up (2009) |
| | 59 (19–110) | 59 (29–88) |
| Number of lessons with | | |
| >50% MVPA (%) | 49 (60.5) | 32 (62.7) |
| >25% Skills practice (%) | 8 (9.9) | 4 (7.8) |
| >35% Promotion PA (%) | 27 (33.3) | 0 (0) |

*Mean Difference based on test of within-subjects contrast; **p value represents statistical significance based on test of within-subjects contrast; ^ MVPA is the sum of the walking and very active categories; ^ Usable PE class time defined as when 51% of students arrive in the instruction area to when 51% of students depart instruction area.
Table 4.1 also shows the mean differences, $p$ values and Partial Eta Squared values for physical activity coded variables, lesson context, and teacher interaction over study period. The decrease in MVPA was not statistically significant; however, there was a significant decrease in the percentage of class time spent in the ‘very active’ category ($MD = -7.9; p = .009$) which is classified as vigorous physical activity by SOFIT.

In terms of lesson context, the majority of PE time was spent in ‘game play’ (43.5%) which increased slightly to 46.6% at 12-month follow-up ($MD = 3.1; p = .199$) (See Table 4.2). The percentage of PE class time spent in ‘skill practice’ or explicit skill instruction decreased from 6.2% to 5.2% ($MD = -1.0; p = .644$). This equated to only 2.9 minutes of skill instruction and practice during PE by the average class at 12-month follow-up. Regarding teacher interaction and the ‘promotion of student activity’, the time teachers spent encouraging and promoting their students to be physically active dropped significantly from 30.8% to 10.1% of PE class time ($MD = -20.7; p < .000$) at 12-month follow-up.

Approximately 60% of the lessons at each time point met the CDC recommendation of at least 50% of class time in MVPA. Whilst no formal guidelines exist for skill instruction and practice or teacher promotion of PA, other studies (Sallis et al., 1997; van Beurden et al., 2003) have reported proportions of around 30% (25% and 35%, respectively). Only 8 (9.9%) lessons at baseline and 4 (7.8%) at follow-up spent more than 25% of class time engaged in skill instruction and practice. Furthermore, in only 27 (33%) lessons at baseline and 0 (0%) lessons at follow-up did the PE teacher spend more than 35% of the lesson time promoting PA. The average number of useable minutes available for PE instruction over the study period remained constant at 59 minutes.
Table 4.2 shows the estimated marginal means and standard error (SE) of PE class time for physical activity levels, lesson context, and teacher interaction when stratified by school type over time. There were differences in the results across the three types of schools. There was a marked decline in MVPA in co-educational schools ($MD=-18.7$) compared with an increase in MVPA in all girls’ ($MD=6.5$) and no change in all boys’ schools ($MD=-0.9$). Furthermore, there was a substantial decline in the vigorous component of MVPA in the co-educational schools ($MD=-18.7$) compared with the other two school types (All girls’ $MD=-3.9$; All boys’ $MD=-1.3$). Other differences in student activity by school type were the substantial increases in PE class time spent sitting ($MD=9.8$) and standing ($MD=9.2$) in the coeducational schools compared with either a reduction or small change in these variables in all girls and all boys schools.

In terms of lesson context, the single sex schools both saw substantial reductions in the percentage of PE class time spent in management (all girls’ $MD=-14.6$; all boys’ $MD=-23.4$). These school types also saw substantial increases in the percentage of PE lesson time dedicated to game play (all girls’ $MD=8.6$; all boys’ $MD=19.0$). Conversely, the coeducation schools saw small increases in PE time spent in ‘management’ ($MD=2.3$) and reduced PE class time spent in ‘game play’ ($MD=-9.4$). All boys’ schools saw more time in PE dedicated to skill practice and instruction ($MD=4.5$) and fitness ($MD=3.0$) contrary to coeducational and all girls’ schools which experienced declines in skill instruction ($MD=-4.4$; $MD=-2.2$) and fitness ($MD=-6.0$; $MD=-2.2$), respectively.
All three school types saw substantial reductions in the percentage of PE class time teachers spent promoting PA. Coeducational and all girls’ schools had the largest reductions with teachers in both school types spending more than 30% of PE class time promoting PA in Year 7 to less than 10% in Year 8 ($MD = -25.7, -21.0$), respectively. All boys’ schools also saw falls from their Year 7 levels in Year 8 ($MD = -6.2$).
**Table 4.2.** Estimated marginal means and standard error (SE) of PE class time (%) for physical activity levels, lesson context, and teacher interaction stratified by school type over time

<table>
<thead>
<tr>
<th>Category</th>
<th>Co-educational schools</th>
<th>All girls’ schools</th>
<th>All boys’ schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008 (n=24)*</td>
<td>2009 (n=7)*</td>
<td>2008 (n=33)*</td>
</tr>
<tr>
<td></td>
<td>M (SE)</td>
<td>M (SE)</td>
<td>M (SE)</td>
</tr>
<tr>
<td><strong>Student Activity (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lying down</td>
<td>0.0 (0.1)</td>
<td>0.7 (0.3)</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Sitting</td>
<td>22.8 (4.7)</td>
<td>32.6 (7.0)</td>
<td>33.1 (3.2)</td>
</tr>
<tr>
<td>Standing</td>
<td>15.8 (2.6)</td>
<td>25.0 (2.7)</td>
<td>22.2 (1.8)</td>
</tr>
<tr>
<td>Walking</td>
<td>37.1 (3.9)</td>
<td>36.0 (5.4)</td>
<td>29.0 (2.6)</td>
</tr>
<tr>
<td>Very active</td>
<td>24.3 (2.5)</td>
<td>6.7 (3.4)</td>
<td>15.5 (1.7)</td>
</tr>
<tr>
<td>MVPA^</td>
<td>61.4 (4.7)</td>
<td>42.7 (6.8)</td>
<td>44.6 (3.1)</td>
</tr>
<tr>
<td><strong>Lesson Context (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>26.6 (3.2)</td>
<td>28.9 (2.9)</td>
<td>36.3 (2.2)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>13.6 (2.5)</td>
<td>18.8 (7.0)</td>
<td>10.5 (1.7)</td>
</tr>
<tr>
<td>Fitness</td>
<td>3.5 (2.3)</td>
<td>9.5 (5.3)</td>
<td>10.0 (1.6)</td>
</tr>
<tr>
<td>Skill practice</td>
<td>9.9 (3.3)</td>
<td>5.5 (4.3)</td>
<td>6.5 (2.2)</td>
</tr>
<tr>
<td>Game play</td>
<td>45.8 (6.8)</td>
<td>36.4 (7.8)</td>
<td>35.6 (4.5)</td>
</tr>
<tr>
<td>Other (free play)</td>
<td>0.5 (1.5)</td>
<td>1.9 (1.0)</td>
<td>1.1 (1.0)</td>
</tr>
<tr>
<td><strong>Teacher Interaction (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promotion of PA</td>
<td>35.3 (4.8)</td>
<td>9.6 (2.4)</td>
<td>30.8 (3.2)</td>
</tr>
<tr>
<td>No promotion of PA</td>
<td>64.6 (4.8)</td>
<td>90.2 (2.5)</td>
<td>68.8 (3.2)</td>
</tr>
</tbody>
</table>

^ MVPA is the sum of the walking and very active categories

* (n=) represents the number of lessons observed in each school-type
4.4 Discussion

The purpose of this study was to examine changes from the first to second year of secondary school in PA levels, lesson contexts and teacher interaction among secondary school students during compulsory PE in NSW. To the best of our knowledge, this is the first study to observe changes over a 12-month period in these variables in Australian secondary schools.

4.4.1 Changes in physical activity levels during PE

There was a significant decrease in the percentage of PE class time students spent being ‘very active’ (engaging in vigorous physical activity; VPA) (20.8% to 12.9%; MD=-7.9). The decreases in VPA participation found in this study differ from another among similarly aged participants. McKenzie et al. (2004) reported that time spent in VPA in the control group of their middle-school intervention stayed relatively consistent from baseline to 12-month follow-up (4.6% to 5.0%; MD=0.4). There are several possible reasons for the significant decline found in the current study. First, this decline in VPA during PE may be reflective of the age-related decline in PA that occurs during adolescence (Sallis, 2000). Second, most of the decline in VPA during PE was explained by the decline occurring in co-educational schools (which had co-educational PE classes). VPA in all girls’ and all boys’ schools declined around 4% and 1%, respectively, whereas the decline in co-educational schools was nearly 18%. The reasons for the greater decline in co-educational schools may be that, unlike all girls’ and all boys’ schools, co-educational schools also experienced increases in time spent in management and decreases in time spent in game play. As time spent in management was negatively ($r = -.218; p=.306$) and time spent in game play was positively ($r = .518; p=.010$) correlated to MVPA participation in co-educational schools, this suggests that lesson
context plays an important role in determining PA participation patterns of students during PE.

### 4.4.2 Changes in lesson context during PE

This study found that a substantial proportion of PE lesson time at baseline was spent in management (30.8%, 18.3 minutes) and that this significantly declined at follow-up (22.3%, 13.1 minutes; \( p < .001 \)). These proportions are higher than those found in other studies in Australia (18.8%; Brown & Holland, 2005), Asia (14%; Chow, McKenzie, & Louie, 2009) and the US (9.3%; McKenzie et al., 2004) and the decline is in contrast to the control group in the McKenzie et al (2004) study which reported no change from Year 6 to Year 8. A possible reason for the greater amount of time spent in management at both time points may be the high proportion of children from non-English speaking backgrounds in the sample, with only 38% of the students speaking English at home. This may suggest that language barriers increase the time teachers need to spend managing students as this context includes aspects such as giving verbal instructions. The significant decline in time spent in management overall was largely driven by the changes in the all girls’ and all boys’ schools (\( MD = -14.6\%; -23.4\% \), respectively). Conversely, co-educational schools experienced a small increase in management time during PE (\( MD = 3.3\% \)). This suggests that these teachers found it easier to manage students in single-sex classes, which is supported by Derry and Phillips (2004) in their study of teacher management time in all girls’ versus co-educational PE classes. The decline in management time may also be explained by the increases observed in game play which resulted in concomitant decreases in management time. Furthermore, the higher percentage of knowledge time in coeducational and all girls’ schools compared to that of the all boys’ schools may also have resulted in greater time spent in management for these particular schools.
The other areas of lesson context that are key to promoting physical activity participation in PE are skill practice and fitness instruction (Sallis et al., 1997; McKenzie et al., 2001; van Beurden et al., 2003). In this study, there was a small, but not significant reduction in skill practice ($MD = -1.0\%$) during the 12-month study period. Only all boys’ schools recorded increases in time spent in skill practice ($MD = 4.5\%$) whilst co-educational and all girls’ schools experienced declines of approximately four and two percentage points, respectively. These declines are similar to those found in the M-SPAN study ($MD = -0.8\%$; McKenzie et al., 2004) and suggest that PE teachers spend very small proportions of time instructing and practicing skills as students’ progress through secondary schooling. A possible reason for this is that PE teachers see the teaching of movement skills as less important as students’ age. It may also be that PE teachers find it difficult to engage students when teaching them skills.

There were also small, non-significant increases in the amount of time spent in fitness during PE ($MD = 3.5\%, p = .191$). These increases were most noticeable in the single-sex and co-educational schools and are similar to those found in the control group in the M-SPAN study ($MD = 1.1\%$) (McKenzie et al., 2004). A possible explanation for this may be that teachers feel it is developmentally appropriate to spend more time in health–related fitness instruction as it is less inherently risky for students as they move through adolescence (Boreham & Riddoch, 2001).

### 4.4.3 Changes in teacher interaction during PE

This study also found that teachers spent just under one-third of PE class time (30.8%) promoting physical activity in Year 7 and that this percentage significantly declined by Year 8 (10.1%, $MD = -20.7\%, p < .001$). None of the lessons observed at follow-up reported more than
35% of class time promoting physical activity. Furthermore, the declines were consistent across all three school types. There have been no known studies reporting on changes in promotion of PA by teachers during PE but a cross-sectional study in the US found that around 35% of class time in middle school was spent promoting PA (McKenzie, Marshall, Sallis, & Conway, 2000). Whilst there are no clear justifications for why promotion of PA would drop significantly as students move through secondary school, one explanation could be the autonomy students seek as the move through adolescence and teachers giving them more responsibility for their own physical activity as a result. There is some evidence from longitudinal studies that adolescents’ increase their desire for control over their own educational experiences, especially as they move through Years 6 and 7 (Eccles et al., 1991). However, given that participation in physical activity significantly declines over this time, PE teachers still have an important role in promoting physical activity among older students (CDC, 2011).

4.4.4 Changes based on school type

Although these analyses were largely exploratory due to the small number of class observations in each group, there were differences across the three types of schools that are worth highlighting. There were marked declines in MVPA in co-educational schools ($MD = -18.7\%$) compared with the increases in MVPA or relative stability of MVPA in all girls’ ($MD = 6.5\%$) and all boys’ schools ($MD = -0.9\%$). Furthermore, in terms of lesson context, time spent in game play in coeducational schools declined ($MD = -9.4\%$) whilst it increased in both the all girls’ and all boys’ schools ($MD = 8.6\%; 19.0\%$) and the time in management in coeducational schools increased ($MD = 2.3\%$) whilst it decreased in the all girls’ ($MD = -14.6\%$) and all boys’ ($MD = -23.4\%$) schools.
An explanation for these findings may be that only a small number of classes in the coeducational schools were observed at follow-up. Additionally, the increases and relative stability of MVPA in the all girls’ and all boys’ school compared with the decline in coeducational schools could be related to the differences that exist in lesson contexts of single-sex and coeducational schools. This study found that game play only declined in coeducational schools contrary to changes experienced in the single-sex schools, suggesting that in co-educational classes, one sex dominates participation in PE. A recent observational study that compared the opportunities girls and boys had to participate in team games in single-sex and co-educational high school PE classes suggested that students in single-sex PE settings receive more opportunities for participation (Hannon & Ratliffe, 2007). This finding is supported by qualitative research that suggests that boys tend to dominate in game play during PE because values such as independence, competitiveness, and individuality can be predominately attributed to boys and not girls (Alexander & Luckman, 2001; Brunton, 2003; Park & Wright, 2000). The domination of game play by boys, and the physical activity participation that ensues, may increase as they age in co-educational classes. As such, it may provide an explanation of the declines in MVPA when boys and girls are being observed and proportions of MVPA calculated on observations of both genders simultaneously. Furthermore, if students are not participating in game play because of a gender domination differential, more management issues may arise which may also explain the increases in management time in the co-educational schools.

4.4.5 Strengths and limitations

A strength of this study was that it was the first known to objectively quantify PA participation, lesson context and teacher interaction at baseline and 12-month follow-up in Australian secondary schools. The main limitation of this study was that it reported findings
from a small number of schools and that the number of lesson observations declined into the second year. This made it difficult to infer data on the effect of school-type. Another limitation was that data were only collected at two time points which does not allow for trends to be determined. Further longitudinal research is needed to ascertain whether any trends in MVPA, skill instruction and practice time, and teacher promotion of PA exist as students’ progress into their latter years of compulsory secondary physical education. Finally, data were collected at the same time of the year. We were unable to determine with these data if seasonal issues, such as weather and PE program choices, affected results.

4.4.6 Implications of findings

This study suggests that NSW PE teachers are delivering CDC recommended levels of MVPA during PE and that their predominant means of doing so is via ‘game play’ during their lessons. More research is needed to ascertain what support NSW PE teachers need in the form of professional development and school structure/policy to keep students physically active whilst students are engaged in ‘game play’ and still teach other outcomes set by the Years 7-10 PDHPE syllabus such as movement skills, tactics strategies, teamwork, and problem-solving.

Furthermore, it appears from this study that PE being implemented in NSW secondary schools should examine how it may alleviate the decline in VPA participation and teacher promotion of PA. The declines in promotion of PA are especially cause for alarm as teachers should be expected to maintain adequate levels of feedback and encouragement to promote participation in PE.
4.5 Conclusion

Although it appears NSW schools are able to reduce the amount of time they spend managing students during PE, it is the decline in this VPA and teacher promotion of PA that is of concern. Given the declines in VPA and the increases in time spent in game play, further research is needed to ascertain whether PE instruction could be improved by focussing on skill instruction and fitness in a games-based PE instruction model. Finally, further research for increasing teacher promotion of PA during PE is needed and this may need to occur in the form of professional development programs.

4.6 References


U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health. (2010). *Strategies to Improve the Quality of Physical Education.* United States Government: Washington D.C.


CHAPTER 5

Changes in Enjoyment of Physical Education from Year 7 to Year 8


5.1 Introduction

Physical activity (PA) is associated with a number of health benefits in adolescents. These include reduced anxiety and depression symptoms, increased perceptions of global and physical self-concept, reduced adiposity, improved skeletal health, improved psychosocial health, and improved academic performance (Strong et al., 2005). Recent cross-sectional data show that only 15% of Australian adolescents participate in adequate amounts of PA and that this prevalence declines during adolescence (National Heart Foundation and Cancer Council, 2011). One domain in which PA can occur regularly is during physical education (PE). The role of PE in promoting health-enhancing physical activity is well established (Pate, Davis, Robinson, Stone, McKenzie, & Young, 2006) but recent studies have shown that PA participation during PE in the early years of secondary schooling also declines (Dudley et al., under review; McKenzie et al., 2004). Whilst PA participation during PE is not the sole goal of PE as a curriculum area, it is also commonly accepted that quality PE should be enjoyable for young people to maximise the lifelong development of motor skills, health-related fitness, and health-enhancing physical activity behaviour (Centres for Disease Control, 1997; 2011). The notion of ‘enjoyment’ is seen as integral to effective PE curricula and pedagogy (Ferrer-
Caja & Weiss, 2000). The Centres for Disease Control and Prevention (CDC) identify the importance of enjoyable PE in order to encourage physical activity (PA) participation among children and adolescents. Specifically, the CDC recommends the “use of active learning strategies and an emphasis on enjoyable participation in physical education classes” (CDC, 2011; p.31). Although PE teachers have different views on how enjoyment should be encouraged within a PE curriculum (Cothran & Ennis, 1999; Griffin, Chandler, & Sariscsany, 1993; O’Reilly, Tompkins, & Gallant, 2001), it is suggested that creating meaningful activities for students and developing positive relationships among students and teachers during PE is important when engaging students in enjoyable learning (Cothran & Ennis, 1999; Griffin, Chandler, & Sariscsany, 1993; O’Reilly, Tompkins, & Gallant, 2001. No known studies have specifically examined how enjoyment of PE changes over time during secondary school. The purpose of this study was to assess the enjoyment of PE among students in their first year of secondary school and how this changes over a 12-month period.

5.2 Methods

5.2.1 Design

This chapter reports on the baseline and follow-up data from the Physical Activity in Linguistically Diverse Communities (PALDC) project that incorporated a prospective cohort design. The STROBE Statement (Strengthening the Reporting of Observational Studies in Epidemiology) (von Elm et al., 2008) was followed to ensure the transparent reporting of the study.
5.2.2 Setting and participants

Participants were students enrolled in Grade 7 (first year of secondary school in the state of New South Wales, Australia) in 2008 and assessed 12-months later in Grade 8 in 2009. They were recruited from six secondary schools in south-western Sydney, Australia that were identified by the New South Wales Department of Education and Communities (NSW DEC) as having a high proportion of students from culturally and linguistically diverse (CALD) backgrounds. Four of the schools were single-sex (two all boys’ and two all girls’ schools) and two were co-educational. In each school, all enrolled Year 7 students were invited to participate in the study.

5.2.3 Variables

The primary outcome for this study was enjoyment of PE, operationalised as total enjoyment of PE as well as each of the 11 individual enjoyment items within the Physical Activity Enjoyment Scale (PACES-PE Version) (Motl et al., 2001). Covariates included the length of the PE lesson (time) and school type. Demographic data included sex, age, cultural background (based on language most spoken at home) and socioeconomic status (based on postcode of residence).

5.2.4 Measurement

The Physical Activity Enjoyment Scale for Physical Education (PACES PE Version) (Motl et al., 2001) (see Figure 5.1) was used to collect enjoyment of PE data from the participants. It is
a modified version of the original PACES developed to measure PA enjoyment in college-aged students. Initially, PACES (PE version) consisted of 32 items based on the sources of enjoyment in youth sports (Scanlan et al., 1993; Wankel & Kriesel, 1985). Motl et al. (2001) then evaluated these 32 items using focus groups of eighth grade girls and condensed the final version down to 12-items rated on a 5-point Likert-type scale ranging from 1 (“Dislike a lot”) to 5 (Enjoy a lot”). Figure 5.1 is the final version of PACES (PE version) as published by Motl et al. (2001).
**Factors Influencing Enjoyment of Physical Education**

*When I am in PE class... (1) Dislike a lot... (5) Enjoy a lot*

1. Learning new skills is something that I
2. Changing clothes is something that I
3. Working out with other students is something that I
4. Doing different types of physical activities is something that I
5. Getting warmed up and breaking a sweat is something that I
6. Being with the other students in class is something that I
7. Getting a break from other classes is something that I
8. Being in the gym or on the playing field is something that I
9. Showering after class is something that I
10. Learning about physical fitness and health is something that I
11. Being with the PE teacher is something that I
12. Getting some exercise is something that I

**Figure 5.1**: The Physical Activity Enjoyment Scale (Physical Education version) (Motl et al., 2001)
5.2.4.1 Validity and reliability of Physical Activity Enjoyment Scale (PE Version)

The PACES (PE) instrument was tested for validity and reliability using 8th grade adolescent girls (N=1797) with a mean age of 13.6 years from a North American sample (49.9% African American, 45.8% Caucasian, and 4.3% other or unreported) (Motl et al., 2001). These adolescent girls were randomly assigned to either a calibration (N=899) or cross-validation (N=898) sample, each of which completed the PACES and measures of factors influencing enjoyment of PE, PA, and sport involvement. The validity of the PACES and the measure of factors influencing enjoyment of PE were tested using confirmatory factor analysis. Structural equation modelling (SEM) was also performed to test the relationships among the measures of enjoyment of PE (Motl et al., 2001).

To examine whether measurement of enjoyment of PE was consistent with the researchers' understanding of enjoyment of PE, the authors of PACES (PE Version) (Motl et al., 2011) used a Confirmatory Factor Analysis to test the correlated uniqueness between Items 3 and 6 and Items 2 and 9 of the PACES (PE version) instrument. Model fit was based on generally accepted thresholds for the chi-square index, root mean square error of approximation (RMSEA), relative noncentrality index (RNI), and the non-normed fit index (NNFI). The chi-square index assesses absolute fit of the model to the data, it is however sensitive to sample size (Hi, Li-tze, & Bentler, 1999). The RMSEA represents closeness of fit with values in the vicinity of zero to 0.06 demonstrating an exact or close fit to the model (Hi, Li-tze, & Bentler, 1999). Models whose RMSEA is 0.1 or higher are deemed by Hi, Li-tze, and Bentler (1999) to have a poor fit. The confidence interval (CI) of 90% around the RMSEA statistic should also contain a zero to 0.06 value in order to indicate an exact to close fit. The RNI and NNFI
test the proportionate improvement in fit by comparing the target model with the independence model (Hi, Li-tze, & Bentler, 1999). The minimal acceptable fit in both the RNI and the NNFI are values of 0.90 with values of 0.95 indicating a good fit (Hi, Li-tze, & Bentler, 1999). According to Motl et al. (2001), the Confirmatory Factor Analysis modelling of the PACES PE Version represented an acceptable fit (chi-square; $x^2=223.49$, RMSEA =0.061 [90% CI=0.053– 0.069], RNI =0.94, NNFI=0.92). This demonstrated that PACES (PE Version) has cross-sample validity with estimates of factor loadings, uniqueness, standard errors, $t$ values, and squared multiple correlations all being of appropriate sign and/or magnitude.

Structural Equation Modelling is a method for testing and estimating the causal relationship between statistical data and qualitative causal assumptions (Kaplan, 2000). One of the strengths of SEM is the ability to construct latent variables (these are variables which are not measured directly, but are estimated in the model from several measured variables, of which, each is predicted to be linked to the latent variables) (Kaplan, 2000). This allows researchers to examine the reliability of measurement in the model, which in turn allows the relationship between latent variables to be estimated. The Structural Equation Modelling of PACES (PE Version) was tested using Confirmatory Factor Analysis on the entire sample of adolescent girls and was deemed adequate to estimate the structural model (Motl et al., 2001) and consisted of four latent variables (enjoyment, factors influencing enjoyment of PE, physical activity, and sport involvement) (Motl et al., 2001). The Confirmatory Factor Analysis in the Structural Equation Modelling reported by Motl et al. (2001) indicated that the measurement model again represented an acceptable fit (chi-square; $x^2=1769.57$, RMSEA =0.040 [90% CI=0.038–0.042], RNI =0.93, NNFI =0.92) to indicate the factor loadings, uniquenesses, standard errors, $t$-values, and squared multiple correlations were all of appropriate sign and/or
magnitude. The interfactor correlations were statistically significant and ranged between 0.19 and 0.45 (M =0.30, MD =0.28).

The results reported by Motl et al. (2001) support the validity of scores from the PACES as a measure of physical activity enjoyment among African-American and Caucasian adolescents. The authors also state that a significant relationship existed between the scores on the PACES instrument which provides convergent validity of PACES scores in regard to adolescent enjoyment of PE. In other words, that the individual items within the PACES instrument are in fact related to the larger construct of enjoyment of PE. Furthermore, according to Motl et al. (2001) when the modified PACES (PE Version) was used on adolescent girls, the internal consistency (the extent to which the instrument tests enjoyment of PE) had a Cronbach’s alpha (Cronbach, 1951) of 0.87. Cronbach’s alpha is a coefficient statistic ranging between 0 and 1 (Cronbach, 1951).

In the current study, item 9 “Showering after class is something that I” was deleted from the scale because none of the participants involved in the study attended schools that provided showering facilities. Two tests were conducted to ascertain reliability of the modified PACES (PE version) (Appendix E) without item 9. Firstly, internal consistency statistics for the modified PACES (PE Version) were calculated across the sample from baseline (N=560) and follow-up (N=504) data. Participants came from all six schools and all 27 PE classes. Internal consistency scores were re-calculated on the effect of removing each enjoyment item within the PACES (PE version). Secondly, a one-week test-retest reliability analysis was conducted on 91 (10%) students. Data were reported as an intraclass correlation (ICC) coefficient and a coefficient of variation (CV). The minimum acceptable value for an ICC as a reliability coefficient is 0.75 with agreement greater than 0.90 being classified as excellent (Shrout &
Fleiss, 1979). Whilst CVs are dependent on instrument measures and no range can be determined as indicating a good method performance or poorer method performance in universal statistical analysis, Motl et al. (2001) report the CV of the original PACES (PE version) instrument to be 5%.

Table 5.1 shows that the PACES (PE Version) had an overall internal consistency of $\alpha=0.74$ at baseline and $\alpha=0.80$ at follow-up indicating that whilst slightly lower than reported in previous studies of adolescents (Motl et al., 2001) is still well within acceptable limits. All of the 11 individual enjoyment items within the PACES (PE Version) also showed acceptable internal consistency with scores ranging between $\alpha=0.71$ and $\alpha=0.81$. Furthermore, one-week test-retest reliability analysis of the sub-sample proved to have acceptable reliability with a CV of 5.1% and an ICC of 0.86 which are consistent with the CV reported in the original PACES (PE version) instrument development by Motl et al. (2001) and the ICC indicating acceptable values in accordance with Shrout and Fleiss (1979).
Table 5.1: Physical Activity Enjoyment Scale (PE Version) Reliability

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Enjoyment Items</td>
<td>Cronbach’s α (Baseline) if item was deleted</td>
<td>.715</td>
<td>.741</td>
<td>.721</td>
<td>.714</td>
<td>.733</td>
<td>.730</td>
<td>.749</td>
<td>.715</td>
<td>.708</td>
<td>.722</td>
</tr>
<tr>
<td></td>
<td>Cronbach’s α (Follow-up) if item was deleted</td>
<td>.776</td>
<td>.809</td>
<td>.777</td>
<td>.772</td>
<td>.795</td>
<td>.790</td>
<td>.805</td>
<td>.777</td>
<td>.789</td>
<td>.788</td>
</tr>
<tr>
<td>PACES (PE) Cumulative Score</td>
<td>Cronbach’s α (Baseline)</td>
<td>.743</td>
<td></td>
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<tr>
<td></td>
<td>Cronbach’s α (Follow-up)</td>
<td>.803</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Test-retest reliability (Follow-up/Retest)</td>
<td>Intraclass correlation coefficient (ICC)</td>
<td>.863</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Typical error (%CV)</td>
<td>5.1%</td>
<td></td>
<td></td>
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</tbody>
</table>
5.2.3 Procedures

The procedures for this study were approved by the University of Wollongong Human Research Ethics Committee (Appendix B, HE 07/062). All participants and their parents or legal guardian were provided with information sheets about the study and provided written informed consent. Demographic data were collected on all 586 consenting participants from school enrolment records. Data collected included sex, date of birth, postcode of residence (used as socioeconomic status proxy) and language most spoken at home (used to determine cultural background).

Trained data collectors administered the PACES (PE version) to participants during a single PE lesson in the second semester of the school year (July-November 2008 and July to November 2009). Analyses were performed on data collected in 2008 when the students were in seventh grade and again in 2009 school when the same students were in eighth grade. Collecting data in the same months of the year ensured that variation in season was not a factor affecting enjoyment.

5.2.4 Data analysis

Means, standard deviations and effect sizes using Cohen’s $d$ (Cohen, 1988) were calculated for enjoyment scores (both total and individual enjoyment items) at baseline and follow-up. Statistically significant differences greater than 0.4 at baseline were considered large enough to infer that a meaningful difference existed between the enjoyment items. Effect sizes (Cohen’s $d$) were calculated as the difference between the means at baseline and follow-up divided by the pooled standard deviation (Cohen, 1988). By convention, the subtraction of the
follow-up mean from the baseline mean indicates whether the difference is positive (indicated by a positive $d$ value) or negative (indicated by a negative $d$ value).

Estimated marginal means followed by a general linear multivariate analyses were then conducted accounting for time, sex and school-type. This was done to ascertain the relationship between the outcome variables and the covariates at the smallest discernable level. As for most statistical tests in the social sciences, follow-up estimated marginal means (accounting for each of the covariates) were deemed to have changed significantly if the change from baseline to follow-up was $p<0.05$ (Schmidt, 1996). All data were analysed using Statistical Package for Social Science (SPSS) version 14.

### 5.3 Results

#### 5.3.1 Participants

A total of 658 Year 7 students were enrolled in the six schools. Of the total enrolment, 586 students (Boys, $n=266$; Girls, $n=320$; 89% of those enrolled) consented to demographic data being collected from school enrolment records and participation in the enjoyment questionnaire. Demographic data were collected on all 586 students (89%) at consent and enjoyment of PE data were collected on 560 students (85%) at baseline and 504 (77%) of these students at 12-month follow-up (See Figure 5.2).
Year 7 enrolment (N=658)

Consented (N=586) (89%)

Demographic data obtained (N=586) (89%)

Baseline (N=560) (85%)

12 month follow-up (N=504) (77%)

Not consented (N=72)

Reasons were
a) Failure to return consent form
b) Leaving school
c) Lack of interest in the study

Attrition rate (N=26)
Reasons were
a) Absent during testing
b) Leaving school

c) Absent during testing
d) Leaving school

Consented  (N=586) (89%)

Baseline (N=560) (85%)

Attrition rate (N=56)
Reasons were
c) Absent during testing
d) Leaving school

Figure 5.2: Flowchart of study
5.3.2 Descriptive Data

Table 5.2 shows that slightly more participants were female (55%) with the all girls’ schools contributing the largest proportion (40%) of participants. The mean age of participants was 12.8 years (SD=0.5) at baseline and 13.9 years (SD=0.4) at follow-up. English and Middle-Eastern dialects were the most common languages spoken at home (38% and 36%, respectively). The representation of English spoken at home was well below the national average of 84% (Australian Bureau of Statistics, 2010). East Asian dialects were the next most common language spoken at home at 7% indicating that the participants from Middle-Eastern and East Asian backgrounds were represented in the sample well above national population averages (1.2% and 2.3%, respectively) (ABS, 2010). As would be expected in a cohort study with a 12-month follow-up period, the proportion of boys and girls, students from different school types, and from different cultural backgrounds and deciles of socio-economic disadvantage remained essentially the same at follow-up as it was at baseline. The only exception was that there was a 10% decrease in participants residing within decile 4 postcodes (48% to 44%).
Table 5.2. Characteristics of the PALDC study (Enjoyment of PE)

<table>
<thead>
<tr>
<th></th>
<th>Baseline (PACES PE)</th>
<th>Follow-up (PACES PE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>254 (45%)</td>
<td>225 (45%)</td>
</tr>
<tr>
<td>Female</td>
<td>306 (55%)</td>
<td>279 (55%)</td>
</tr>
<tr>
<td>Total</td>
<td>560</td>
<td>504</td>
</tr>
<tr>
<td><strong>Mean age (SD)</strong></td>
<td>12.8 (0.5)</td>
<td>13.9 (0.4)</td>
</tr>
<tr>
<td><strong>Participants by school type (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-educational</td>
<td>178 (32%)</td>
<td>167 (33%)</td>
</tr>
<tr>
<td>All girls</td>
<td>233 (42%)</td>
<td>208 (41%)</td>
</tr>
<tr>
<td>All boys</td>
<td>149 (26%)</td>
<td>129 (26%)</td>
</tr>
<tr>
<td><strong>Language spoken at home (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English or Northern European</td>
<td>210 (38%)</td>
<td>190 (38%)</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>205 (37%)</td>
<td>179 (36%)</td>
</tr>
<tr>
<td>East Asian</td>
<td>40 (7%)</td>
<td>39 (8%)</td>
</tr>
<tr>
<td>Eastern European</td>
<td>26 (5%)</td>
<td>36 (7%)</td>
</tr>
<tr>
<td>South East Asian</td>
<td>21 (4%)</td>
<td>21 (4%)</td>
</tr>
<tr>
<td>Pacific Islands</td>
<td>18 (3%)</td>
<td>15 (3%)</td>
</tr>
<tr>
<td>Southern Asian</td>
<td>15 (3%)</td>
<td>13 (3%)</td>
</tr>
<tr>
<td>African</td>
<td>10 (2%)</td>
<td>8 (2%)</td>
</tr>
<tr>
<td>Southern European</td>
<td>5 (&gt;1%)</td>
<td>4 (&gt;1%)</td>
</tr>
<tr>
<td><strong>Index of Relative Social Disadvantage Deciles</strong>&lt;sup&gt;8&lt;/sup&gt; (%) based on postcode of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6 (1%)</td>
<td>5 (&gt;1%)</td>
</tr>
<tr>
<td>2</td>
<td>4 (&gt;1%)</td>
<td>4 (&gt;1%)</td>
</tr>
<tr>
<td>3</td>
<td>1 (&gt;1%)</td>
<td>1 (&gt;1%)</td>
</tr>
<tr>
<td>4</td>
<td>266 (48%)</td>
<td>224 (44%)</td>
</tr>
<tr>
<td>5</td>
<td>53 (11%)</td>
<td>49 (10%)</td>
</tr>
<tr>
<td>6</td>
<td>40 (7%)</td>
<td>36 (7%)</td>
</tr>
<tr>
<td>7</td>
<td>3 (&gt;1%)</td>
<td>3 (&gt;1%)</td>
</tr>
<tr>
<td>8</td>
<td>15 (3%)</td>
<td>14 (3%)</td>
</tr>
<tr>
<td>9</td>
<td>62 (11%)</td>
<td>58 (12%)</td>
</tr>
<tr>
<td>10</td>
<td>110 (20%)</td>
<td>110 (22%)</td>
</tr>
</tbody>
</table>

<sup>8</sup>Lower IRSD deciles indicate greater socio-economic disadvantage
5.3.3 Main Results

Table 5.3 reports the unadjusted means, standard deviations and effect sizes of total and individual enjoyment items of PE for boys and girls over time. Means are reported in terms of Mean Difference (MD) from baseline to follow-up. Effect sizes are reported as a Cohen’s $d$ value and a semantic descriptor of the effect size. When judging effect sizes in terms of educational outcomes (enjoyment is frequently defined as a legitimate educational outcome for PE) (Dudley et al., 2011), Hattie (2009) recommends in relation to educational outcomes that $d=0.2$ is a small, $d=0.4$ is a medium and $d=0.6$ is a large effect size (Hattie, 2009; p.9).

At baseline, total enjoyment of PE was 45.8 out of 55 (Range 11-55) (Boys 45.9, Girls 45.7) indicating that the average student responded to the PACES enjoyment items with a response of “Enjoy a little” to most questions. Little variation existed between boys and girls at baseline. In each of the 11 individual enjoyment items (Range 1-5) within the PACES (PE version), boys and girls had identical ratings at baseline of their enjoyment of PE in items ‘Learning new skills’ (4.5), ‘Being with other students’, (4.6), ‘Participating in different types of physical activity’ (4.5), and ‘Getting exercise’ (4.6). Two enjoyment items had differences of 0.4 or greater between boys and girls at baseline. They were ‘Getting warmed up and sweaty’ (3.7 boys; 3.1 girls) and ‘Being with the PE teacher’ (3.9 boys; 4.3 girls). This indicates that the enjoyment of PE in boys and girls is comparable across most enjoyment items of PE using PACES (PE Version) with the exception of items 5 and 10 from baseline. Further baseline data analysis revealed that item 2 “Changing clothes” was the lowest scored item, for boys and girls irrespective of sex, with a mean of 2.9 (1.2 SD) (Boys, 2.8; Girls, 3.0).
At follow-up, Table 5.3 shows that overall enjoyment of PE had a mean decline (MD) of -1.8. The 12-months between Year 7 and Year 8 had a small negative effect size on enjoyment of PE (d= -0.30). The declines, however, showed that time had larger negative effect size in girls (MD= -2.3; d= -0.39) compared with boys (MD= -1.2, d= -0.21). Item 2 ‘Changing Clothes’ and Item 5 ‘Getting warmed up and sweaty’ still remained the lowest scoring items (M=2.7, MD= -0.2; M=3.4, MD=0.0) for both sexes at follow-up (Girls M=2.5, 3.0 respectively; Boys M=2.7, 3.4 respectively). ‘Changing Clothes’ however increased at follow-up and had a small positive effect size in boys (MD=0.1, d=0.09) but noticeably decreased in girls with a medium negative effect size in girls (MD= -0.5; d=0.42). The relationships that exist within a PE class were also important. Item 3 ‘Being active with other students’ and item 10 ‘Being with the PE teacher’ were shown to have an overall negative effect size of d= -0.40 and -0.31 respectively. In ‘Being with the PE teacher’, the decline was greater in girls.
Table 5.3: Unadjusted means (Standard Deviation) and effect size (Cohen’s $d$) of enjoyment of physical education by sex and enjoyment item over time

<table>
<thead>
<tr>
<th>PACES (PE)</th>
<th>Baseline (N=225)</th>
<th>Follow-up (N=225)</th>
<th>Effect size* (Cohen’s $d$)</th>
<th>Baseline (N=279)</th>
<th>Follow-up (N=279)</th>
<th>Effect size* (Cohen’s $d$)</th>
<th>Baseline (N=504)</th>
<th>Follow-up (N=504)</th>
<th>Effect size* (Cohen’s $d$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1. Learning new skills</td>
<td>4.5 (.67)</td>
<td>4.4 (.85)</td>
<td>-0.13</td>
<td>4.5 (.67)</td>
<td>4.3 (.79)</td>
<td>-0.27</td>
<td>4.5 (.67)</td>
<td>4.3 (.82)</td>
<td>-0.27</td>
</tr>
<tr>
<td>2. Changing clothes</td>
<td>2.8 (1.2)</td>
<td>2.9 (1.1)</td>
<td>0.09</td>
<td>3.0 (1.2)</td>
<td>2.5 (1.2)</td>
<td>-0.42</td>
<td>2.9 (1.2)</td>
<td>2.7 (1.1)</td>
<td>-0.17</td>
</tr>
<tr>
<td>3. Being active with other students</td>
<td>4.6 (.68)</td>
<td>4.3 (.81)</td>
<td>-0.40</td>
<td>4.6 (.69)</td>
<td>4.3 (.82)</td>
<td>-0.40</td>
<td>4.6 (.68)</td>
<td>4.3 (.82)</td>
<td>-0.40</td>
</tr>
<tr>
<td>4. Different types of PA</td>
<td>4.5 (.74)</td>
<td>4.4 (.82)</td>
<td>-0.13</td>
<td>4.5 (.77)</td>
<td>4.3 (.87)</td>
<td>-0.24</td>
<td>4.5 (.76)</td>
<td>4.4 (.85)</td>
<td>-0.12</td>
</tr>
<tr>
<td>5. Getting warmed up and sweaty</td>
<td>3.7 (1.1)</td>
<td>3.9 (1.0)</td>
<td>0.19</td>
<td>3.1 (1.3)</td>
<td>3.0 (1.2)</td>
<td>-0.08</td>
<td>3.4 (1.3)</td>
<td>3.4 (1.2)</td>
<td>0.00</td>
</tr>
<tr>
<td>6. Being with others</td>
<td>4.3 (.86)</td>
<td>4.1 (.92)</td>
<td>-0.22</td>
<td>4.5 (.78)</td>
<td>4.4 (.83)</td>
<td>-0.12</td>
<td>4.4 (.82)</td>
<td>4.3 (.89)</td>
<td>-0.12</td>
</tr>
<tr>
<td>7. Getting a break from other classes</td>
<td>4.4 (.91)</td>
<td>4.3 (.91)</td>
<td>-0.11</td>
<td>4.3 (.97)</td>
<td>4.4 (.91)</td>
<td>0.11</td>
<td>4.4 (.94)</td>
<td>4.3 (.91)</td>
<td>-0.11</td>
</tr>
<tr>
<td>8. Being in the gym/playing fields</td>
<td>4.6 (.73)</td>
<td>4.5 (.79)</td>
<td>-0.13</td>
<td>4.4 (.88)</td>
<td>4.3 (.88)</td>
<td>-0.11</td>
<td>4.5 (.82)</td>
<td>4.4 (.85)</td>
<td>-0.12</td>
</tr>
<tr>
<td>9. Learning about fitness</td>
<td>3.9 (1.0)</td>
<td>3.8 (1.0)</td>
<td>-0.10</td>
<td>4.0 (.99)</td>
<td>3.7 (1.1)</td>
<td>-0.29</td>
<td>4.0 (.99)</td>
<td>3.7 (1.0)</td>
<td>-0.30</td>
</tr>
<tr>
<td>10. Being with the PE teacher</td>
<td>3.9 (.85)</td>
<td>3.7 (1.0)</td>
<td>-0.22</td>
<td>4.3 (.94)</td>
<td>3.9 (1.0)</td>
<td>-0.41</td>
<td>4.1 (.92)</td>
<td>3.8 (1.0)</td>
<td>-0.31</td>
</tr>
<tr>
<td>11. Getting exercise</td>
<td>4.6 (.75)</td>
<td>4.4 (.78)</td>
<td>-0.26</td>
<td>4.6 (.70)</td>
<td>4.4 (.84)</td>
<td>-0.26</td>
<td>4.6 (.72)</td>
<td>4.4 (.81)</td>
<td>-0.26</td>
</tr>
<tr>
<td>PACES (PE) Total Score</td>
<td>45.9 (5.3)</td>
<td>44.7 (6.3)</td>
<td>-0.21</td>
<td>45.7 (6.1)</td>
<td>43.4 (5.8)</td>
<td>-0.39</td>
<td>45.8 (5.7)</td>
<td>44.0 (6.1)</td>
<td>-0.30</td>
</tr>
</tbody>
</table>

*Cohen’s $d = (M_1 - M_2) / SD_{pooled}$

where $SD_{pooled} = [SD_1 + SD_2] / 2$
Table 5.4 shows estimated marginal means and between-subjects effects by time between baseline and follow-up, time between baseline and follow-up stratified by sex, and time between baseline and follow-up stratified by school type. Whilst only small, there was an overall significant estimated marginal mean decline ($MD = -1.8$) in enjoyment of PE in the 12-month study period ($p < .0001$). Furthermore, in each of the individual enjoyment items, all but two (‘Getting warmed up and sweaty’ and ‘Getting a break from other classes’) exhibited small ($< MD = -0.3$) but statistically significant declines across the cohort from baseline to follow-up.

When examining changes over time for boys and girls, there was no statistical difference in the overall decline in enjoyment of PE between boys and girls ($p = .083$) (Girls MD = -1.3, Boys MD = -0.2). ‘Changing clothes’ ($p < .001$) and ‘Getting warmed up and sweaty’ ($p = .013$) were the only statistically significant items different between boys and girls with girls showing declines (MD = -0.5; MD = -0.1 respectively) as opposed to small increases among boys (MD = 0.1; MD = 0.2 respectively).

Pairwise comparisons based on estimated marginal means revealed that ‘Learning new skills’ (All girls’ MD = -.175, $p = .003;$ All boys’ MD = -.186, $p = .014;$ Co-ed MD = -.236, $p = .001$) and ‘Being with the PE teacher’ (All girls’ MD = -.422, $p < .001;$ All boys’ MD = -.217, $p = .42;$ Co-ed MD = -.228, $p = .022$) showed statistically significant interactions with time across all three school types ($p < .001$). This indicated that the differences over time did vary by school-type.

The ‘Being active with others’ (All girls’ $MD = -.131, p = .034,$ Co-ed $MD = -.530, p < .001$) and ‘Being with others’ (All boys’ $MD = -.233, p = .016;$ Co-ed $MD = -.322, p < .001$) enjoyment items saw
statistically significant declines in all girls’ and co-educational and all boys’ and co-educational schools respectively. ‘Changing clothes’ (All girls’ $MD=-.529, p<.001$) and ‘Learning about fitness’ (All girls’ $MD=-.316, p<.001$) significantly declined in all girls’ schools only. ‘Being in the gym/playing fields’ (Co-ed $MD= -.309, SE=.077, p<.000$) significantly declined in co-educational schools only.
Table 5.4: Estimated marginal means (standard error) and between subjects effects by time between baseline and follow-up, time between baseline and follow-up/sex, and time between baseline and follow-up/school type

<table>
<thead>
<tr>
<th>Time / School type</th>
<th>Baseline</th>
<th>Follow-up</th>
<th>p Interaction Effect (CI 95%)</th>
<th>Base</th>
<th>Follow-up</th>
<th>Time / Sex</th>
<th>p Interaction Effect (CI 95%)</th>
<th>Base</th>
<th>Follow-up</th>
<th>Time / Sex</th>
<th>p Interaction Effect (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
<td>All Boys</td>
<td>All Boys</td>
<td>Co-ed</td>
<td>All Boys</td>
<td>All Boys</td>
<td>Co-ed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PACES (PE) 11-  Enjoyment items (Range 1-5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Learning new skills</td>
<td>4.5 (.03)</td>
<td>4.4 (.04)</td>
<td>4.5 (.05)</td>
<td>4.5 (.04)</td>
<td>4.4 (.06)</td>
<td>4.3 (.05)</td>
<td>p&lt;.001</td>
<td>4.5 (.05)</td>
<td>4.7 (.06)</td>
<td>4.4 (.05)</td>
<td>4.5 (.06)</td>
</tr>
<tr>
<td>2. Changing clothes</td>
<td>2.8 (.05)</td>
<td>3.0 (.05)</td>
<td>2.8 (.08)</td>
<td>3.0 (.07)</td>
<td>2.9 (.08)</td>
<td>2.5 (.07)</td>
<td>p&lt;.001</td>
<td>3.0 (.08)</td>
<td>3.1 (.10)</td>
<td>2.7 (.10)</td>
<td>2.7 (.10)</td>
</tr>
<tr>
<td>3. Being active with other students</td>
<td>4.6 (.03)</td>
<td>4.3 (.04)</td>
<td>4.6 (.05)</td>
<td>4.6 (.04)</td>
<td>4.3 (.06)</td>
<td>4.3 (.05)</td>
<td>p&lt;.001</td>
<td>4.5 (.05)</td>
<td>4.5 (.06)</td>
<td>4.7 (.06)</td>
<td>4.4 (.07)</td>
</tr>
<tr>
<td>4. Different types of PA</td>
<td>3.8 (.06)</td>
<td>4.2 (.06)</td>
<td>3.8 (.08)</td>
<td>4.2 (.07)</td>
<td>4.0 (.10)</td>
<td>3.0 (.10)</td>
<td>p&lt;.001</td>
<td>4.3 (.08)</td>
<td>4.3 (.10)</td>
<td>3.0 (.10)</td>
<td>4.0 (.10)</td>
</tr>
<tr>
<td>5. Getting warmed up and sweaty</td>
<td>4.3 (.04)</td>
<td>4.2 (.06)</td>
<td>4.3 (.06)</td>
<td>4.3 (.05)</td>
<td>4.1 (.05)</td>
<td>4.4 (.05)</td>
<td>p&lt;.001</td>
<td>4.5 (.06)</td>
<td>4.4 (.07)</td>
<td>4.4 (.07)</td>
<td>4.5 (.08)</td>
</tr>
<tr>
<td>6. Being with others</td>
<td>4.4 (.04)</td>
<td>4.3 (.06)</td>
<td>4.4 (.06)</td>
<td>4.3 (.06)</td>
<td>4.4 (.06)</td>
<td>4.4 (.06)</td>
<td>p&lt;.001</td>
<td>4.2 (.06)</td>
<td>4.5 (.07)</td>
<td>4.5 (.07)</td>
<td>4.4 (.08)</td>
</tr>
<tr>
<td>7. Getting a break from other classes</td>
<td>4.3 (.04)</td>
<td>4.3 (.06)</td>
<td>4.3 (.06)</td>
<td>4.3 (.06)</td>
<td>4.4 (.06)</td>
<td>4.4 (.06)</td>
<td>p&lt;.001</td>
<td>4.2 (.06)</td>
<td>4.5 (.07)</td>
<td>4.5 (.07)</td>
<td>4.4 (.08)</td>
</tr>
<tr>
<td>8. Being in the gym/playing fields</td>
<td>4.3 (.04)</td>
<td>4.2 (.06)</td>
<td>4.3 (.06)</td>
<td>4.2 (.06)</td>
<td>4.4 (.06)</td>
<td>4.3 (.06)</td>
<td>p&lt;.001</td>
<td>4.5 (.06)</td>
<td>4.7 (.07)</td>
<td>4.5 (.07)</td>
<td>4.4 (.08)</td>
</tr>
<tr>
<td>9. Learning about fitness</td>
<td>4.0 (.04)</td>
<td>3.7 (.04)</td>
<td>3.9 (.07)</td>
<td>4.0 (.06)</td>
<td>3.8 (.07)</td>
<td>3.6 (.06)</td>
<td>p&lt;.001</td>
<td>4.0 (.07)</td>
<td>4.1 (.09)</td>
<td>3.7 (.09)</td>
<td>3.7 (.09)</td>
</tr>
<tr>
<td>10. Being with the PE teacher</td>
<td>4.1 (.04)</td>
<td>3.8 (.05)</td>
<td>3.9 (.06)</td>
<td>4.3 (.06)</td>
<td>3.7 (.07)</td>
<td>3.9 (.07)</td>
<td>p&lt;.001</td>
<td>4.4 (.08)</td>
<td>4.1 (.08)</td>
<td>3.8 (.09)</td>
<td>3.9 (.09)</td>
</tr>
<tr>
<td>11. Getting exercise</td>
<td>4.5 (.03)</td>
<td>4.4 (.05)</td>
<td>4.6 (.05)</td>
<td>4.6 (.04)</td>
<td>4.4 (.06)</td>
<td>4.4 (.05)</td>
<td>p&lt;.001</td>
<td>4.5 (.05)</td>
<td>4.6 (.06)</td>
<td>4.6 (.06)</td>
<td>4.5 (.07)</td>
</tr>
<tr>
<td>PACES (PE) Total Score (Range 11-55)</td>
<td>45.8 (.26)</td>
<td>44.0 (.28)</td>
<td>45.9 (.39)</td>
<td>44.7 (.35)</td>
<td>45.7 (.41)</td>
<td>43.4 (.37)</td>
<td>p&lt;.001</td>
<td>45.9 (.39)</td>
<td>44.0 (.45)</td>
<td>47.1 (.49)</td>
<td>45.7 (.41)</td>
</tr>
</tbody>
</table>
5.4 Discussion

The purpose of this study was to describe the levels of enjoyment of PE in secondary school students in New South Wales. This is the only known study to examine enjoyment of PE in Australian secondary schools with high proportions of students from culturally and linguistically diverse backgrounds.

The main findings in this study were that students enjoy PE in Grade 7 but their enjoyment of PE declines slightly as they progress through Grade 8 regardless of sex or school type. When examining the data by sex, enjoyment of PE in girls declines at a greater rate than boys. Finally, there are specific aspects of PE that contribute most to this decline which include having to change clothes to participate in PE and getting warmed up and sweaty.

Baseline data from this study indicate that with the exception of “Changing clothes”, boys and girls in their first year of secondary school enjoy most aspects of PE as determined by the PACES (PE Version) instrument. Explanations as to why this is the case are speculative. It may be explained by the novelty of specialised PE teachers and facilities that are offered by NSW secondary schools. Most NSW primary schools do not offer specialised PE teachers or specialist facilities for PE to occur. Another explanation for these findings is that given the sample in this study were predominantly from culturally and linguistically diverse backgrounds they may, as Dollman and Lewis (2010) suggest, relish the opportunities to participate in sport and physical activity during school time given the expense of participating in extra-curricular and amateur sport in Australia. Barr-Anderson et al. (2008) suggest that PE environments where students feel comfortable, supported, and encouraged to be physically active tend to be the lessons students most enjoy. Further investigation is needed to ascertain
whether students in fact experience these feelings during PE as they progress through their secondary schooling.

The decline of enjoyment in PE from Year 7 to Year 8 whilst small, regardless of sex or school-type, is an important finding. Other Australian studies using PACES data collected on adolescents report lower levels of baseline enjoyment of physical activity (mean 50, range 24-60). However, these measurements were taken on a small group (<40) of adolescent girls with a mean age of 16.5 years in school sport rather than PE (Dudley, Okely, Pearson, & Peat, 2010). Hence, comparisons between the two studies are difficult. A US study found that 50% of adolescent girls indicated that they enjoyed PE class when they were asked to agree or disagree with the statement “I enjoy PE” (Barr-Anderson et al., 2008) at baseline prior to receiving a PE intervention. However, it is difficult to make baseline comparisons with this study because different instruments were used and only asked a single enjoyment item question. Speculating on the decline of enjoyment in PE from Grade 7 to Grade 8 is therefore difficult as there are no known studies that have examined these changes over time in secondary school-aged students. Of the experimental or quasi-experimental studies that have implemented interventions in secondary school PE or school sport to improve enjoyment of PE since 1990 (Christodoulidis et al., 2001; Digelidis et al., 2003; Neumark-Sztainer et al., 2003; Jamner et al., 2004, McKenzie et al., 2004; & Dudley et al., 2010), none observed statistically significant declines in enjoyment of PE or PA in intervention or control groups when they manipulated curriculum-derived variables such as content and instruction method. Two studies (Dudley et al, 2010; Jamner et al, 2004) provided sufficient data in order to calculate an effect size using Cohen’s $d$ in the control groups for comparison. Contrary to this study, both reported a positive effect size of $d=0.43$ and $d=0.26$ respectively in control groups. However, both these studies only examined girls and did so for less than six months.
Therefore, we might assume that something occurs during this period that affects student enjoyment of PE that is beyond the curriculum itself or occurs during the transition between Years 7 and 8. Whilst any conclusions will be speculative, it may be that the novelty of having a specialist PE teacher and facilities that students may not have had in their primary schooling may contribute to enjoyment of PE in Grade 7 but this ‘novelty’ diminishes over time. There may also be a change in the PE teacher or the relationship students had with their Year 7 PE teacher that changes as students move into Grade 8. There is some evidence to suggest that creating meaningful activities for students and developing positive relationships with students is important when engaging students in enjoyable learning (Brophy, 2010).

Earlier evidence from this cohort suggests that the amount of time teachers spend interacting with their students, that is promoting and encouraging them to be active and learn new skills, in Grade 7 diminishes to one third of that time by Grade 8 (Dudley et al., Under review). Further research is needed to understand this decline and how it tracks and impacts in subsequent years of secondary schooling.

It is also clear from this study that “Changing clothes” in PE is a major barrier to enjoyment regardless of sex or school-type and that this becomes a larger issue as time progresses. A previous study has identified the difficulty in estimating the influence changing clothes has on enjoyment of PE and physical activity (Dishman et al., 2005) but not provided an explanation as to why this is the case. Apart from the obvious safety concerns regarding the wearing of appropriate footwear, there are no known studies that show requiring students to change into alternate clothing is a necessary aspect of PE participation nor that it improves PE participation. The lower scores in girls around this issue might be explained by a number of qualitative studies that have shown that tight, ill-fitting PE uniforms were major impediments to girls participating in school-based physical activity (Porter, 2002; Coakley & White, 1992;
Regardless of the explanations, it appears from this study that schools may need to reconsider the daily uniform students are required to wear if they are going to engage with PE and participate in school-based physical activity. This may also go some way why the “getting hot and sweaty” item also rated lower in girls. The dislike of PE uniforms augmented by the fact that none of the schools in this study offered showering facilities may go some way to explain these results.

Finally, issues such as “learning about fitness” and “being with the PE teacher” had significant declines over the 12-months from means in the “like a little” response to means in the “neither like or dislike” response. Whilst there are no comparison studies, this indicator of indifference to concepts of ‘fitness’ and ‘teacher relationship’ is cause for concern. There is some research to suggest that students perceive fear of failure and embarrassment associated with fitness testing (Corbin & Pangrazzi, 1992) and consequently, PE teachers are less likely to encourage learning about fitness because students may in turn have unfavourable feelings about PE and be less likely to participate in PA outside of school (Silverman & Subramaniam, 1999). If so, further research into the pedagogy of fitness instruction and testing in a PE context is needed to ensure these concerns are addressed so that fitness instruction can occur in PE without fear of it impeding on lifelong PA participation. The importance of teachers fostering positive relationships with their students in order to improve learning outcomes is well cited in the literature and has been for many years (Decker, Dona, & Christenson, 2007; Baker, 1999; Tiedeman, 1942). It is evident from this study that PE teachers in NSW secondary schools need to ensure that their relationships with their students remain encouraging and supportive. Further research may be needed to ascertain the professional development needs of teachers to ensure they can continue to foster positive relationships as their students’ progress through compulsory secondary school PE education.
5.5 Conclusion

Although it appears students in NSW schools enjoy PE, it is apparent that decline in this enjoyment during the early years of secondary school is of concern. Physical education may be one of the few settings in which some students, especially those from CALD backgrounds, can be physically active and learn the skills necessary to lead a physically active life. This study identified specific areas of PE enjoyment that can be addressed in these schools including examining school uniform policies and requirements to change clothing, and increasing teacher promotion, support and encouragement during PE.

5.6 References


CHAPTER 6

Summary, Findings, Recommendations and Limitations

Adapted version manuscript prepared for publication as: Dudley, D.A., Okely, A.D., Cotton, W.G., and Pearson, P. Future policy, practice and research of physical education in Australia and New Zealand. (Manuscript prepared for peer-review)

6.1 Summary

This chapter provides a summary of the four research papers for the purposes of this dissertation. It presents the key findings of the study in relation to the five research questions before concluding with recommendations for future research, pedagogy and practice of PE in NSW secondary schools and limitations of the study.

6.1.1 Research paper one

The systematic review of the effectiveness of PE interventions targeting physical activity, movement skills and enjoyment of physical activity (Chapter 2) identified, critically reviewed and compared existing school-based, curriculum PE interventions. The results of the review detailed the nature, scope and focus of intervention strategies reported, and reported outcomes of these interventions. The most effective teaching strategy to increase children’s levels of physical activity and improve movement skill proficiency in primary schools was direct instruction, a prescribed curriculum, adopting a whole-school approach to physical activity and providing teachers with sufficient, ongoing professional development in using PE instruction methods and curriculum. For secondary schools, using a combination of prescribed PE curriculum with elements of student choice and substantial teacher professional
development combined with sufficient teaching resources have the potential to make important differences to levels of student PA participation.

During secondary school PE, the review highlighted that it is important to promote movement skill development and physical activity participation. It is clear from the evidence presented in the review that PE teachers are capable of making substantial improvements in these outcomes. However, a lack of high quality evaluations with adequate statistical power hampers conclusions concerning the effectiveness of interventions to improve enjoyment of PE. Physical education teachers, researchers, and education and health policy makers need more evidence on how the diverse nature of PE practice and pedagogy can play a central role in positively influencing young people’s physical activity participation, movement skill proficiency and enjoyment of physical activity which in turn may then be capable of influencing health and education policy internationally.

6.1.2 Research paper two

Research paper two (Chapter 3) involved a cross-sectional study to determine the levels of PA, lesson context and teacher interaction students receive during PE in NSW secondary schools. The study used systematic direct observation of Year 7 PE classes over a six-month period and found that substantial variations in the PA, lesson context and teacher interaction exist within PE in NSW secondary schools. A large proportion of classes, especially classes in all girls’ schools, did not meet the Centers of Disease Control and Prevention (CDC) recommendation of 50% of class time in MVPA. Levels of skill instruction and practice were also well below international comparisons. This study identified specific areas of PE instruction including focussing on skill instruction, improving PE pedagogy, allocating more
useable time to PE, improving management efficiency, and increasing teacher promotion of PA that could be improved in NSW secondary schools.

6.2.3 Research paper three

The third research paper (Chapter 4) reported the longitudinal follow-up findings of the prospective cohort used in this study. The purpose of this study was to describe student participation in and patterns of PE in NSW secondary schools. Again, systematic direct observation of PE classes was used over a six-month period of the same students who were now in Year 8. Data analyses included a series of multivariate general linear models to ascertain changes in each of the SOFIT observations over time.

There was a reduction in the percentage of PE time spent in MVPA and vigorous physical activity (VPA) over the 12-month period. Significant declines also occurred in percentages of PE time spent in management and in time that teachers spent promoting physical activity. Small, but not significant, increases in PE time spent in fitness and game play were also observed. The significant declines in VPA, and time spent promoting physical activity in PE during the first two years of secondary school highlight the need to develop strategies in Australian secondary schools to reverse these trends whilst at the same time meeting other important curriculum goals.

6.2.4 Research paper four

The fourth research paper (Chapter 5) reported the longitudinal enjoyment of PE in this prospective cohort study. The purpose of the study was to describe student enjoyment of PE
in NSW secondary schools. A validated 5-point Likert scale questionnaire was used to collect data pertaining to student enjoyment of PE when participations were in Year 7 and again in Year 8. Data analyses included reliability testing of the data collection instrument and parametric linear modelling of individual and collective enjoyment item scores.

According to the study, students in NSW schools enjoy PE when they enter secondary school; however, there is some decline in enjoyment of PE from the first to the second year. Secondly, the decline in enjoyment of PE may be linked largely to attributes of school policy regarding PE and the practice of PE teachers. Specifically from a policy perspective, it was clear from this study that “Changing clothes” in PE was a major barrier to enjoyment regardless of gender or school-type and that this became a larger issue as time progressed. From a pedagogy perspective, it was evident from this study that PE teachers in NSW secondary schools need to ensure that their relationships with their students remain encouraging and supportive as this element of enjoyment in PE significantly declined during the study period.

6.2 Findings

Each of the thesis research questions and their findings are addressed in this section. A summary of these findings is shown in Table 6.1.
Table 6.1: Summary of study findings

<table>
<thead>
<tr>
<th>Paper number and title</th>
<th>Research questions addressed</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/Dudley, D.A., Okely, A.D., Cotton, W.G., Pearson, P., and Caputi, P. Physical activity levels and movement skill instruction in secondary school physical education. <em>Journal of Science and Medicine in Sport; In Press, Accepted 28/10/11</em></td>
<td>2/What proportion of PE class time is spent in explicit movement skill instruction or practice and does this change from Year 7 to Year 8? 3/What proportion of PE class time have high levels of physical activity participation and does this change from Year 7 to Year 8? 4/ What proportion of PE class time do teachers spend supporting their students in movement skill and physical activity and does this change from Year 7 to Year 8?</td>
<td>PE classes dedicate 6% of class time to skill instruction/practice in Year 7 and this declined to 5% in Year 8. Students spend 57% of PE class time engaged in MVPA but this declines significantly to 52% in Year 8. PE teachers spend 30% of class time encouraging their students to be active and learn skills in Year 7 this declines significantly to 10% of class time by the time students are in Year 8.</td>
</tr>
<tr>
<td>3/Dudley, D.A., Okely, A.D., Cotton, W.G., Pearson, P., and Caputi, P. Physical activity levels, lesson context, and teacher interaction during physical education in Australian secondary schools. <em>Under review</em></td>
<td>5/ To what extent and what aspects of enjoyment in PE lessons change from Year 7 to Year 8?</td>
<td>Students’ enjoyment of PE declines from Year 7 to Year 8. The relationship students have with their PE teacher contributes significantly to this decline. Having to change clothes for PE is the largest contributor to students not enjoying PE.</td>
</tr>
</tbody>
</table>

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6.2.1 Research question one

Research question one: What interventions utilising PE from the systematic review have successfully improved movement skills, physical activity levels and enjoyment of physical activity and what are the pedagogical practices and policies of successful interventions?

Interventions which utilised a process-product pedagogical approach during PE would be effective in influencing their targeted outcome whether it is movement skill competence, physical activity participation or enjoyment of PE proved to be mostly true with the exception of the enjoyment outcome. Of the 23 studies examined in the systematic review, 15 reported a statistically significant intervention effect on physical activity participation. Four studies reported a statistically significant intervention effect on movement skill development and one study reported a statistically significant effect on enjoyment of physical activity.

In the interventions that targeted physical activity and movement skills outcomes, the evidence from the systematic review suggests that process-product pedagogies such as direct or explicit teaching strategies were most the effective teaching strategy. Another component of the effective interventions that targeted physical activity and movement skills was the provision of professional development programs for teachers using a well-designed prescribed curriculum. A prescribed PE curriculum was often supported with additional resources such as PE equipment, lesson plans, web-support and mentors or in-school consultants if required.

The lack of efficacious studies targeting enjoyment of PE makes it difficult to draw conclusions about the attributes of an effective PE intervention capable of influencing
enjoyment. This limits our understanding of the construct of enjoyment of PE and our ability to measure it as exemplified in this systematic review.

6.2.2 Research question two

Research question two: What proportion of PE class time is spent in explicit movement skill instruction or practice and does this change from Year 7 to Year 8?

The hypothesis that less than 25% of PE class time will be dedicated to explicit skill instruction and this will not change from Year 7 to Year 8 was accepted. The percentage of PE class time spent in ‘skill practice’ or explicit skill instruction in Year 7 was 6.2% of PE class time and this decreased to 5.2% in Year 8 (MD= -1.0; p=.644). Only all boys’ schools recorded increases in time spent in skill practice (MD=4.5%) whilst co-educational and all girls’ schools experienced declines of approximately four and two percentage points, respectively. These declines are similar to those found in the M-SPAN study (MD= -0.8%; McKenzie et al., 2004) and suggest that PE teachers spend very small proportions of time instructing and practicing skills as students progress through secondary schooling. A possible reason for this is that PE teachers see the teaching of movement skills as less important as students’ age. It may also be that PE teachers find it difficult to engage students when teaching them movement skills.

6.2.3 Research question three

Research question three: What proportions of PE class time have high levels of physical activity participation and does this change from Year 7 to Year 8?
The hypothesis that less than 50% of PE class time will be spent in MVPA and that this participation will decline from Year 7 to Year 8 was partially accepted. Of the 81 Year 7 and 51 Year 8 lesson observations, 49 (60.5%) met the recommendation of spending at least 50% of class time in MVPA in Year 7 and 32 (63%) did likewise in Year 8. The mean proportion of time spent in MVPA during PE in Year 7 was 56.9% with this declining to 52.1% ($MD=-4.8, p=.777$) by Year 8. Whilst not statistically significant, this decline nonetheless equated to a mean loss of 2.7 minutes of MVPA per PE lesson as students progressed from Year 7 into Year 8.

There was a significant decrease in the percentage of PE class time students spent being ‘very active’ (engaging in vigorous physical activity; VPA) (20.8% to 12.9%; $MD=-7.9$). There are several possible reasons for the significant decline found in the current study. First, this decline in VPA during PE may be reflective of the age-related decline in PA that occurs during adolescence (Sallis, 2000). Second, most of the decline in VPA during PE was explained by the decline which occurred in co-educational schools (which had co-educational PE classes). Vigorous physical activity in all girls’ and all boys’ schools declined around 4% and 1%, respectively, whereas the decline in co-educational schools was nearly 18%. The reasons for the greater decline in co-educational schools may be that, unlike all girls’ and all boys’ schools, co-educational schools also experienced increases in time spent in management and decreases in time spent in game play. This study found in this sample that, at baseline, time spent in management was negatively ($r=-.218; p=.306$) and time spent in game play was positively ($r=.518; p=.010$) correlated to MVPA participation in co-educational schools. This suggests that lesson context plays an important role in determining PA participation levels of students during PE.
6.2.4 Research question four

Research question four: What proportions of PE class time do teachers spend supporting their students in movement skill and physical activity and does this change from Year 7 to Year 8?

The hypothesis that less than 35% of PE class time will be spent with PE teachers giving encouragement and support that promotes movement skills and physical activity participation and that this proportion will decline from Year 7 to Year 8 was accepted. This study found that teachers spent just under one-third of PE class time (30.8%) promoting physical activity in Year 7 and that this percentage significantly declined by Year 8 (10.1%, $MD= -20.7\%$, $p<.001$). None of the lessons observed at follow-up reported more than 35% of class time promoting physical activity. Furthermore, the declines were consistent across all three school types. There have been no known studies reporting on changes in promotion of PA by teachers during PE but a cross-sectional study in the US found that around 35% of class time in middle school was spent promoting PA (McKenzie et al., 2000). Whilst there are no clear justifications for why promotion of PA would drop significantly as students move through secondary school, one explanation could be the autonomy students seek as the move through adolescence and teachers giving them more responsibility for their own physical activity as a result. There is some evidence from longitudinal studies that adolescents’ increase their desire for control over their own educational experiences, especially as they move through Years 6 and 7 (Eccles et al., 1991). However, given that participation in physical activity significantly declines over this time, PE teachers still have an important role in promoting physical activity among older students (CDC, 2011).
6.2.5 Research question five

Research question five: To what extent and what aspects of enjoyment in PE lessons change from Year 7 to Year 8?

Finally, the hypothesis that enjoyment of PE will decline from Year 7 to Year 8 and non-curricular aspects of PE will contribute most to this decline was accepted. At baseline, total enjoyment of PE was 45.8 out of 55 (Range 11-55) (Boys 45.9, Girls 45.7) indicating that the average student responded to the PACES enjoyment items with a response of “Enjoy a little” to most questions. Little variation existed between boys and girls at baseline. In each of the 11 individual enjoyment items (Range 1-5) within the PACES (PE version), boys and girls had identical ratings at baseline of their enjoyment of PE in items ‘Learning new skills’, (4.5), ‘Being with other students’, (4.6), ‘Participating in different types of physical activity’ (4.5), and ‘Getting exercise’ (4.6). Two enjoyment items had differences of 0.4 or greater between boys and girls at baseline. They were ‘Getting warmed up and sweaty’ (3.7 boys; 3.1 girls) and ‘Being with the PE teacher’ (3.9 boys; 4.3 girls). This indicates that the enjoyment of PE in boys and girls is comparable across most enjoyment items of PE using PACES (PE Version) with the exception of items 5 and 10 from baseline. Further baseline data analysis revealed that item 2 “Changing clothes” was the lowest scored item, for boys and girls irrespective of sex, with a mean of 2.9 (1.2 SD) (Boys, 2.8; Girls, 3.0).

At follow-up, the overall enjoyment of PE had a mean decline (MD) of -1.8. The 12-months alone between Year 7 and Year 8 has a small negative effect on enjoyment of PE d= -0.30. The declines however showed that time had larger negative effect in girls (MD= -2.3;
Item 2 ‘Changing Clothes’ and Item 5 ‘Getting warmed up and sweaty’ still remained the lowest scoring items (M=2.7, MD= -0.2; M=3.4, MD=0.0) for both sexes at follow-up (Girls M=2.5, 3.0 respectively; Boys M=2.7, 3.4 respectively). ‘Changing Clothes’ however increased at follow-up and had a small positive effect in boys (MD=0.1, d=0.09) and notably decreased in girls with a medium negative effect in girls (MD= -0.5; d=0.42). The relationships that exist within a PE class are also shown to be an important variable. Item 3 ‘Being active with other students’ and item 10 ‘Being with the PE teacher’ were shown to have an overall negative effect of d= -0.40 and -0.31 respectively. In ‘Being with the PE teacher’, the decline was greater in girls.

6.3 Recommendations

Recommendations based on the findings of this study are addressed in this section with regard to future research, policy and practice of PE in New South Wales.

6.3.1 Recommendations for future PE research

In terms of design and methodology for future PE efficacy studies in PE, the review findings reaffirm that sample size calculations should be completed before recruitment to ensure that studies are adequately powered to detect statistically significant differences between groups in a study. Entire schools or even school districts may need to be recruited in order to maximise any potential sample size. Physical education interventions that focus on physical activity, movement skill or enjoyment should also be methodologically sound and follow well established guidelines to ensure the transparent reporting of their findings (e.g. CONSORT
2010 (Moher et al., 2010) and TREND (Des Jarlais et al., 2004) statements). Future research should also pay attention to providing longer intervention and follow-up periods, transparency of their randomisation procedures, and using assessors who are blind to group allocation. Furthermore, movement skill interventions that focus on secondary school PE curriculum are needed, especially during the early years of secondary schooling. The absence of studies targeting movement skills in secondary schools from the literature limits education policymakers from justifying the compulsory inclusion of PE in secondary curriculum. This position is supported by Bailey’s (2006) review that the scientific evidence does not support that the claimed effects of PE curriculum occur automatically. More evidence is needed to ascertain the contribution that positive PE experiences, characterised by enjoyment, diversity, engagement, and well trained teachers with sufficient and ongoing professional development can make to achieve the claim benefits of a PE curriculum. Finally, given that 13 of the 23 studies included in this review were conducted in the United States, there is a strong case for more experimental and quasi-experimental studies to be conducted in Australia and New South Wales secondary schools.

Unlike many developed countries, Australia and New Zealand in particular have adopted an explicit commitment to the social and culturally constructed notions of PE over the same period (Wright, 2004). One of the reasons for a lack of evidence in PE in Australia may be due to the dominant socio-cultural influences in the NSW PDHPE curriculum and focus on constructivist-driven models of PE instruction. Tinning (2004) contends that PE curricula in at least two Australian states (Queensland and NSW) have had an explicit commitment to social and culturally constructed notions of health and PE since the early 1990s. Social Critical Theorist’s responsible for this orientation of PE curricula have dominated the discourse in NSW PDHPE curriculum reform and design since 1991 (Cliff, Wright, & Clarke,
Based on the evidence presented in this dissertation, the claims of social critical theorists regarding the NSW PDHPE curriculum’s ability to improve movement skills proficiency and make for enjoyable physical activity need to be balanced with evidence derived from scientific methods and discourse. Furthermore, whilst it is commonly accepted within the PE teaching and research community that focusing solely on direct instruction teaching strategies could be potentially problematic when seeking to develop wider learning skills and independent learning, more research is needed into which teaching strategies and models of PE instruction are capable of improving physical activity, movement skill development and student enjoyment of physical activity. The absence of popular PE curriculum instruction pedagogical models that advocate teaching strategies other than direct instruction such as Teaching Games for Understanding (Bunker & Thorpe, 1982), Sport Education (Siedentop, 1994) and other constructivist-based PE curriculum models from the evidence provided in this dissertation invite the opportunity for further research that can investigate their effects on physical activity, movement skill and enjoyment using experimental and quasi-experimental designs.

Future research in PE needs to ensure PE researchers, system administrators, principals and teachers work together to strengthen the public trust in scientific evidence being collected in PE settings. Schools and administrators of education systems are often ignoring the full range of evidence available to them when deciding on PE reform and curriculum design.

6.3.2 Recommendations for PE pedagogy and practice
It is clear from the evidence presented in this thesis that movement skill development needs to be the key focus of PE curriculum for children and adolescents in order for them to acquire the movement skills necessary to lead physically active lives. Three of the four movement skill interventions presented in Chapter 2 also reported significant increases in physical activity participation (McKenzie et al., 1998; van Beurden et al., 2003; Salmon et al., 2008). In this light, movement skill competency in conjunction with physical activity participation should be part of a range of indicators of an effective PE curriculum and of effective PE pedagogy.

In terms of effective teaching strategies, direct and explicit teaching strategies, when combined with a detailed curriculum, are capable of increasing physical activity participation and movement skill proficiency in children and adolescents. As previously stated, more research is needed into which other teaching strategies and models of PE instruction are capable of improving physical activity, movement skill development and student enjoyment of physical activity.

### 6.3.3 Recommendations for PE policy

Given the number of effective physical activity interventions adopting cross-curricular approaches, it is apparent that PE should not be the sole source of PA in schools. It may be pertinent for education and health decision makers to view physical activity in schools through a whole-school approach. In other words, share the responsibilities of physical activity across the entire school community and across the curriculum. Much in the same way numeracy and literacy are areas of focus in Mathematics and English, respectively, these areas of learning are also cross-curricular in nature and can/have been explored in other curriculum
areas. Advocating for a whole-school approach to physical activity is by no means a new concept and has been supported by numerous studies (Sallis & Owen, 1999; Cale, 2000; Biddle et al., 2004). Yet the absence of PE curriculum that explicitly adopt whole school approaches to physical activity or provide training to teachers in how to do so, suggest that the recommendations proposed in the previous studies have gone unheeded.

This thesis also shows that substantial and quality professional development for teachers should be included in PE programs. In accordance with numerous other studies (Sallis et al., 1997; McKenzie et al., 2003; McKenzie et al., 2004; Armour & Yelling, 2007; Jago et al., 2009; Armour et al., 2010), ongoing teacher professional development and support is a key element of an effective PE curriculum. Given their appearance in the reviewed literature, more interventions could be conducted into the use of web-based professional development and teacher support that provides lessons plans and teaching strategies employed in PE classes.

Finally, it is clear from this study that changing clothes in order to participate in a PE lesson is a major barrier to enjoyment regardless of sex or school-type and that this becomes a larger issue as time progresses. Whilst a previous study has identified the difficulty in estimating the influence changing clothes has on enjoyment of PE and physical activity (Dishman et al., 2005), no explanation as to why this is the case has been made. Apart from the obvious safety concerns regarding the wearing of appropriate footwear, there are no known studies that show requiring students to change into alternate clothing is a necessary aspect of PE participation nor that it improves PE participation. Regardless of any explanation that might appear in the literature, it appears from this study that schools need to reconsider the daily uniform students
are required to wear if they are going to engage with PE and participate in school-based physical activity.

6.4 Limitations

The papers presented in this thesis provide original insights into the nature of PE physical activity, movement skill instruction and enjoyment of PE in NSW secondary schools in context of published international interventions into proven aspects of effective PE and school sport. There are however, some general limitations of the three research papers in Chapters 3, 4 and 5 that warrant consideration and should be addressed in future research.

First, the six schools and participant sample used for these papers came from schools with a high proportion of students from culturally and linguistically diverse backgrounds. Even though this data collected over two years provided a wealth of information on the nature of PE in NSW secondary schools, there exists the possibility that the findings this study may only be representative of the sampled demographic of these participating schools.

Secondly, this study reported findings from a small number of schools and in the observations using the SOFIT instrument, the number of lesson observations declined in the second year. This made it difficult to infer physical activity, lesson context, and teacher interaction data based on school-type. A further limitation was that data for the PALDC study were only collected at two time points which does not allow for trends in the data to be determined.
Finally and whilst not strictly a limitation, it is worth noting that the collection of enjoyment of PE data was collected via an instrument using a 5-point Likert scale. The scores from the Likert scale items were treated as a continuous measure (variable) of enjoyment. Whilst this practice is common among social scientists/educational researchers (Carifio & Perla, 2007; Glass, Peckham & Sanders, 1972) and has been used in the past when measuring enjoyment of PE and PA (Cairney et al., 2007; Carroll & Loumidis, 2001; Dudley et al., 2010; Fairclough, 2003), there is a body of thought that Likert scales cannot elicit a continuous variable response for parametric analysis (Jamieson, 2004). In order to permit transparency of the findings from this measure in this study, only parametric statistical analyses were performed. Furthermore, the calculation of effect sizes using Cohen’s $d$ and the presence of strong alpha results (many with $p$ values <.001) strengthen the claims for using a parametric analysis in this study.

6.5 References


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Appendix A

Search Strategy and Reviewer Checklist for Systematic Review

Types of Studies

Studies were included if they were intervention or an evaluation of a program. This included controlled trials and randomised controlled trials.

Types of Participants

Studies were included if they involved children with a mean age between 5 and 18 years of age (school aged).

Types of Interventions

*Interventions included*

Included studies of interventions that involved physical education and school sport as the primary mode of intervention.

*Settings*

Only interventions within schools (primary or secondary school) were included.

*Intervention personnel*

There were restrictions on who delivered the intervention. Intervention personnel must have been researchers, teachers, or physical activity professionals.
Interventions excluded

Excluded studies designed for children with a critical illness or severe co-morbidities (special populations) or special needs.

Types of outcome measures

To be included, studies have to report one or more of the following primary outcomes, presenting a baseline and a post-intervention measurement.

Primary outcomes included: activity level, fitness, exercise habits, participation in activity/play, energy expenditure, free living habitual physical activity, movement skill development, movement skill proficiency, enjoyment of activity, social support for physical activity from teachers or peers.

SEARCH STRATEGY FOR IDENTIFICATION OF STUDIES

Databases

Databases were selected

The following databases were search from: PubMed, Ovid Medline, Sports discus, Science Direct, PsycINFO, ERIC Ovid, A+Education.

Expert Informants

Additionally, a number of experts in the discipline of physical education or the promotion of physical activity were contacted with a view to seeking additional references.
Reference lists searched

The reference lists of systematic reviews (identified from searches detailed above) that included information on physical education interventions for the promotion of physical activity, development of movement skill, enjoyment or social support of physical activity among children or adolescents published between January 1990 and June 2010 were scanned.

Management of hits

Articles were rejected on initial screen if the reviewer could determine from the title and abstract that the article did not meet the inclusion criteria for this review.

Full-text copies of ______ papers were assessed independently against the inclusion criteria by _______ reviewers (DD, initials). _________ articles were included in this review. They are _________

The search strategy was limited to those interventions in the English language.

Key words

The following groups of key words were checked:

Participants: Child* OR adolescen* OR young people OR youth OR pediatric OR paediatric OR school-age* OR student* OR school*

AND

Strategies: Physical* OR activ* OR school sport* OR exercise OR education OR physical education OR PE OR curriculum

AND
Outcomes: physical OR active* OR exercise habits OR energy expenditure OR exercise OR time in activity OR step* OR count* OR enjoyment of activity OR movement skill OR motor skill OR social support OR teacher support OR peer support OR feedback

AND

Designs: Clinic* OR random* OR trial OR evaluation OR intervention OR experiment OR program* OR pilot OR feasibility OR treatment.
Reviewer Checklist for Systematic Review

Author’s Surname ___________________ Date Published ____________
Reviewer Initials __________

Criteria

Type of Study

Non-randomised controlled/comparison trial ______________________ □ yes
Randomised controlled/comparison trial ______________________ □ yes □ no (exclude)

Participants

Mean age > 5 years and < 18 years □ yes □ no (exclude)

Age Group

Mean age ≥ 5 years, < 12 years (children) □ yes
Mean age ≥ 12 years and ≤ 18 years (adolescents) □ yes

Setting

Physical Education ____________________________________________ □ yes
School Sport ________________________________________________ □ yes □ no (exclude)

Reported statistical analysis of physical activity, fundamental skill development OR instruction time, enjoyment of physical education OR physical activity, peer OR teacher support for participation in PE OR PA collected at least at pre- and post-test □ yes □ no (exclude)

Post-test was measured

After treatment ____________________________________________ □ yes
During treatments (i.e. during last week(s) of intervention) □ yes □ no (exclude)

Please circle one

Based on assessment of the study - Abstract / Full Text
This study should be - Included / Excluded
Appendix B

University of Wollongong Research Ethics Approval

28 November 2007

Ms Kim McKeen
Faculty of Education
University of Wollongong
Dear Ms McKeen,

I am pleased to advise that the amendments dated 31 October 2007 to the following Human Research Ethics application have been approved.

Ethics Number: HE06/182
Project Title: Evaluation of the Physical Activity in Linguistically Diverse Communities Project.
Name of Researchers: Ms Kim McKeen, Dr Philip Pearson, Dr Louise Hardy, Dr Anthony Okely, Dr Kerry O’Brien, Mr Dean Dudley
Amendment/s: To extend the research to include year 7 and 8 students of high schools – Granville Boys HS, Auburn Girls HS and Granville South HS.

Additional researcher - Dr Kerry O’Brien and Mr Dean Dudley
Students to complete questionnaire re perceived physical competence, enjoyment of physical activity, social support for physical activity and physical activity self-efficacy
Observation of student participation in physical education classes using SOFIT
Revised Information Sheets and Consent Forms

Amendment Approval Date: 9 November 2007
Expiry Date: 14 June 2008

Please remember that in addition to reporting proposed changes to your research protocol the HREC requires that researchers immediately report:

- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete monitoring reports annually and at the end of your project. These reports are sent out approximately 6 weeks prior to the date your ethics approval expires. The reports must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

The University of Wollongong/SE Sydney and Illawarra Area Health Service Humanities, Social Science and Behavioural HREC is constituted and functions in accordance with the NHMRC National Statement on the Ethical Conduct in Research Involving Humans.

Yours Sincerely,

A/Professor Garry Hoban

Chairperson, Human Research Ethics Committee
Appendix C

Student Information and Consent Form

Evaluation of the Physical Activity in Linguistically Diverse Communities Project, 2008-2011

INFORMATION SHEET FOR ADOLESCENTS

What are we trying to do?
- We want to measure the way you perform movement skills such as catching, what happens in PE lessons, and how good you feel you are at certain activities.

What are we going to do?
- We will ask you to complete a questionnaire about how good you feel you are at physical activity; how much you enjoy it; the level of support you receive for physical activity from your peers, family, and teachers; and how confident you feel you are participating in physical activity.
- We will ask you some questions about yourself such as what language you speak most at home, your postcode of residence, date of birth, gender, number of brothers and sisters, and mum and dad’s level of occupation.
- We will observe up to five PE lessons to see what goes on in your classes.
- You will then perform these following skills: run, vertical jump, catch, kick, throw, leap, strike, dodge, and side gallop.

Will there be any problems?
- There should be no problems during the tests as we only want you to do what you feel comfortable doing. There are no right or wrong answers for any of the activities you have to do.
- You do not have to do anything you do not want to do. Remember that you can stop at any time.

How long will it take?
- It should take around 1.5 hours to finish all the assessments except the observations of the PE lessons which will occur over a four-week period. These assessments will be completed from October 2008 and then be repeated approximately two and three years later in 2010/2011.

Do you have any questions?
- If you do have any questions, make sure you ask one of the teachers who are assessing your class.
If you have any concerns or complaints regarding the way the research is or has been conducted, contact the Complaints Officer, Human Research Ethics Committee, University of Wollongong on (02) 4221-4457.

Thank you for your help!

This research project is being conducted as part of the Evaluation of the Physical Activity in Linguistically Diverse Communities Project. The researchers conducting this project have your protection, interests, and safety as first priority at all times. The above information sheet explains the procedures, which will be carried out as part of this study. Your signature indicates:

1. You have read the information provided about this project;
2. You have been given the opportunity to discuss the contents with one of the researchers before commencing the assessments;
3. You clearly understand the procedures;
4. You voluntarily agree to participate in the project

If you would like to discuss the research further, please contact Dr Phil Pearson on (02) 4221-3889. If you have any concerns or complaints regarding the way the research is or has been conducted, you can contact the Complaints Officer, Human Research Ethics Committee, University of Wollongong on (02) 4221 4457.

I (name)___________________________________________ agree to take part in the study titled: “Evaluation of the Physical Activity in Linguistically Diverse Communities Project”.

Surname: ______________________  Given name: _____________________
Date:____________2008
Appendix D

Parent Information and Consent Form

PHYSICAL ACTIVITY IN LINGUISTICALLY DIVERSE COMMUNITIES PROJECT, 2007-2010.

INFORMATION SHEET FOR PARENTS

Dear Parent

Your child’s school and their class have been selected to participate in the evaluation of the Physical Activity in Linguistically Diverse Communities Project (PALDC), an initiative of the NSW Department of Education and Training and the NSW Department of Health. The PALDC project is being conducted by researchers from the University of Wollongong, University of Sydney, and Charles Sturt University. Full details of all researchers and their affiliations are provided at the end of this information sheet. This information sheet will describe the purpose of this project and outline what is required of you and your child should you agree to be involved.

What is the purpose of this study?

The aim of the study is to evaluate the PALDC Project which will be implemented in your child’s school over the next 3 years. To evaluate how effective the PALDC Project is we would like to take some assessments before and after the Project is implemented. As healthy lifestyle behaviours are thought to influence physical activity and fitness if they are adopted over long time periods and become part of daily habits, we would also like to take the assessments at two- and three-years after the beginning of the Project. This will allow us to determine how effective the PALDC Project is in the long-term.

The PALDC Project

The Project will involve staff at your child’s school working together to bring about change in the area of student physical activity and fundamental movement skill proficiency. The Project is also designed to enhance teacher understanding and confidence in these areas.

WHAT WILL YOU AND YOUR CHILD BE ASKED TO DO?

The PALDC Project will be implemented in your child’s school as part of the school’s action plan for 2007-2008. We are seeking permission to conduct some assessments on you and your child so that we can evaluate the effect of this Project over this time. None of the assessments will hurt your child – in fact you may be interested in their results. These assessments will take place from Term 4, 2007 to Term 4 2008 and approximately two and three years later (Term 4, 2009/2010).
We will ask your child to complete a questionnaire about how good he/she feels they are at physical activity; how much they enjoy it; the level of support they receive for physical activity from their peers, family, and teachers; and how confident they feel they are participating in physical activity.

We will observe up to five PE lessons to see what goes on in their PE classes.

We will ask him/her some questions about themselves and their family such as what language they speak most at home, their postcode of residence, date of birth, gender, and mum and dad’s occupation.

We will ask them to perform these following fundamental movement skills: run, vertical jump, catch, kick, throw, leap, strike, dodge, and side gallop.

**What are the risks of the study?**

**Parents**

There are no risks to parents in this study.

**Measurements taken for children**

The assessments will be just like those in which your child would participate in physical education in school. The fundamental movement skills tests do involve your child participating in physical activity, some of which may be moderate to vigorous in intensity for a short period of time. The structure of the assessments will apply appropriate warm-up, cool-down and stretching activities.

**Participation in the study.**

Individual parents or children will be free to discontinue participation at any time. Discontinuation of you or your child’s involvement will not jeopardise your or their current or future relationship with the University of Wollongong.

**What will happen to the information you and your child provide?**

All the information collected during this study will be kept strictly confidential and be stored in a locked office. The name of your child will not be revealed or used in the study and will only be seen by the researchers involved in the study. The results of the study will assist in making recommendations for future physical activity programs designed to improve skills and increase activity levels amongst overweight children.

**Who is conducting the study?**

The people in charge of the study from the University of Wollongong are:

Dr Tony Okely  
Senior Lecturer in Health and Physical Education  
Faculty of Education – University of Wollongong

Dr Phil Pearson  
Lecturer in Health and Physical Education  
Faculty of Education - University of Wollongong

Dr Louise Hardy  
Postdoctoral Fellow - NSW Centre for Overweight & Obesity  
University of Sydney

Dr Kerry O’Brien  
School of Health Sciences, University of Wollongong

Ms Kim McKeen
If you and your child agree to participate, could you please complete the attached consent form and return them to your child’s PE teacher. If you have any questions regarding the study, please contact Dr Tony Okely on (02) 4221 4641. If you have any concerns or complaints regarding the way the research is or has been conducted, you can contact the Complaints Officer, Human Research Ethics Committee, University of Wollongong on (02) 4221 4457.

Your co-operation in this project will be greatly appreciated.
The Physical Activity in Diverse Communities (PALDC) Project

PARENT CONSENT FORM

I have been given information about the PALDC research project and have had the opportunity to discuss any aspect of the research project with Dr Phil Pearson and the other researchers involved.

I understand that, if I consent to my child participating in this project, he/she will need to complete the following assessments at school:

- a questionnaire about how good they feel they are at physical activity; how much they enjoy it; the level of support they receive for physical activity from their peers, family, and teachers; and how confident they feel they are participating in physical activity.
- Have up to five PE lessons observed to see what goes on in their PE classes.
- Some questions about themselves and their family such as what language they speak most at home, their postcode of residence, date of birth, gender, and mum and dad’s occupation.
- Perform, to the best of their ability, the following fundamental movement skills: run, vertical jump, catch, kick, throw, leap, strike, dodge, and side gallop.

I understand that these assessments will be completed from July 2008 and approximately two and three years later in 2010/2011.

I have been advised of the potential risks and burdens associated with this research, and have had an opportunity to ask Dr Phil Pearson any questions I may have about the research and my participation.

I understand that my child’s participation in this research is voluntary and I am free to refuse his/her participation and I am free to withdraw him/her from the research at any time. My refusal to his/her participation or withdrawal of consent will not affect my relationship with the University of Wollongong.
If I have any enquiries about the research, I can contact Dr Phil Pearson on (02) 4221 3889.

By signing below I am indicating my consent to participate in the PALDC research project conducted by Dr Tony Okely, Dr Phil Pearson, Dr Louise Hardy, Kim McKeen Dr Kerry O’Brien, and Dean Dudley as it has been described to me in the information sheet. I understand that the data collected from my participation will be used in journal publications and conference presentations, and I consent for it to be used in that manner.

I agree for myself (name)……………………………………………

and my child (name)………………………………………………to take part in the PALDC study.

Child’s class:…………………………………………

Child’s school:……………………………………

Address:………………………………………………………….

Phone:………………………… Child’s DOB:………………………………

Parent’s/Guardian’s Signature:…………………………………Date:……………………
Appendix E

*Physical Activity Enjoyment Scale (PE Version)*

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<tr>
<th></th>
<th>Dislike a lot</th>
<th>Dislike a little</th>
<th>Neither like nor enjoy</th>
<th>Enjoy a little</th>
<th>Enjoy a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning new skills is something that I...</td>
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<td>2. Changing clothes is something I...</td>
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<td>3. Being active with other students is something that I...</td>
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<td>4. Doing different types of physical activity is something that I...</td>
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<td>5. Getting warmed up and breaking into a sweat is something that I...</td>
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<tr>
<td>6. Being with the other students in the class is something that I...</td>
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<td>7. Getting a break from other classes is something that I...</td>
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<tr>
<td>8. Being in the school gym, hall or on the playing fields is something that I...</td>
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<tr>
<td>9. Learning about physical fitness and health is something that I...</td>
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<tr>
<td>10. Being with the PE teacher is something that I...</td>
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<tr>
<td>11. Getting some exercise is something that I...</td>
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