Balancing the Learning and Physical Activity Agendas in Physical Education Using a Game Centred Approach

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Balancing the Learning and Physical Activity Agendas in Physical Education

Using a Game Centred Approach

Research Thesis

Brendan Ryan

This thesis is presented as part of the requirements for the award of the degree of Doctor of Philosophy

University of Wollongong

Date 7/11/2016

Supervisors: Dr Gregory Forrest and Dr Dana Perlman
Declaration

I certify that the work contained in this thesis has not been submitted for a degree at any other university or educational institution. The thesis contained is entirely my work.
Acknowledgements

Firstly, I would like to acknowledge my mother Sharon, father Robert and partner Grace for their understanding, assistance and advice throughout all phases of this research. I am grateful for having such caring parents and a supportive partner. I would not have been able to complete this thesis without them. In particular, my father Robert, with his many years of expertise in education, was always willing to review my work, and to assist in refining my thesis, and for this I thank him.

Secondly, I want to thank both my supervisors, Greg Forrest and Dana Perlman, for their guidance, expertise, feedback and sincere encouragement during all stages of this project. I feel privileged to have had such dedicated and enthusiastic mentors who have made the entire process more enjoyable. Greg in particular has not only been a research supervisor but also a mentor in my teaching career. Without his guidance and belief in my abilities I would not have even considered conducting this research and for this, I owe him great appreciation. It should also be noted that John Revington provided editorial services for this thesis, including corrections to punctuation, spelling and grammar, checking references for consistency and suggested minor changes to expression. This was also greatly appreciated.

Thirdly, I would like to acknowledge the National Rugby League (NRL) and their Game Development Officers who conducted lessons for this project. Without the in kind support and the resources of the NRL, this research would not have been possible. Moreover, the professionalism and passion of the GDOs involved in this study was second to none and testament to the NRL.

Finally, I would like to thank the students and schools who were involved in this study. I thoroughly appreciated the opportunity to conduct my research with them and truly hope the students gained something valuable from their experiences.
Abstract

In Australia there has been a concerted effort to provide quality and enriching learning experiences for students in primary school Physical Education (PE). An issue that arises in facilitating these learning experiences is the difficulty of balancing the educational outcomes of PE and the recommended levels of physical activity (PA) for students. Currently in New South Wales primary schools, teaching methods may need a new focus in order to better balance these two goals. A teaching model that may have the potential to balance the educational and physical activity agendas in primary schools is Game Centred Approaches (GCAs).

The aim of this study was to examine the influence of a Game Centred Approach (GCA), in balancing the educational and PA agendas within primary school PE. The central focus was on examining the influence of using a GCA on Stage 3 primary school students’ Game Play Understanding (GPU) within an Invasion/Field Territory Game unit. In addition, this study aimed to examine how the GCA unit would influence the in-class PA levels of students.

The study involved fourteen Stage 3 classes from six primary schools in NSW, Australia. All of the classes received a six-lesson GCA unit in the Invasion/Field Territory Game category. The study utilised a quantitative approach with a quasi-experimental design. Students were videoed playing a pre- and post-test Invasion/Field Territory Game. This was done to measure their learning in the form of Game Play Understanding (GPU) by measuring four components: Decision-Making (DM), Support (SUP), Base/Adjust (B/A) and Skill Execution (SE). Videos were analysed using an adapted version of the Game Performance Assessment Instrument (GPAI) (Oslin, Mitchell and Griffin, 1998).

Accelerometers were used to collect data on in-class PA levels throughout the GCA unit. PA data was calculated in metabolic equivalents (METs). Lesson time spent in PA variables, Total Physical Activity (TPA) and Moderate to Vigorous Physical Activity (MVPA), were established using age-related cut points. From this, the time students spent in PA variables was derived and then averaged over the six-lesson unit.

GPU results indicate that the GCA used had a significant influence on the students’ overall GPU, as they achieved statistically significant improvements in the four GPU components. In-class PA results suggest, that the GCA unit also had a significant influence on students’ in-class TPA and MVPA.
This study concluded that using a GCA when teaching Stage 3 students in the Invasion/Field Territory Game category can significantly improve student GPU and has the potential to offer significant learning benefits. Furthermore, using a GCA can allow this learning to take place whilst students are physically engaged for a large proportion of lesson time.
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List of Acronyms

ACARA: Australian Curriculum, Assessment and Reporting Authority

AIHW: Australian Institute of Health and Welfare

B/A: Base/Adjust

BOS: Board of Studies

BYL: Backyard League

DEC: Department of Education and Communities

DM: Decision-Making

GCA: Game Centred Approach

GDO: Game Development Officer

GofG: Grammar of Games

GPAI: Game Performance Assessment Instrument

GPU: Game Play Understanding

GS:GA: Get Skilled: Get Active

HREC: Human Research Ethics Committee

IOR: Inter-Observer Reliability

MVPA: Moderate to Vigorous Physical Activity
NRL: National Rugby League

PA: Physical Activity

PDHPE: Personal Development, Health and Physical Education

PE: Physical Education

PIS: Participant Information Sheet

SE: Skill Execution

SERAP: State Education Research Applications Process

SES: Socio-Economic Status

SOFIT: System for Observation of Fitness Instruction Time

SPANS: Schools Physical Activity and Nutrition Survey

SPSS: Statistical Package for the Social Sciences

SUP: Support

TPA: Total Physical Activity

UNESCO: United Nations Educational, Scientific and Cultural Organisation

UOW: University of Wollongong

USDHHS: United States Department of Health and Human Services

WHO: World Health Organisation
Definitions of Key Terms

A number of terms have been used throughout this thesis. Their definitions are as follows:

**Accelerometer**: A device used to measure physical activity levels.

**Action Rules**: Rules that assist game players to understand how to play a game or sport.

**Game Centred Approaches (GCAs)**: A pedagogical model used for the teaching of games and sports in Physical Education. The model focuses on enhancing students’ understandings of how to play games and sports.

**Game Play Understanding (GPU)**: A measure of a player’s understanding of how to produce effective and efficient action in a game. It involves a game player’s ability to make decisions during play, their practical efficiency in regard to movement skills, their support of teammates and their ability to adjust to changing game situations.

**Game Performance Assessment Instrument (GPAI)**: An assessment tool designed to measure game performance in a variety of different games and sports, in both offence and in defence/without possession.

**In-Class Physical Activity**: Physical activity (i.e. TPA and MVPA) that students take part in during Physical Education lesson time.

**Moderate to Vigorous Physical Activity (MVPA)**: Physical activity that requires a moderate amount of exertion and noticeably raises the heart rate.

**Invasion/Field Territory Games**: A category of games. The aim of Invasion/Field Territory Games is for a team to score by moving a ball (or other projectile) into another team’s territory and either shooting into a target (a goal or basket), or moving the ball across a line (e.g. try line or end zone). To stop the other team scoring, a team must prevent its opponents from bringing the ball into their territory and blocking their attempts to score.
Offence: Usually refers to times when a player or team is in possession of the ball/projectile object in a game or sport and on the attack.

Physical Education (PE): A subject taught in schools, commonly associated with educating students with the aim of instilling a lifelong commitment to physical activity and enhancing their understanding of various games and sports concepts.

Primary Rules: Rules that set the parameters of play and dictate the boundaries within which game players must operate.

Primary School: The first seven years of schooling that students undertake in Australia. Starting at Kindergarten and concluding at Year Six.

Principles of Play: Underlying principles that help to explain the main aim or premise of games and sports from different categories.

Stage Three: A two year period of work undertaken by students in Years five and six, in Australian, New South Wales (NSW) primary schools. Students in this stage typically range in age from ten to twelve years old.

Strategy: A plan selected prior to playing a game with the intent of organising individual players and the team as a whole during competitive play. They are usually based on likely actions that may be undertaken by opponents.

Tactics: Plans that are made during the game. They are dynamic in nature and are used by players to adapt to the immediate requirements of their ever changing opposition.

Total Physical Activity (TPA): Any bodily movement that substantially increases energy expenditure.

Skill-Drill Approach: A pedagogical approach used for the teaching of games and sports in Physical Education. The approach focuses on enhancing students’ proficiency in sports related movement skills.
Chapter One
Introduction

The F-10 Australian Curriculum - Health and Physical Education (ACHPE) (Australian Curriculum, Assessment and Reporting Authority (ACARA), 2015a) explains that two of the main rationales for Physical Education (PE) in primary schools are to promote student learning and health-enhancing physical activity through engagement in movement activities. Within PE lessons, there is the potential for students to achieve various educational outcomes (e.g. cognitive learning) through participation in quality learning experiences (Rossi, 2006). In addition, PE is an ideal vehicle through which students can be provided with some of their recommended daily Physical Activity (PA) (Ministerial Council on Education, Employment, Training and Youth Affairs, 2008; Crawford, Australian Independent Sport Panel & Australian Department of Health and Ageing, 2009; Audit Office of New South Wales, 2012).

This being the case, in Australia there has been a concerted effort to make the provision of quality and enriching learning experiences for students one of the main agendas in primary school PE. In addition, attempts are often made to balance the key learning focused agenda with engaging students in an appropriate amount of health-enhancing PA. As such, the F-10 ACHPE (ACARA, 2015a) combines learning objectives with strong PA components. Essential to students achieving educational outcomes, alongside higher levels of PA in primary school PE, is their participation in games and sports lessons. As Turner (2005) notes, up to sixty-five per cent of PE curriculum time can be focused on the teaching of sports and games, which emphasises their importance for allowing deep and meaningful learning to occur, as well as for the possibility of high levels of in-class PA.

Within Australian PE, one of the most widely implemented instructional approaches for teaching games and sports in primary schools is the traditional skill-drill approach, in which students are engaged in activities that focus on the development of movement skill proficiency (Forrest, Wright & Pearson, 2012). Research, which is elaborated upon later within the literature review chapter, indicates that the skill-drill approach may not be best practice for teaching games and sports, from both a learning and in-class PA perspective.
This suggests different instructional strategies may be needed for teaching PE in primary schools to achieve the desired outcomes.

Game Centred Approaches (GCAs) are promoted as an alternative to the traditional skill-drill approach for the teaching of games and sports in PE. GCAs is an umbrella term used to refer to a number of interrelated teaching models, including Teaching Games for Understanding (TGFU) (Bunker & Thorpe, 1982) and the Tactical Games Model (TGM) (Griffin, Mitchell, & Oslin, 1997). In Australia, key models include Game Sense (den Duyn, 1997), Play Practice (Launder, 2001) and Play with Purpose (Pill, 2013). Nomenclature aside, the main aim of GCAs is to facilitate students’ understanding of how to play games and sports by encouraging student-centred learning, problem solving, development of technique and decision-making in game-like situations (Webb, Pearson & Forrest, 2006). Moreover, GCAs are pedagogical models that have the potential to assist teachers in achieving the educational and PA agendas of PE within primary school settings (Harvey & Jarrett, 2014).

The benefits of GCAs are well documented and supported by an ever-growing body of empirical evidence (Alison & Thorpe, 1997; Austin, Haynes & Miller, 2004; Gabrielle & Maxwell, 1995; Gray, Sproule & Morgan, 2009; Griffin, Oslin & Mitchell, 1995; Mandigo et al., 2008; McNeill, Fry & Johari, 2011; Miller et al., 2016 and Mitchell, Griffin & Oslin, 1995; 1997). One such benefit is that GCAs have the ability to increase students’ motivation and enjoyment of playing games and PE, whilst still encouraging skill development (Bunker & Thorpe, 1982). Oslin and Mitchell (2006) claim that another advantage of GCAs is that they provide students with an understanding of the technical and tactical skills necessary to be successful across a wide variety of games, thus providing them with the ability to transfer knowledge across different games. The many benefits of GCAs are examined further in the literature review of this thesis.

Although there is research to support the use of GCAs, it can be suggested they are still not widely used in primary school PE environments. According to Forrest, Wright and Pearson (2012), despite 15 years of exposure to GCAs, and 15 years of teacher professional development in GCAs in Australia, there has been minimal change in the teaching of games and sports. From a review of the literature, it is evident that much of the research that positions GCAs as effective pedagogy for enhancing students’ learning, demonstrated by their Game Play Understanding (GPU), is at least 15 years old. In addition, in Australia there
have been limited studies examining the implementation of GCAs in actual school settings (Pill, 2011a).

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2015) posit that PE is the entry point for lifelong participation in PA. In relation to student in-class PA, there has been a recent study which focused on the PA element of PE lessons alone (Dudley et al., 2012) and the literature review identified only two studies which examine PA levels in lessons that utilise GCAs (Smith et al., 2015 & Miller et al., 2016). However, only one of these studies (Miller et al., 2016) has investigated whether using GCAs can maintain high levels of in-class PA for students, whilst concurrently facilitating enjoyment and learning, demonstrated through improvements in students’ GPU.

It is clear that in Australian schools, it has been the role of PE to balance two often competing agendas. One of these agendas is to facilitate quality learning experiences for students. The other is to provide students with in-class PA that can assist them to achieve some of their recommended daily PA (Rossi, 2006). Games and sports in PE have been identified as an area where this balance is consistently attempted (Silverman & Ennis, 2003). However, as the time allocated to PE in schools has a direct bearing on the achievement of these goals, educators are often forced to choose between one agenda or the other, or attempt to pursue both and achieve neither. As will be made clear throughout this thesis, teaching using GCAs in games and sports lessons may have the potential to form part of a solution to this problem.

1.1 Aim of the Research

The aim of this study is to examine the influence of a GCA in balancing the educational and PA agendas within primary school PE. Specifically, the study focuses on the influence of using a GCA on Stage 3 (i.e. Grade 5/6 & age 10-12 years) students’ learning in the form of Game Play Understanding (GPU). This was within an Invasion/Field Territory Game Unit, implemented by the National Rugby League (NRL), as part of their Backyard League (BYL) program. In addition, the study examined how the GCA unit influenced in-class PA levels of Stage 3 students, by determining whether they met United States of America (USA) prescribed in-class PA thresholds.
1.2 Research questions

This study is guided by the following questions:

Central Question
Can improvements in learning and high levels of in-class physical activity (PA) be achieved concurrently in a unit where students are taught using a GCA?

In order to answer this central question two primary questions were used to examine both the learning and physical activity facets of the study, they are as follows:

Student Game Play Understanding (GPU)
1) What is the influence of a GCA Invasion/Field Territory Game unit on the Game Play Understanding (GPU) (i.e. student learning) of Stage 3 students?

Student In-Class Physical Activity
2) What is the influence of a GCA Invasion/Field Territory Game unit on Stage 3 students’ in-class physical activity (PA) levels (i.e. Total Physical Activity – TPA & Moderate to Vigorous Physical Activity – MVPA) in an Invasion/Field Territory Game unit?

1.3 Hypotheses

Student Game Play Understanding (GPU)
1) Stage 3 students who are taught a unit on Invasion/Field Territory Games using a GCA, will demonstrate significant improvements in their GPU.

Student In-Class Physical Activity (PA)
2) Stage 3 students who are taught a unit on Invasion/Field Territory Games using a GCA will be physically active (TPA) for an average of two-thirds of lesson time across the unit.
The identification of the two-thirds TPA threshold is based on work summarised by van der Mars (2006).

3) Stage 3 students who are taught a unit on Invasion/Field Territory Games using a GCA will engage in MVPA for a minimum of 50% of lesson time on average, across the unit, as recommended by the United States Department of Health and Human Services (USDHHS) (2010)

1.4 Significance
This study is significant because it will:

a) Provide further research in support of GCAs
b) Inform future practice and curriculum in PE
c) Address the dearth of research on PA levels in GCA lessons
d) Contribute to determining if PA and learning outcomes can be achieved simultaneously in PE lessons.

One of the main goals within PE is to enhance the learning of students (Chen & Ennis, 2004). Specifically, within PE, student learning can be focused within three domains (psychomotor, cognitive and affective) (Harvey & Jarrett, 2014). It can be argued that in many primary schools, teachers are often most concerned with students having fun in games and sports lessons, with few longitudinal aims being associated with PE (Quay & Peters, 2008). This is often at the expense of lesson structure, with activities conducted in a piecemeal fashion, often devoid of significant physical activity or meaningful learning (Quay & Peters, 2008). According to Stolz and Pill (2014), an instructional approach that has been identified as demonstrating promise in enhancing all three domains of learning and raising the quality of PE in primary schools is GCAs.

However, the literature review of this thesis indicates that GCAs are not widely used in actual school settings, despite their identified benefits. Many advocates of GCAs (see for example Griffin, Brooker & Patton, 2005 and Butler et al., 2008) partially attribute this to a lack of field-based research relating to GCAs. This lack is evident within Australian primary schools, where minimal research has been conducted regarding GCAs (Pill, 2011a). One of the most championed benefits of GCAs is that they have the potential to enhance students’ GPU, yet
the majority of studies supporting this claim are at least 15 years old and few have been conducted in an Australian primary school setting. In addition, many of these studies (Allison & Thorpe, 1997; Gabrielle & Maxwell, 1995; Griffin, Oslin & Mitchell, 1995; Mitchell, Griffin & Oslin, 1995; 1997, Miller et al., 2016) utilised relatively small samples, decreasing the generalisability of the results. The current study is of worth because it endeavours to partially address this oversight in the literature by providing evidence from a significant sample that can be used to determine the influence that using a GCA can have on students’ GPU in Australian primary schools.

The new F-10 national curriculum for Health and Physical Education in Australia has a strong focus on students understanding and learning through movement in games and sports contexts, as opposed to simply participating (Australian Curriculum, Assessment and Reporting Authority – ACARA, 2015a). For instance, one of the elaborations/key teaching points from the Movement and Physical Activity descriptors is that students work towards ‘developing strategies that exploit the playing space to create overlaps and extra attackers’ (ACARA, 2015a). It can be argued that more traditional approaches to teaching games and sports in PE wouldn’t facilitate the achievement of this and similar outcomes (Pill, 2011a & Kirk, 2005a). This is additional impetus for further investigating the effectiveness of teaching approaches such as GCAs, which more closely align with the educative aims of this new curriculum.

Within NSW primary schools, as the literature review points out, students’ lack of PA is a concern (Hardy et al., 2010 and The Audit Office of NSW, 2012). The significance of this study is further reinforced by the fact that it examines a teaching method that has the potential to engage students in TPA for the majority of lesson time, whilst concurrently raising their MVPA levels, in the limited time that is allocated for PA and PE in NSW primary schools. A recent report produced by Active Healthy Kids Australia (2014) explains that there is a significant dearth of research relating to the quantity and quality of PA in Australian school settings. Furthermore, the report argues that the objective measuring of PA variables in PE lessons is essential to address this paucity of research. This is particularly important for legitimising the use of GCAs in a performative culture now focused on accountability, assessment and compliance with physical activity guidelines (UNESCO, 2015). In essence, this study is further justified by the notion that it can contribute to addressing this deficiency.
The significance of the current study is increased by the fact that although students’ GPU and PA levels in PE lessons have been researched in isolation in the past, to the knowledge of this researcher there have been only two studies (Smith et al., 2015 and Miller et al., 2016) which have examined students’ PA levels in GCA lessons. Moreover, only one of these studies (Miller et al., 2016), has investigated whether both outcomes, student learning and in-class PA, can be balanced in games lessons. However, it should be noted that because it was a pilot study, Miller et al. (2016) has various limitations, all of which will be discussed in the literature review. Thus, the results of the current study will address a gap in the research literature and provide new findings about the merits of GCAs. It is also anticipated that the results will lead to further research into pedagogical methods used to assist physical educators to effectively achieve both learning and PA outcomes in the curriculum. The significance of the study is further strengthened by the fact that it has the potential to investigate how more time can be devoted to PA in lessons with less time spent on instruction using a GCA.

1.5 Overview of Research Design

This study followed a quasi-experimental design. The study aimed to determine the influence of using a GCA (independent variable), in a primary school setting, on students’ GPU and in-class PA levels (dependent variables), in a specific games category (Invasion/Field Territory Games). The study utilised a pre-test/post-test design to examine the influence of the GCA unit on students’ GPU. Assessment of students’ achievements in meeting PA thresholds was ongoing throughout the unit.

1.6 Overview of Methodology

The study involved Stage 3 (i.e. Grade 5 & 6/Age 10-12 years) students in fourteen classes across six primary schools in NSW Australia. All classes received a six-lesson Invasion/Field Territory Game unit, taught using a GCA as the principal pedagogical model. The unit was implemented as part of the National Rugby League’s (NRL) Backyard League (BYL) program and was taught by NRL Game Development Officers (GDOs). GDOs attended a one-day workshop and training course on GCAs and how to implement all lessons within the teaching unit. This is elaborated on in the methodology chapter. The teaching model used was
a GCA called the ‘Grammar of Games’ (Forrest, 2015a), which will be explained in-depth in the methodology chapter. All lessons covered outcomes from the Games and Sport strand of the NSW PDHPE syllabus (BOS NSW, 2007).

The study utilised a quantitative approach with a quasi-experimental design in order to determine GPU prior to and following the GCA unit. Exploration of primary question one was achieved through videoing students’ game play in the pre- and post-test Invasion/Field Territory Games of modified touch Rugby League (Backyard League). These videos were then analysed using an adapted version of the Game Performance Assessment Instrument (GPAI) (Oslin, Mitchell & Griffin, 1998). This provided numerical data which was used to determine each student’s overall GPU.

To answer primary question two, physical activity monitors called accelerometers were worn by participants to measure their in-class PA levels during the lessons taught in the GCA unit. This method provided data that indicated the amount of lesson time that students were physically active (i.e. TPA) and engaged in MVPA, thus enabling the researcher to ascertain the influence of using a GCA on students’ in-class PA levels within the lessons taught.
Chapter Two

Literature Review

2.1 The Traditional Skill-Drill Approach for Teaching Games and Sports

2.1.1 Overview of Teaching Physical Education Using Skill-Drill in NSW Primary Schools

According to various authors (Forrest, 2015b; Harvey & Jarrett, 2014; Kirk, 2010) the teaching of games and sports in PE has been based upon providing students with a broad range of experiences in different sports, with an emphasis on students becoming proficient in foundational movement skills (i.e. sprint run, overarm throw, catch, dodge, pass). Historically, physical educators have endeavoured to achieve these aims through utilising a pedagogical approach known as the traditional skill-drill approach, as it will be referred to from now on in this review. The traditional skill-drill approach is characterised by students developing technical proficiency in foundational and then specialised movement skills, and it is based on the premise that these skills need to be learnt before they are put into practice, during game play in an associated sport (Rink, 2002). The traditional skill-drill approach follows a sequential three-stage process consisting of a warm-up, skill practice or drills, and a game-based activity at the end (Roberts & Fairclough, 2011). This approach has been relatively unchallenged over the last fifty years and remains the modus operandi for teaching games and sports during PE in most Australian school settings (Wright & Forrest, 2007, and Forrest, Wright & Pearson, 2012).

This is currently the case in NSW primary schools, with the skill-drill approach reflected in teaching resources regularly used by primary school teachers such as ‘Get Skilled: Get Active’ (GS:GA) (NSW Department of Education and Training - DET, 2000) and the Live Life Well @ School resource (DEC, 2015). These resources are presented on the NSW Department of Education and Communities (DEC) curriculum support website (DEC, 2015) as the key to more active students and were developed to assist primary school teachers to help students attain mastery in various movement skills (DET, 2000).
Evidence from the NSW Schools Physical Activity and Nutrition Survey (SPANS) 2010: Short Report (Hardy et al., 2010) suggests that from its inception until 2004, the ‘GS:GA’ resource had a positive impact on students’ proficiency in movement skills, as many realised statistically significant improvements. However, since 2004 there has been minimal improvement in the movement skills of primary school students, with mastery of some skills, in fact declining. The NSW SPANS (Hardy et al., 2010) indicates that the level of mastery for all movement skills is currently low among primary school students in NSW, with only 50–60% of Year 6 students exhibiting proficiency. Current curriculum expectations suggest students in Year 6 should be able to perform movement concepts in a controlled and sequenced manor in order to meet benchmarked standards (NSW Department of Education, 2017 & ACARA, 2015a). Considering the aforementioned benchmarks in conjunction with the low levels of proficiency indicated in the NSW SPANS report (Hardy et al., 2010), it can be suggested that many students in Year 6 are not reaching movement skill competency and thus arguably failing a key component of PE.

From the aforementioned evidence, one can infer that despite the availability of such resources as ‘GS:GA’ for at least a decade, they have been relatively ineffective in achieving their aim of teaching students to master various movement skills. It is plausible then, to conclude that this lack of success may in part be due to the traditional skill-drill approach for teaching games which underpins these resources. As such, it is necessary for this review to examine some of the limitations of the traditional skill-drill model.

2.1.2 Limitations of the Traditional Skill-Drill Approach

Although the traditional skill-drill approach is frequently utilised in PE lessons, there is evidence that indicates that the approach may have limitations in achieving its intended outcomes when teaching games and sports. One such limitation is that the skill-drill approach often involves the exclusive use of a directive teaching style (Light, 2013b). Magill (1990) explains that the skill-drill approach places the teacher at the centre of the learning process, whilst the student simply reproduces knowledge in the form of correct skill execution. Pill (2011a) argues that as a result, students who learn via the traditional skill-drill approach can become passive recipients in the learning process and are often only involved in rote learning. This then presents the problem that in PE lessons where the traditional skill-drill approach is
used, students may not be engaged at a level that could facilitate higher-order thinking, in performing tasks which require problem solving and/or decision-making (Kirk, 2005a). This apparent lack of foregrounding of student cognitive engagement or ‘higher level’ cognitive processing is a concern for PE, considering the new ACHPE is grounded on the key idea of critical inquiry and positions PE on the general idea of critical thinking, decision making and problem solving development (ACARA, 2015a). Moreover, it can be argued that the traditional skill-drill approach is not reflective of a quality teaching approach (Light, Curry & Mooney, 2014 and Pill, 2011b), as required by the NSW Quality Teaching Framework (NSW DET, 2003) because of the abovementioned limitations.

The aforementioned literature supports the notion that due to limited student involvement in cognitive processes, the traditional skill-drill approach may not help students understand how to play the game in which the skills they have learnt are applied. Foundational studies into games and sport teaching, summarised by Oslin and Mitchell (2006), Stolz and Pill (2014) and Harvey and Jarrett, (2014) suggest that the traditional skill-drill approach can be ineffective at improving students’ decision-making and ultimately does not assist them in becoming better game players. Indeed, lessons using the skill-drill approach may lead to students being able to complete skills to a high standard in practice but as Light, Harvey and Mouchet (2014) indicate, in many cases this does not translate into performing the skill during game play. It can be argued that because the constituent parts of sports are compartmentalised and techniques are practised in isolation under decontextualised conditions in skill-drill lessons, this practice is unlikely to relate to actual game play (Roberts & Fairclough, 2011). According to Jones, Harvey and Kirk (2014) teaching using the skill-drill approach can cause movement skills to become increasingly abstract and so far removed from the game that they are rendered meaningless, leading to a lack of significance and relevance for students. Furthermore, it can be argued that there is little point in a student being able to perform a skill in isolation, yet not understand how to play the game in which that skill could be used, and as the research illustrates this is a definite limitation in relation to the use of the skill-drill approach.

Oslin and Mitchell (2006) suggest that using the traditional skill-drill approach can isolate students who have limited experience in the sport being learnt, and this has been suggested as one of its major shortcomings. O'Connor (2006) argues that the traditional skill-drill approach rewards students who enter PE lessons with existing skills and who possess athletic
competencies. Conversely, the traditional skill-drill approach can isolate and marginalise students who lack movement skills. The isolation of less athletic students in PE lessons due to the use of the traditional skill-drill approach is further highlighted in research summarised in Oslin and Mitchell (2006). Oslin and Mitchell’s (2006) summary supports the view that inexperienced students can leave skill-drill lessons with low self-efficacy, a poor perception of their movement abilities and ultimately disengagement with PE. This can in turn impact on their long-term participation in games and sports (Kirk, 2005b). From the research outlined above, it can be surmised that lessons using the traditional skill-drill approach do not support students who lack movement skills. Rather, these lessons may mean that many of these students do not derive enjoyment from PE, and these lessons may facilitate the aforementioned negative outcomes and experiences.

Kirk (2005a) infers that a further limitation of approaches like the traditional skill-drill approach is that they are characterised by short periods of PA, due to an over emphasis on technique. This notion is supported by van Beurden et al. (2003), who found that in lessons which focused on promoting mastery of FMS, on average, students were only engaged in MVPA for 34.7% of lesson time, well under the 50% needed to provide students with health-related benefits (USDHHS, 2010). The lack of PA undertaken by students in skill-drill focused lessons is further reinforced by Fairclough and Stratton (2005). Fairclough and Stratton (2005) found that students, who participated in skill-based activities during PE were only involved in MVPA for 22% of lesson time. The traditional skill-drill approach places such a strong emphasis on skill-drill based activities (Rink, 2002) that it is conceivable that such an approach could be relatively ineffective in promoting high levels of MVPA.

Forrest, Wright and Pearson (2012) explain that one of the underlying aims of the skill-drill approach is for students to be proficient in, or master, movement skill before the more cognitive elements of game play are addressed. Mastery of movement skills requires students to complete skills at quite an advanced level, as ‘mastery’ is ‘characterised by the integration of all the component parts of a pattern of movement into a well-coordinated, mechanically correct and efficient act’ (Gallahue & Donnelly, 2003, p. 63). Moreover, it takes roughly 600 minutes of instruction time for primary school children to become proficient in one movement skill (Hardy et al., 2010). The implications of this are that mastery of movement skills is rarely achieved in the time allocated for PE (McCracken, 2001). From this, one can deduce that the traditional skill-drill approach could be deemed to be fundamentally flawed,
as there is simply not enough time for students to ‘master’ movement skills. As a result, students may have limited opportunities to experience the more cognitive components of game play. One pedagogical method that has shown promise in facilitating understanding of cognitive elements of game play is found in Game Centred Approaches (GCAs).

2.2 Game Centred Approaches (GCAs) for Teaching Games and Sports

2.2.1 Overview of Game Centred Approaches (GCAs)

GCAs are regularly presented as meaningful and effective methods for teaching the games component of PE. GCAs is an umbrella term that refers to teaching models that use modified games as the core learning vehicle in games and sports lessons (Oslin and Mitchell, 2006). Most GCAs have spawned from the work of Bunker and Thorpe (1982) who drew on the earlier work of Mauldon and Redfern (1969). Some of these models include Teaching Games for Understanding (Bunker, and Thorpe 1982), The Tactical Games Model (Mitchell, Oslin, and Griffin, 2006), Play Practice (Launder, 2001), Game Sense (Light, 2004), the Tactical-Decision Learning Model (Grehaigne, Wallian, and Godbout 2005), the Ball School model (Memmert and Roth 2007), the Games Concept Approach (McNeill et al. 2008) and the Invasion Games Competence Model (Tallir et al. 2007). While there are a vast range of GCA models and nomenclature developed from different circumstances, according to Bunker and Thorpe (1982) and Forrest, Webb and Pearson (2006), the general aim of GCAs is to facilitate students’ understanding of how to play games and sports by encouraging student-centred learning, problem solving, and the development of technique and decision-making in game-like situations. Bunker and Thorpe (1982) and Light (2013a) note that GCAs are founded on the belief that students come to PE lessons with their own understandings about games, and they should therefore be active participants in the learning process, constructing their own knowledge around games and sports. According to Kirk and MacPhail (2002) this aligns GCAs with more contemporary constructivist, student-centred learning perspectives and it can be argued this increases the intellectual quality of GCA lessons and may promote higher levels of cognitive learning.

GCAs have developed into a worldwide movement with variations in practice developing according to local needs and circumstances. While there are many variations in the titles used
to describe the different GCAs, the majority follow a similar process when teaching games and sports. This process generally involves students initially playing a modified version of a game, focusing on game play understanding (GPU), strategic and tactical problems, game rules, and principles that underlie various actions within games (Gréhaigne, Richard & Griffin, 2005). As students’ understanding of the game and associated concepts develops, the complexity of play is gradually increased with the addition of further rules, concepts and techniques. As a result of GCAs placing a strong focus on playing modified games for a large proportion of lesson time (Stolz and Pill, 2014 & Harvey and Jarrett, 2014) there is also a higher potential for more quality PA to occur (Culpepper, Tarr & Killion, 2011). The most well recognised GCA, Teaching Games for Understanding (TGfU) incorporates six basic phases that are taught in a cyclical manner. These phases are: students playing the game (which is the focus), game appreciation by students, development of strategic and tactical awareness, assisting students to make appropriate decisions, skill execution/practice and then game performance (Webb, Pearson & Forrest, 2006). Within these phases quality teacher questioning is vital, as it is key in helping students develop tactical understandings, by focusing their attention on particular aspects of the game and assisting them with decision-making (Wright & Forrest, 2007).

As Mitchell, Oslin and Griffin (2006) explain, rather than teaching students about one game or sport GCAs are based on the view that games should be grouped. Moreover, they posit the notion that games should be taught via one of four categories: Target, Striking/Fielding, Net/Wall Court or Invasion/Field Territory Games. These categories are based on the similarities that exist between games in regard to their primary and action rules, their principles of play and their strategic and tactical underpinnings (Gréhaigne, Richard & Griffin, 2005). This allows a focus on the concepts of the category, rather than on a particular a sport. Moreover, teaching students about various concepts using a number of different games within a category allows students the opportunity to transfer the concepts learnt in one game to other games in that category, as opposed to limiting the focus to just one particular sport (Mitchell, Oslin and Griffin, 2006).
2.2.2 Advantages of Game Centred Approaches (GCAs)

2.2.2.1 Cognitive Learning

There is a growing body of evidence indicating that GCAs have the capacity to improve student learning outcomes in games and sports lessons. Much of the foundational research on GCAs involved comparative studies that aimed to determine which model, the traditional skill-drill or the GCA, is better for teaching games and sports (Wright et al., 2005). Findings from these early studies indicate that there are a range of advantages to using GCAs. One notable advantage, found in numerous studies, is that students’ learning via GCAs has the ability to produce significant improvements in various aspects of their GPU, particularly decision-making in both offence and defence (Light, Harvey & Mouchet, 2014). These studies have involved students playing games including basketball, hockey, volleyball, squash and soccer (Allison & Thorpe, 1997, Gabrielle & Maxwell, 1995, Griffin, Osln & Mitchell 1995, Mitchell, Griffin & Osln, 1995, 1997).

The literature makes clear that GCAs have the potential to elicit improvements in the cognitive area of decision-making, a major aspect of students’ GPU. Gréhaigne, Richard and Griffin (2005) argue that students’ ability to make correct decisions in games lessons is essential to them becoming competent game players and achieving success in PE lessons. The fact that there are numerous studies (Allison & Thorpe, 1997, Gabrielle & Maxwell, 1995, Griffin, Osln & Mitchell 1995, Light, Harvey & Mouchet, 2014, Mitchell, Griffin & Osln, 1995, 1997) which have all reported similar positive results adds to the credibility of the claim that GCAs can improve students’ GPU, and this can be offered as an important advantage of the approach. However, it should be noted that the majority of these studies were conducted at least 15 years ago and this review has found that to date, there have been only a limited number of Australian primary school studies that attest to these results.

Research findings summarised in Stolz and Pill (2014) highlight that it is difficult to make conclusive statements about the efficacy of GCAs, because the generalisations found in the aforementioned literature may be of minimal use to practitioners. According to Brooker et al (2000) such research could be deemed to have marginal relevance to the ‘natural setting’ of each practitioner and as Stolz and Pill (2014) posit, what may be effective with one class may
not necessarily equate to the same approach working in other contexts (e.g. different curriculum expectations, different kinds of students, organisational and equipment constraints). According to Stolz and Pill (2014) this is why a change from a ‘technical vs. tactical’ perception of research in action in the 1990s has been repositioned to research occurring in a ‘naturalistic setting’ of the PE teaching context (Brooker et al., 2000). Thus, new research is needed for further conclusions to be made on whether the improvements suggested in earlier research (Allison & Thorpe, 1997, Gabrielle & Maxwell, 1995, Griffin, Oslin & Mitchell 1995, Mitchell, Griffin & Oslin, 1995, 1997) can occur in various Australian primary school settings, and whether the claims made by these early researchers are still applicable in today’s PE teaching and learning environments.

It is often proposed that learning via GCAs assists students to transfer game play concepts, as well as their tactical and strategic knowledge, across games in the same category. Mitchell and Oslin (1999) found that students were able to transfer the tactical and procedural knowledge learnt in a unit on badminton, to a unit centring on pickleball (a modified Net/Wall Court game). Similar studies have also reported positive results, with students being able to transfer their decision-making skills and tactical understandings from volleyball to badminton (Jones & Farrow, 1999), soccer to basketball (Castejón Oliva, 2000 cited in Garcia Lopez et al., 2009, p. 56) and Ultimate Frisbee to European Handball (Martin, 2004). Although more research may be needed in this area, the research that does exist supports the view that learning via GCAs can assist students to transfer their knowledge from one game to another in the same category, and this can be offered as a further benefit of utilising the approach.

### 2.2.2.2 Movement Skill Development

Whilst the central aim of GCA lessons it not to promote movement skill mastery and practice, various research (Gray & Sproule, 2011, Memmert & Ko´nig, 2007 and Tallir et al., 2007) provides evidence that they are still effective at improving students’ movement skills. Research conducted in school settings on students in grades six and nine (Allison & Thorpe, 1997, French et al., 1996, Mitchell, Griffin & Oslin, 1995, 1997 and Turner & Martinek, 1992) indicates that students taught using a GCA demonstrated significant improvements in their movement skills over the course of a unit. Moreover, in each of these studies there was
also a group of students who were taught using the traditional skill-drill approach. From the results, it was concluded that there was minimal difference in the movement skill performance of the GCA and traditional skill-drill groups at the end of the units.

Austin, Haynes and Miller (2004) further reinforce the notion that GCAs are effective in improving students’ fundamental movement skill achievement. Following a GCA intervention, the post-test results from their study showed overall improvement in the level of mastery in students’ kicking skills. Although there may be a need for additional studies, there is no conclusive evidence that indicates that GCAs are any less effective than the traditional skill-drill approach at improving students’ movement skills.

However, there is research that suggests GCAs may in fact be advantageous for movement skill development. Turner and Martinek (1999) found that students who were taught using a GCA were more proficient in their ball control and passing execution in hockey, compared to a control and traditional skill-drill group. Their findings were supported by Ford, Yates and Williams (2010) and Williams and Hodges (2005), who suggested that performing movement skills in game play, as is done in GCA lessons, may be more beneficial to skill development, as the approach places performers under the perceptual, cognitive and movement demands that are required during games. According to these studies students are therefore more likely to be proficient in the skill during actual game play. From the above evidence, it can argued that the ability to apply skills in game play is more beneficial and relevant than only being able to perform a skill in practice and in isolation. Although this area may require supplementary research, it is plausible to suggest that using GCAs may on certain levels be more advantageous to the movement skill development of students than the skill-drill approach.

2.2.2.3 Affective Advantages

Another advantage of GCAs is that they have potential to increase students’ motivation for playing games and through this improve their attitudes towards PE. There are a number of studies that provide data in support of this assertion. These studies are particularly valuable as they report on students’ responses to GCAs. One such study was conducted in Australia by Chen and Light (2006) and examined the responses of a Year 6 class of thirty students, who
undertook a ten-week cricket unit, underpinned by a GCA. The qualitative data of this study indicated that the unit had a positive impact on students’ social interactions, relationships, perceptions of learning and attitudes towards PE.

Larger recent studies (Mandigo et al., 2008, McNeill, Fry & Johari, 2011, Gray, Sproule & Morgan, 2009 and Jones, Marshall & Peters, 2010), further corroborate the evidence from Chen and Light (2006). The findings of these studies indicate that the GCAs used, generated a strong mastery and motivational climate, with the students associating success with the lessons taught and recording positive affirmations relating to their perceived development of movement skills and game understanding. This finding is important as students’ intrinsic motivation and perceived confidence are precursors to lifelong participation in games and sports and higher levels of PA as adults (UNESCO, 2015). In addition, Fry et al. (2010) suggest that students may in fact prefer to learn via GCAs. From their qualitative results, Fry et al. (2010) were able to report that the primary school students in their study preferred to learn via GCAs, as opposed to their regular PE lessons. Earlier studies have examined students’ perceptions of GCAs from the teachers’ perspectives (Allison & Thorpe, 1997 and Mitchell, Griffin & Oslin, 1997). The conclusions of these studies closely align with, and reinforce, the results of the aforementioned studies, which examine motivation and enjoyment during GCA lessons from student perspectives.

From the above review of the research, it is apparent that the use of GCAs can be a valuable and appropriate pedagogy for enhancing the motivation and enjoyment of students in PE lessons, which is a clear advantage from a teaching and learning perspective.

2.2.3 Current Adoption of Game Centred Approaches (GCAs) in Australian School Settings

Despite the evidence of GCAs’ capacity to deliver quality educational outcomes, the literature provides minimal evidence of them being adopted in Australian primary and secondary school settings. Pill (2011a) found that GCAs were not fully understood or implemented by the majority of secondary PE teachers that were surveyed in South Australia. Pearson and Webb (2010) found similar results when they surveyed secondary PE teachers in NSW. The results from their study reveal that only 45% of teachers had incorporated GCAs
into their teaching of games. Pearson and Webb (2010) also examined pre-service teacher observations of PE lessons, and from all the pre-service teachers surveyed, only 22% indicated that they had observed teachers that utilised a GCA. Pill (2011a) suggests the absence of school-based research on GCAs in Australia may be a key reason for this lack of acceptance.

Unfortunately, there is no research to date that has examined teacher adoption of GCAs in Australian primary school PE settings. According to the Audit Office of NSW (2012) primary school teachers receive professional development on how to teach using GCAs. In addition, there has also been a shift towards primary pre-service teacher education advocating the usage of GCAs for games teaching (Webb, Pearson & Forrest, 2006). However, usage of GCAs by expert PE teachers in secondary schools is limited, and resources such as ‘GS:GA’ encourage the use of the skill-drill approach in primary schools. Moreover, as highlighted in Whipp et al. (2011), primary school teachers face many barriers in regards to teaching PE (e.g. lack of time, knowledge, energy, training, confidence and suboptimal attitudes towards PE). Given these obstacles, it is plausible that the adoption of GCAs would be just as infrequent, if not more infrequent, in NSW primary schools as it is in the state’s secondary schools. The lack of acceptance of an approach that has a wide range of conceivable benefits is definitely an area of concern that researchers should aim to address.

2.3 Physical Activity Levels During Game Play in Physical Education Lessons

One way in which students’ in-class PA can be increased within school settings is to promote higher levels of game play within PE lessons. From the current literature it can be surmised that lessons that involve game play as the focus have the potential to facilitate higher levels of in-class PA (Culpepper, Tarr & Killion, 2011). Culpepper, Tarr and Killion (2011) found students were most physically active in lessons where game play was the focus, compared to fitness- and skill-orientated lessons. This was further supported in another study where the PA levels of twenty-seven Year 7 classes were analysed (Dudley et al., 2012). Dudley et al. (2012) found that on average, game play made up almost half (44%) of the lesson time, of the classes observed. The study also found that the average time students spent in MVPA was 56.9%. From this, Dudley et al. (2012) were able to extrapolate that positive correlations
between MVPA and game play exist. As a result, the inference can be made that students’ participation in game play was a major contributing factor to the high proportion of time spent in MVPA. Both studies provide initial evidence in support of the notion that game play in PE lessons can engage students in higher levels of PA.

In lessons that use GCAs, playing the game is the central focus. Therefore, it can be inferred that using GCAs in PE would have the potential to promote high levels of in-class PA. Such an idea is reinforced by Bell et al. (2011), who found that students participating in small-sided and modified games had higher levels of in-class PA, compared to when they played full-sided games. Further to this, Hannon and Ratcliffe (2005) reported a relationship between participating in modified Invasion/Field Territory Games and heart rate elevation, and Owen, Twist, and Ford (2004) found that soccer games that had fewer players (i.e. 3 vs. 3) compared with those that had more (i.e. 5 vs. 5) produced higher heart rates. In addition, Van Acker et al.’s (2010) study found that using modified games with abridged rules has the potential to elicit MVPA levels that meet the USDHHS (2010) guidelines. Smith et al. (2015) further substantiated this claim, finding that MVPA levels in classes where a GCA was the principal pedagogical model met recommended PA thresholds. Furthermore, a review by Gabbett, Jenkins, and Abernethy (2009) suggests that many coaches and elite trainers believe that games-based training that utilises modified small-sided games, are an effective method for promoting high levels of PA and improving players’ fitness (Gamble, 2004 and Gabbett, 2006).

Based on the findings from a range of studies (see for example, Bell et al., 2011, Hannon & Ratcliffe, 2005, Owen, Twist & Ford, 2004, Van Acker et al., 2010, Gamble, 2004 and Gabbett, 2006), one could infer that GCAs have the capacity to facilitate high levels of PA in PE lessons because, as identified earlier, student involvement in small-sided and modified games is a fundamental component of GCAs. However, from this review, it would appear that although studies have examined the in-class PA levels of students participating in game play during PE, there is a scarcity of studies that explore students’ in-class PA in PE lessons where a GCA is used. The only study that has examined whether both outcomes (student learning and PA) can be achieved simultaneously is that of Miller et al. (2016). However, it should be noted that unlike the current study, Miller et al.’s (2016) study was only a pilot project and had a relatively small sample of students that had their GPU analysed after GCA
lessons \((n=32)\). Moreover, due to the pilot nature of the Miller et al. (2016) study, the System for Observation of Fitness Instruction Time (SOFIT) (Pope et al., 2002) was used instead of accelerometers. From the research of Westerterp (2009), it can be inferred the SOFIT is a less valid method for measuring in-class PA, compared to accelerometers. This indicates a gap in the literature and as Harvey and Jarrett (2014) emphasise, more research is needed that directly investigates the in-class PA levels of students in PE lessons which utilise a GCA.

2.4 Physical Activity and Australian Primary School Students

2.4.1 Importance of Physical Activity for Primary School Students

It is universally recognised that PA is vital to the health of primary school students (UNESCO, 2015, Audit Office of NSW, 2012, Australian Institute of Health and Welfare (AIHW), 2012; The World Health Organisation (WHO), 2010). As a result, the NSW PDHPE K-6 Syllabus (BOS, 2007) emphasises that it is the responsibility of schools and PE to provide students with regular and frequent opportunities for health-enhancing PA. For many children, PE provides their only consistent sessions of physical activity and this increases the necessity for students to receive their entitlement of quality physical education within school curricula (UNESCO, 2015). Numerous reports (Audit Office of NSW, 2012; Australian Institute of Health and Welfare (AIHW), 2012; The World Health Organisation (WHO), 2010) list the various health benefits associated with young people participating in regular PA. These benefits include: favourable skeletal development, improved physical and psychological wellbeing and an increased likelihood of PA in adulthood.

Not only does PA benefit primary aged young people’s physical health, but it can also be of great value to them cognitively. A report produced by the Centre for Disease Control (2010), reported that several studies have found associations between PA and student attention span, and that PA has the potential to enhance students’ concentration levels during class time. Several studies (Ericsson, 2008, Tremarche, Robinson, & Graham, 2007, Dollman, Boshoff, & Dodd, 2006 and Carlson et al., 2008) also attest to the notion that increasing students’ in-class PA has the potential to enhance their performance in both literacy and numeracy.
Conversely, if primary school students lack PA, it can have a negative impact on their wellbeing. There is clear evidence that a lack of PA has a strong relationship with obesity (Pietiläinen et al., 2008). A review conducted by Cliff et al. (2010) suggests that this can be of particular detriment to primary aged students’ participation in games and sports and their social and mental wellbeing, as well as having catastrophic long-term effects, not only on the individual but also on the wider community. Cliff’s findings are supported by the estimated annual direct cost of obesity in Australia of twenty-one billion dollars in 2005 (Colagiuru et al., 2010). Furthermore, according to the AIHW (2012), there is a relationship between the increasing proportion of Australian children who are overweight and obese and a lack of PA. The above review highlights the importance of primary aged students participating in regular PA.

2.4.2 Current Physical Activity Levels of Students in New South Wales (NSW) Primary Schools

The Australian Department of Health and Ageing (2014) recommend that young people should accumulate at least sixty minutes of MVPA every day. However, despite the obvious aforementioned health benefits, only 19% of Australian children and young people, aged 5–17 years meet the physical activity recommendations (Australian Bureau of Statistics (ABS), 2013). It is a widely held belief that schools and PE are an effective medium through which students can be provided with some of this daily PA (Australian Sports Commission, 2016, McKenzie & Lounsbery, 2009, National Heart Foundation of Australia, 2014 and UNESCO, 2015). For this reason, it is recommended that within PE lessons, students engage in MVPA for at least 50% of lesson time (USDHHS, 2010). However, various reports and studies suggest that in primary schools this is rarely achieved (Hollis et al., 2016).

Evidence suggests that many primary school students in NSW also do not meet the recommended amount of TPA per day. Results found in the SPANS report (Hardy et al., 2010) from a large study that examined primary aged students’ PA in NSW, suggests that overall less than 50% of the Year K, 2 and 4 students surveyed spent sixty minutes or more per day in PA. Similarly, amongst the Year 6 students surveyed in the study, only 58.3% achieved the recommended daily PA in summer school terms, with the percentage being even less in winter school terms at 54% (Hardy et al., 2010). As such, it can be deduced that
overall, NSW primary school students struggle to achieve recommended levels of PA, which is consistent with the findings of Hollis et al. (2016), who reviewed a number of studies worldwide that examined primary school students MVPA in PE lessons.

The previous discussion provides evidence to support a perception that in NSW primary schools, students are rarely provided sufficient opportunity to receive enough PA and that this contributes to the overall low levels of PA. According to the Audit Office of NSW (2012), primary schools should provide students with at least two hours of planned PA per week. The Audit Office of NSW (2012) concluded that roughly 30% of NSW government primary schools do not meet this recommendation. The Audit Office of NSW (2012) also suggests that even in schools that do provide two hours of planned PA, students are likely to be inactive for periods of this time, due to the class management, equipment set-up and activity transition logistics that are inherent in most organised sport and PE lessons (Roberts & Fairclough, 2012).

From the Audit Office of NSW (2012) report it can be inferred that current programs and initiatives in place within NSW primary schools for helping students receive some of their daily PA have a need for improvement. This is indicative of the necessity for researchers to examine new and innovative approaches that can improve students’ levels of in-class PA. The National Heart Foundation of Australia (2014) and Active Healthy Kids Australia (2014) have called for further research into how active Australian children and young people are when engaged in organised activities, such as PE lessons. The National Heart Foundation of Australia (2014) argues that research is needed because little is known regarding the ‘quality’ (intensity of activity and amount of time being active) of organised movement activities and levels of physical participation during games sessions, thus providing further impetus for the current study.

2.5 Outsourcing Physical Education to External Providers

Outsourcing PE to external providers, such as development officers from various sporting bodies is a common practice in many primary schools (Williams, Hay & Macdonald, 2011). While this practice may be common, it is worth noting that whilst there are benefits to utilising external providers there are also disadvantages around them being used to deliver the
PE curriculum. There has been some commentary in recent years around some generalist primary school teachers having an ‘inexpert’ level of knowledge and competence that may prevent them from being willing or able to teach PE (Williams & Macdonald, 2015 and Powell, 2015). The above notion is further supported by various research and literature (Morgan, 2008; Morgan & Hansen, 2008; Faucette et al., 2002; Faulkner et al., 2008; Sloan, 2010; and Sherman, Tran & Alves, 2010, Whipp et al., 2011) which suggests some primary school teachers face many barriers in regards to teaching PE (e.g. lack of time, knowledge, energy, training, confidence and suboptimal attitudes towards PE).

Considering the above barriers it can be argued that using external providers could be beneficial to both students and teachers in primary schools. Some benefits include; the fact that many external providers have highly developed sport specific skills and knowledge, they understand how to appropriately structure a coaching session (e.g. warm-up, stretching, modified games & skill practice) they are comfortable instructing in various PE settings, they provide the appropriate equipment for the lesson, they may increase student motivation towards the activity, many provided by sporting bodies are free of cost and are economical in regards to time, as they set-up and then pack up the lesson at its conclusion (Williams, Hay & Macdonald, 2011 and Powell, 2015).

Although using external providers to deliver PE curriculum seemingly has a range of benefits there are also potential disadvantages to their usage. There is research (Powell, 2015, Parnell et al., 2016 & Jones and Green, 2017) which suggests that some external providers adopt a discourse that reflects a view that PE is equivalent to coaching sport skills (e.g. teaching students how to perform specific sports related skills and the rules of specific sports). Furthermore, there is also research and literature (Griggs, 2008, Griggs, 2010, Blair & Capel, 2011, Parnell et al., 2016 and Jones & Green, 2017) to suggest that external providers may be able to provide engaging sporting experiences but may not understand curriculum requirements as they often have a high level of content knowledge (e.g. what to coach) but have low levels of pedagogical content knowledge (e.g. how to coach/teach or how to plan and assess appropriately), may not be able to develop the same rapport with students as teachers and can have difficulty dealing with the behaviours of more challenging students.

From the above evidence it can be suggested that PE delivered by external providers may only expose students to the traditional skill-drill approach. It can be argued that only being
exposed to the traditional skill-drill approach could lead to student’s experiencing some of
the approaches pitfalls as emphasised earlier in this review (e.g. reliance on the use of a
directive teaching style, doesn’t promote cognitive learning and less conducive to health
enhancing PA) and not being exposed to the benefits of more constructivist teaching
approaches such as GCAs and their associated benefits (e.g. Promotion of cognitive learning,
higher levels of PA and enhanced motivation towards participating). Whilst a coaching sports
specific skills discourse may be appropriate for training sports teams it does present issues in
regards to the delivery of PE curriculum where as suggested in the F-10 ACHPE curriculum
(ACARA, 2015a) at the end of Years 5 and 6 students should be able to propose and
combine movement concepts and strategies to achieve movement outcomes
and solve movement challenges whilst applying the elements of movement when composing
and performing movement sequences. Arguably, these standards of achievement could be
difficult to achieve using a traditional skill-drill approach. Whilst an external provider
delivering PE may be better than a program delivered by certain generalist primary school
teachers, there could still be deficiencies in the coverage of the PE curriculum and therefore
may not preferable to a trained PE teacher delivering the curriculum.

Through a close examination of the literature regarding outsourcing PE to external providers
it is evident that there may be certain benefits around this practice. However, a review of the
literature has also problematized their usage based on a range of potential disadvantages
namely, the educational quality of the lessons they are able to deliver. With both these
advantages and disadvantages in mind, it is clear that if external providers such as sporting
bodies are to be used in Australia in the provision of some primary school PE, then their
programs and teaching units should be subject to assessment to confirm their achievement of
F-10 ACHPE (ACARA, 2015a) outcomes and that those involved in the delivery of programs
develop skills and receive professional learning on ‘how to teach’ and used to supplement
current programs within schools rather than being a substitute for quality PE delivered by an
appropriately qualified teacher as suggested in the Australian Council for Health, Physical
Education and Recreation (ACPER) National Position Statements (ACPER, 2018).
2.6 Summary

This review provides a strong conceptual and theoretical foundation for conducting the current study. This review analysed literature on PA, specifically that which relates to NSW primary school students and their PA levels. Overall, it is apparent that a vast number of NSW primary school students are not achieving the recommended amount of PA per day, which is concerning, considering that PA is essential for health and wellbeing. The amount of time spent in PA in NSW primary schools, and the methods by which students attain some of this PA, could be improved. This is a concerning situation which has been highlighted by this review, indicating that there is a need for research on innovative teaching approaches that could address this problem. GCAs are one such approach that could provide a remedy. However, it is clear from this review that more research is needed into the effectiveness of GCAs.

In summary, it was made evident that in-class PA levels can be improved by promoting game play in PE lessons. As has been previously discussed, GCAs are a teaching model where the chief aim is to develop students’ understanding through game play, and this indicates that they may be beneficial in promoting high levels of in-class PA. Yet, this review found only a few studies that examine the PA levels that can be achieved by students in GCA lessons. This lack is one which the current study aimed to address.

Evidence provided in this chapter confirms that the traditional skill-drill approach is still one of the most widely used approach for teaching games and sports in Australian primary schools. The usage of the skill-drill approach continues despite the research suggesting that it may not be best practice for promoting student learning and in-class PA. This indicates that a different focus may be needed for the teaching of PE in primary schools. The literature review has also sought to analyse and evaluate GCAs, which could be seen as a viable and arguably more appropriate alternative for teaching games and sports, in terms of balancing the learning and PA goals of PE.

After consideration of the literature, which demonstrates the many advantages of using GCAs, it is evident that they are a viable alternative for teaching games and sports and can be of potential for positive benefit to all students, particularly in promoting significant learning
and PA. Despite these advantages, this review suggests that GCAs are not widely used within actual primary and secondary school settings in Australia. This highlights a distinct problem, one which many researchers (see Pill, 2011a; Metzler, 2005; Griffin, Brooker & Patton, 2005; and Butler et al., 2008) suggest can only be solved by ‘filling the chasm between theory and practice’ (Butler et al., 2008, p. 6) with more field-based research in school settings. As a result of this review, deficiencies within the literature have also come to light regarding GCAs. Much of the research that examines improvements in students’ GPU is at least ten years old and Australian research in this area is scarce. This too provided a strong rationale for conducting the current study.
Chapter Three
Methodology

3.1 Introduction

The purpose of this study was to examine the influence of a GCA, in the Invasion/Field Territory game category, on Stage 3 students’ GPU and in-class PA (i.e. TPA and MVPA). The main focus of this study, and the design of the GCA unit, were for Stage 3 students. In order to answer the research questions and test the hypotheses, data was collected using various quantitative methods. In addition, this chapter will detail the research design, development of the GCA unit and data collection tools. Details about the research site, participants, procedures, data analysis methods and ethical considerations will also be provided.

The primary research questions and hypotheses that guided this study are as follows:

Central Question

Can improvements in learning and high levels of in-class physical activity (PA) be achieved concurrently in a unit where students are taught using a GCA?

Student Game Play Understanding (GPU)

1) What is the influence of a GCA Invasion/Field Territory Game unit (independent variable) on the Game Play Understanding (GPU) (i.e. student learning) (dependent variable) of Stage 3 students?

Student In-Class Physical Activity

2) What is the influence of a GCA Invasion/Field Territory Game unit (independent variable) on Stage 3 students’ in-class physical activity (PA) levels (i.e. Total Physical Activity – TPA and Moderate to Vigorous Physical Activity – MVPA) (dependent variable) in an Invasion/Field Territory Game unit?

In order to address these research questions the following hypotheses were tested:
**Student Game Play Understanding (GPU)**

1) Stage 3 students, who are taught a unit on Invasion/Field Territory Games using a GCA, will demonstrate significant improvements in their GPU.

**Student In-Class Physical Activity (PA)**

2) Stage 3 students, who are taught a unit on Invasion/Field Territory Games, using a GCA, will be physically active (TPA) for an average of 2/3 of lesson time, across the unit. The identification of the 2/3 TPA threshold is based on work summarised by van der Mars (2006).

3) Stage 3 students who are taught a unit on Invasion/Field Territory Games, using a GCA, will engage in MVPA for a minimum of 50% of lesson time on average, across the unit, as recommended by the United States Department of Health and Human Services (USDHHS) (2010).

**3.2 Research design**

This study followed a quasi-experimental design, which as Mertens (2010) expounds, is used to determine the influence of an independent variable on a dependent variable. The study aimed to determine the influence of using a GCA (independent variable), in a primary school setting, on students’ GPU and in-class PA levels (i.e. TPA and MVPA) (dependent variables).

To answer the first primary research question, the study utilised a pre-test, post-test design. Lodico, Spaulding and Voegtle (2010) note that the pre-test, post-test design is one of the methods most commonly used if a researcher wants to determine the effectiveness of a certain teaching model. In addition, an ongoing assessment of in-class PA was conducted in each lesson of the unit, using physical activity monitors called accelerometers. PA was assessed during each lesson and not in the pre- and post-test, as the study was concerned with in-class PA.

The study involved 316 students in 14 classes, from across 6 different schools. All students involved in the study (N= 316), participated in a pre-test Invasion/Field Territory Game of
Modified Touch Rugby League (i.e. Backyard League) (see Appendix One). Each student’s game play was recorded using a video camera placed in an area of the play space (a) to capture all students’ game play behaviours and (b) to avoid interfering with actual play. Upon completion of the pre-test game, all students then participated in a six-lesson unit, with each lesson lasting 40 minutes in length and using GCAs as the principal pedagogical model. This unit was implemented as part of the National Rugby League’s (NRL) Backyard League (BYL) program and was taught by NRL Game Development Officers (GDOs). At the conclusion of the unit, post-test data was obtained, with students playing the same game as in the pre-test. To obtain in-class PA (i.e. TPA and MVPA), selected students from each group (N= 210) wore an accelerometer during each lesson in the unit. Not all students in the study wore an accelerometer due to availability of monitors. However, each class had students (N= 15) wearing the monitors. These students were selected at random by the researcher. It is important to note, that each student wore the same accelerometer throughout the study, alleviating the issues associated with inter-accelerometer variability.

The study did not utilise a comparison group due to the fact that offering the new approach to some students at schools and not to others was deemed inequitable, as the NRL could not commit staff to implement the teaching unit post-study for the students in a comparison group. It was also not feasible to offer the program to students in a comparison group at a later date due to time constraints and the organisational structures of the schools involved. Through the utilisation of intact classes, randomisation of students was conducted at the class level, supporting this study’s classification as quasi-experimental (Creswell, 2008).

Mertler and Charles (2005) explain that the major limitations associated with conducting quasi-experimental research that pose a threat to internal validity are the lack of a pre-test/post-test design and randomisation of participants. Within this study, the researcher attempted to address the aforementioned limitations by (a) conducting pre- and post-tests and (b) randomising classes. Other threats to internal validity are discussed throughout this chapter and practices used to minimise their impacts are explained. The flow chart on the following page provides an overview of the methodology of this study.
Figure 1: Methodology Flow Chart

The GCA, Invasion/Field Territory Game unit is developed. Pre- and post-test games are designed.

Consent to conduct the study sought and granted by The University of Wollongong Human Research Ethics Committee (UOWHREC) and The New South Wales Department of Education and Communities State Education Research Approval Process. (NSW DEC SERAP).

Schools approached by the researcher to gauge expressions of interest. 6 primary schools are selected to take part in the research. Participant information sheets and consent forms distributed to 14 classes who will take part in the research.

Quasi-experimental design used to investigate the principal research questions takes place.

14 Classes

Invasion/Field Territory Game Unit

Pre-test

6 Lessons

Post-test

Video footage of the pre- and post-test and physical activity monitors (accelerometers) worn by students, were the modes of data collection for this study.

Video footage and accelerometer data was organised and individual students were allocated codes. Video footage and accelerometer data were analysed.

Results/Findings drawn from the data analysis.
3.3 Development of the Game Centred Approach (GCA) Invasion/Field Territory Game Unit and Pre and Post-test Game

The teaching unit that formed the basis of this study was developed by Dr Gregory Forrest (PhD), a leading expert in the area of games and sports teaching and coaching. The content and structure of the lessons within the unit were based on GCAs. The GCA used as the basis for the unit in this study is called the Grammar of Games (GofG) (Forrest, 2015a). This GCA should be explained, as it has some differences to other GCAs. Figure 2 outlines the teaching approach used in this study.

**Figure 2: Diagram of Game Centred Approach (GCA) used in this Study**

(Forrest, 2015a)

As Figure 2 shows, the GCA used in this study advocates that playing the game and developing students’ understanding of the underlying concepts and principles of games and sports should be the central focus of lessons. As Figure 2 highlights, within GCA lessons, strategy and tactics, movement skill technique and decision-making are all focus areas, with
the strong interdependence between the concepts made clear to students (Gréhaigne, Richard & Griffin, 2005). However, additional areas of concentration and communication (verbal and non-verbal) were also a focus. In addition, the GCA used in this study focuses on developing students’ understandings of the principles of play for the Invasion/Field Territory game category, as this gives students access to what Gréhaigne, Richard and Griffin (2005) describe as the internal logic of the game category. Principles of play are underlying principles that help to explain the main aim or premise of games or sport (Hopper, 1998). Once understood, these principles can then be applied to each of the specific sports that belong in that category. In this study, the underlying principles in offence were to move to create, receive or deliver the ball, advance to score and use an appropriate pass. In defence, the underlying principles focused on tracking and pressuring the ball and receivers, and using player-to-player defence, zone defence, or a mix of the two. This approach assumes that students’ understanding of these principles increases when they can identify where they are applicable in the Invasion/Field Territory sports they may play, allowing improved transfer of the principles into the context (sport) of the unit.

Additionally, the GCA in the current study involved students learning about primary rules and action rules. Primary rules are those that set the parameters of play and dictate the boundaries within which game players must operate (Gréhaigne, Richard & Griffin, 2005). For instance, a primary rule in Rugby League (a popular Invasion/Field Territory Game/Sport in Australia) is that the ball cannot be passed forward from the hands. Another is that players have six tackles to complete an attacking set. Action rules are those ‘unwritten rules’ that assist students in understanding how to play a game, and often form the foundations to achieve principles of play (Gréhaigne, Richard & Griffin, 2005). These action rules are often common across sports in the same category. For instance, in the Invasion/Field Territory Game category a simple action rule related to offence is that a player should be moving when they receive a pass, such as when taking a hit-up in Rugby League or when receiving the ball from a handpass in Australian Football. Within the unit, the focus was on three action rules for when a team is in possession of the ball and three action rules for when a team is without possession. As with the principles of play, the identification of commonality of the action rules in Invasion/Field Territory sports was encouraged to allow improvement of transfer of learning. These rules are shown in the table on the following page.
Table 1: Action Rules for Game Centred Approach (GCA) Unit

<table>
<thead>
<tr>
<th>With Possession</th>
<th>Without Possession</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Be moving when you receive a pass</td>
<td>1) Play as big as possible (with your body)</td>
</tr>
<tr>
<td>2) If you don’t get the first pass, be ready for the next</td>
<td>2) Don’t rush at the player you’re marking (remain in the defensive line)</td>
</tr>
<tr>
<td>3) Run straight at the defensive line</td>
<td>3) Try to stop a pass being made (tag, intercept, pressure the ball carrier or receiver)</td>
</tr>
</tbody>
</table>

All of the above concepts were imbedded throughout the unit and lessons taught in this study. This was facilitated by students playing two modified games, one called ‘10 Passes’ and another called ‘Kangaroos and Jillaroos’ (See appendix two for a detailed description of both games). In each week’s lesson, additional primary rules and progressions were added to the game, with the specific aim of developing students’ understanding of the principles of play and the action rules and their application within the four concepts (Decision-Making, Strategy and Tactics, Movement Skill Execution and Communication and Concentration) explored using the aforementioned GCA. Thus, the application of each principle of play involved: developing plans for game play; making decisions in game play; knowing which aspects of the game to focus on; learning how to communicate in a way that ensures the principle is applied successfully; and understanding the different movement skills needed in play. The lessons in the unit aligned with the Stage 3, Games and Sports strand of the K-6 PDHPE syllabus (BOS NSW, 2007). This allowed participants to achieve the normal PE outcomes for their year group. Each lesson was forty minutes in length, a time frame that is consistent with most primary school PE lesson times (Audit Office of NSW, 2012).

Following the development of the lessons, the researcher and supervisors discussed and designed the pre- and post-test Invasion/Field Territory Game in collaboration with the NRL (see Appendix One). The game was a simple modified version of Touch Rugby League called Backyard League. It was specifically designed for small teams (four players a side) in order to maximise participation and allow students the opportunity to demonstrate their understanding of the concepts learnt throughout the unit. Once the researcher and supervisors were satisfied with the quality of the lessons and the pre- and post-test, they were submitted to the University of Wollongong Human Research Ethics Committee (UOW HREC) and then
placed under review by the NSW Department of Education and Communities State Education Research Applications Process (SERAP). The unit, lesson plans, as well as the pre- and post-test, were deemed ethically appropriate.

3.4 Game Category Selection and Justification

The researcher decided that the unit should focus on a single game category, Invasion/Field Territory Games. This decision was based on the belief that Invasion/Field Territory Games have relatively low levels of inactivity (due, for example, to their quick restarts) and facilitate opportunities for all students to be involved in the game simultaneously (Perlman & Forrest, 2015). Due to this high involvement of students, it was postulated that during analysis observers would have a greater number of game play sequences to inform their judgment about each player’s performance during game play. Moreover, the literature suggests that teaching units utilising Invasion/Field Territory Games has the potential to elicit higher levels of physical activity than games in other categories (Perlman & Forrest, 2015). This further supported the selection of the game category, as promoting high levels of physical activity was one of the aims of the GCA unit. A variety of modified Invasion/Field Territory Games were designed for students to experience throughout the unit (see Appendix Two).

Focusing the unit on Invasion/Field Territory Games was also based on the requirements of the NRL and the prior experience of the NRL GDOs who taught the unit, along with the requirements of the analysis instrument used for assessing the pre- and post-test performances, the Game Performance Assessment Instrument (GPAI) (Oslin, Mitchell & Griffin, 1998). The GPAI used for assessing GPU in this study has been validated and is most commonly used for assessing Invasion/Field Territory Games (Arias-Estero & Castejon 2014), such as basketball and soccer, whereas it has not been validated for assessing other games in different categories (Memmert & Harvey, 2008). The instructors for the unit (NRL GDOs) also had a greater level of confidence, training and content knowledge on Invasion/Field Territory Games and this too acted as a determinant in the selection of the game category for the unit.
3.5 The Backyard League Program (BYL)

The NRL BYL is the NRL’s entry-level program for children. It was developed to introduce students to the game of Rugby League, a popular Invasion/Field Territory Game in NSW. The major objective of NRL BYL is to provide every primary school-aged child in Australia with the opportunity to experience playing Rugby League, and to enhance their understanding of how to play the game. The program is typically run in primary schools for five to six lessons. Prior to this study the BYL program was already run across NSW primary schools. However, the researcher through discussions with the NRL felt that the program had inconsistencies in its implementation and could be updated to reflect more current games teaching ideologies such as GCAs. This made the program an ideal medium for testing the GCA utilised in this study.

3.6 Fidelity of Implementation

To ensure that the GCA unit was implemented in the manner required for this study, each lesson was video recorded and evaluated by two independent monitors who were experts in GCAs and games teaching. Each expert had a PhD in the games and sports teaching realm, a combined thirty years PE teaching experience and had coded over one thousand hours of video across different sports prior to this project. Video recordings of one lesson from sessions one to six of the teaching unit were randomly chosen to validate the Game Development Officers (GDO) use of the GCA. It should also be noted that a lesson taught by each GDO involved in the study was assessed. Each of these lessons was observed in its entirety (i.e. 40 minutes) and assessed. In the assessments teaching practice was measured against several elements of GCAs. These elements were: modified game play as the focus, principles of play, primary and action rules, strategy and tactics, student decision-making and use of questioning by the GDO. These recordings were then used in conjunction with the GCA Assessment Scaffold (Forrest, 2015b) (see Appendix Three) to determine if the lessons were reflective of GCA pedagogy. From this assessment each lesson was found to be ‘developed’ in its use of GCAs and as such, both of the independent experts agreed that the unit taught was reflective of the content and strategies outlined in the unit and lesson plans.
3.7 Sample Selection

3.7.1 Selection of Research Site

Primary school students were chosen as participants because it had been identified that current programs in Australian primary school PE could be improved (Audit Office of NSW, 2012). Utilisation of a GCA within a primary school setting was based on its capacity to be an effective and quality pedagogical approach (Forrest, Wright & Pearson, 2012). The researcher decided to use the GCA with Stage 3 primary school students because it can be argued that if students are exposed to GCAs at an early age in primary schools, this may assist in their development of GPU and strengthen their results in secondary school. The above argument is supported by Kirk (2005b) who has suggested that future success and learning in PE stem from early experiences in primary school. Stage 3 students were selected as they are transitioning from general experiences to more specific games and sports programs in high school, and are developmentally of the appropriate age for the method used (Mitchell, 2005).

The study utilised a purposeful sample that was inclusive of diverse demographics and socio-economic statuses, from the Sutherland Shire, Campbelltown, Wollongong and Shellharbour areas. The selection of schools was also based on NRL staffing, resources and pre-established relationships between the NRL and schools. As a result of this sampling students had varying levels of Rugby League experience as indicated in a survey conducted by the NRL not related to the current study. The NRL’s survey indicated that only some students had played Rugby League before (26% of Males and 2% of females) whilst the rest of the students in the study had limited experiences. No data was collected on students GCA familiarity however, as suggested in the literature review it is likely that due to the limited usage of GCAs in NSW primary schools it is unlikely students would have been exposed to a GCA before the current study. Prior to making contact with any primary school, the researcher gained permission from both the University of Wollongong Human Research Ethics Committee (UOW HREC) and the New South Wales (NSW) Department of Education and Communities (DEC) State Education Research Applications Process (SERAP). Next, the researcher made initial contact with six principals of government primary schools, located in low, moderate and high socio-economic areas in the Sutherland Shire, Campbelltown, Wollongong and Shellharbour areas.
A formal meeting with each principal was organised, where details of the project were discussed and a letter describing the specifics of the proposed study was given to each principal. All six principals approved the request to conduct the study in their school. A copy of the letter to the principals can be found in Appendix Four.

### 3.7.2 Selection of Participants

A total of 378 students were approached from 14 Stage 3 classes to take part in the study from across the six schools. Only students whose parents/guardians provided consent participated in the study, from the 378 students approached a total of 316 students consented to take part in the study. All students whose parents consented to their participation took part in the six-lesson GCA unit. All students whose parents did not provide consent still participated in the GCA unit as it formed part of their regular PE program, however they were excluded from all video recordings and did not participate in the pre- and post-tests.

All Stage 3 classes at each school were selected to take part in the study. This was done to inflate the sample size, in order to allow for participant drop-out and attrition, which can pose a threat to internal validity (Mertler and Charles, 2005). The large sample size was also used to increase the generalisability of the results (Cohen, Manion & Morrison, 2011). It should be noted that the study did not utilise a comparison group due to ethical considerations, NRL staffing constraints and organisational constraints in the schools involved.

### 3.7.3 Demographic Details

Schools and students who participated in this study were selected based on their differing levels of socio-economic status (SES), the percentage of Aboriginal and Torres Strait Islander students involved, and the percentage of students from non-English speaking backgrounds. The following table summarises the demographics of the six schools involved in this study.
Table 2: Demographics of Schools Involved in Study

<table>
<thead>
<tr>
<th>School</th>
<th>No. of Students involved in study</th>
<th>SES Status</th>
<th>Aboriginal and Torres Strait Islander Students</th>
<th>Language Background other than English</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 HE</td>
<td>38</td>
<td>Moderate - High</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>2 CE</td>
<td>54</td>
<td>Low - Moderate</td>
<td>4%</td>
<td>10%</td>
</tr>
<tr>
<td>3 BH</td>
<td>66</td>
<td>Low</td>
<td>23%</td>
<td>20%</td>
</tr>
<tr>
<td>4 SC</td>
<td>86</td>
<td>High</td>
<td>3%</td>
<td>19%</td>
</tr>
<tr>
<td>5 TUL</td>
<td>31</td>
<td>Moderate</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>6 PRS</td>
<td>41</td>
<td>Low</td>
<td>4%</td>
<td>72%</td>
</tr>
</tbody>
</table>

Source: (ACARA, 2015b)

3.8 Selection and Training of National Rugby League (NRL) Game Development Officers

The NRL BYL program is implemented across primary schools Australia wide. This program is traditionally run by GDOs who are trained by the NRL to facilitate lessons in school settings. As the GCA approach was tested through the BYL program, GDOs were utilised to implement the teaching unit for this study. The GDOs were paid by the NRL to run the program in the selected schools, making their involvement a convenient and cost-effective way to facilitate the GCA teaching unit simultaneously across different locations. Five GDOs were selected to facilitate the program across the six schools in the study, due to the fact that they were responsible for the selected schools based on their region of employment and their working relationships within each school. The use of external providers to outsource PE programs in primary schools is a common practice within Australia (Williams & Macdonald, 2015). Therefore, the researcher saw no issues in the program being taught by GDOs as opposed to the classroom teacher, as this was reflective of the current teaching landscape in NSW primary school PE.

All five GDOs were experienced in implementing the traditional BYL program and had teaching and coaching qualifications. Further to this, each GDO attended a one-day workshop and training course on GCAs and how to implement all lessons within the teaching unit. The
training day was facilitated by Dr Gregory Forrest (PhD) and the researcher. Each lesson in the teaching unit was broken down, explained and demonstrated, with the GDOs having the opportunity to participate and observe exemplar teaching practice utilising the GCA. In addition, each GDO was provided with a teaching resource (see Appendix Two) with activities, lesson plans and suggested questions to assist with their implementation of the program.

Although the unit was deemed ethically sound, it was still under a constant state of review by the researcher, supervisors and NRL GDOs in regard to both the content and appropriateness of the GCA. After each lesson, the researcher would meet to discuss and review lesson implementation and effectiveness with the GDOs. GDOs also had the opportunity to have their questions relating to the teaching unit answered by the developer Dr Gregory Forrest via an online reflection blog that was set up by the NRL for this project. McAlpine et al. (2004) argue that teachers should constantly review and reflect upon their practice, as this assists in determining lesson weaknesses, thus allowing alterations to be made to improve future practice. The GDOs were able to seek advice on any issues that arose during lessons and any necessary modifications were made to the plan for the following lesson to ensure that any elements of the GCA that were difficult to implement were rectified.

3.9 Procedures

3.9.1 Authorisation

For this research project to take place, authorisation was required from the UOW HREC and the NSW DEC SERAP. In addition, participant consent, as well as parent/guardian consent, were obtained due to all students being under the age of consent.

3.9.1.1 Approval from the University of Wollongong Human Research Ethics Committee and New South Wales Department of Education and Communities State Education Research Applications Process.

The UOW HREC granted approval for this research project from 19/06/2014 to 18/06/2015. The reference number for this approval was HE14/154.
As this study was conducted in a NSW DEC school, approval was also sought and granted by the NSW DEC SERAP. The reference number for this approval was 2014134.

### 3.9.1.2 Participant consent

Meetings were arranged with the fourteen classes involved in the study. In these meetings the project was explained verbally and students’ questions were answered. At these meetings, a Participant Information Sheet (PIS) (see Appendix Five) was distributed to students to give to their parents/guardians. The PIS outlined the purpose of the study, what it involved, and what would be expected of students who chose to be participants. At this time a parental consent form (see Appendix Six) was also distributed to students. It was explained to the students that if they wanted to participate in the study, they would need to get parental permission, as they are under the age of consent. In addition, all potential participants were informed that they could refuse to take any further part in the study at any time, and that all information and data obtained within the study would have no impact on their relationship with the researcher or the University of Wollongong.

### 3.10 Data Collection

#### 3.10.1 Data Collection tool: Pre-test and Post-test

In this study all participants played a modified Invasion/Field Territory Game that was used to measure GPU in the pre- and post-test. The game was a modified form of Rugby League, a traditional Invasion/Field Territory Game played in Australia. A description of the game and its rules can be found in Appendix One. Prior to participation in the pre-test game the researcher explained all the primary rules to students and they were shown how to wear their accelerometers. Students were then broken up into randomly assigned groups of four and allocated to one of four fields. Students were provided five minutes to play the game in order for them to become familiar with the rules. At this time, it was made clear to the participants that they could ask any questions of the researcher or GDOs regarding the rules of the game. The introductory five-minute period was used to ensure that when students were video
recorded, they would be predominantly playing the game, as opposed to asking procedural questions or trying to work out the rules.

After the initial five-minute session, video recording commenced and the students participated in the game for fifteen minutes. Each of the games was refereed by the researcher or the GDO in order to make sure that students were following the primary rules and playing the game correctly. The researcher, assistants and GDOs ensured that they only clarified primary rules and did not provide any advice to participants on how to play the game (e.g. movement skill technique, strategy and tactics and positioning), even if they were asked. This was done because providing students with advice could have improved their game play and given them an advantage, thus impacting upon the tests’ validity. The post-test followed exactly the same procedure as the pre-test, with students playing the same opposition and each of the games lasting the same period of time (15 minutes). The fifteen-minute duration of play was selected for two reasons. Firstly, it was deemed an appropriate amount of time to collect sufficient video to analyse students GPU. Secondly, the fifteen-minute duration was also based on organisational constraints of the schools involved and the fact that other procedural activities needed to also be conducted within the forty-minute timeframe allocated by the schools for each lessons. The following table details how the forty minute period allocated for the pre and post-test was divided.

**Table 3: Breakdown of lesson time for Pre and Post-test**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction provided by researcher and NRL GDOs</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Explanation and demonstration of Pre/Post-Test</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Students broken up into teams and allocated a designated field of play.</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Introductory game-play to become familiar with the rules of the game.</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Video recording and students participate in Pre/Post-test.</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Conclusion and thanks</td>
<td>5 minutes</td>
</tr>
</tbody>
</table>
3.10.2 Data Collection tool: Videos of Pre and Post-test

In order to capture students’ game-play, both the pre- and post-tests were video recorded. The researcher set up two high definition cameras, chosen because of their ability to capture the complexity of students’ movement responses, on each of the four fields. These cameras were located in an area which provided a clear view of the entire playing space. Teams of students were video recorded playing the pre- and post-test games for seven-and-a-half minutes with their backs to the camera. They then moved to the other side of the field, so that they were facing the camera, and then played for a further seven-and-a-half minutes. This was done to ensure that all students could be clearly seen, so as to assist later analysis. Heath, Hindmarsh and Luff (2010) argue that video footage is beneficial as it allows the researcher to stop, pause and rewind, thus making analysis easier, and as Banville and Polifko (2009) point out, it is particularly useful in capturing and analysing movement responses. The aforementioned points explain why the pre- and post-tests were videoed, because in order to analyse students’ GPU, the tests needed to be reviewed a number of times. Videos also allowed the researcher and assistants to take their time when making assessment judgements.

3.10.3 Data Collection tool: Activity Monitor (Accelerometer)

To enable the collection of data on students’ in-class PA levels during the lessons in the unit, students wore an activity monitor called an accelerometer around their waists. One-hundred-and-fifty-five participants in the GCA group were required to wear an ActiGraph GT3X+ accelerometer, which were placed on their waists at the right hip and supported by an elastic band. This device provided a measure of activity intensity and duration measured in counts. Data from the accelerometers provided the researcher with the amount of time (in seconds) that students engaged in TPA and MVPA. According to Hjorth et al. (2012), ActiGraph accelerometers are the most extensively validated monitors on the market. Furthermore, Westerterp (2009) suggests that using an accelerometer is one of the most valid ways to measure both PA time and intensity. Accelerometers were distributed to students before each lesson, GDOs then recorded the start and finish time of each session. This enabled the researcher to determine the beginning and end of each lesson for measurement of PA using the ActiGraph software.
3.11 Data Analysis

Analysis of data was conducted to answer each research question. As such, analysis was conducted to answer the questions associated with (a) GPU and (b) in-class PA.

3.11.1 Student Game Play Understanding (GPU)

3.11.1.1 The Game Performance Assessment Instrument (GPAI)

Student GPU was measured using a modified Game Performance Assessment Instrument (GPAI) (Oslin, Mitchell & Griffin, 1998). The GPAI is a multidimensional observation tool designed to measure game performance behaviours that demonstrate tactical understanding (Oslin, Mitchell & Griffin, 1998). The GPAI measures individual game performance components such as: decision-making, skill execution, support play and a player’s ability to adjust in a game, with the end result being an overall score in each component. When viewed together, these components can be used to make inferences regarding a student’s overall GPU (Gréhaigne, Richard & Griffin, 2005). As Memmert and Harvey (2008) discuss, the GPAI is highly useful because it can be adapted and modified to suit a number of different games, and as Arias-Estero and Castejon (2014) point out, it is the most popular assessment instrument used for measuring game performance in PE.

The GPAI was chosen to assess students’ GPU, due to the fact that it is a widely accepted method for assessing this outcome. This acceptance is typified by a number of studies (Griffin, Oslin & Mitchell, 1995; Harvey, 2003; Harvey et al., 2010; Mitchell, Griffin & Oslin, 1995; Mitchell & Oslin, 1999; Pritchard et al., 2008) that have used the GPAI to determine students’ GPU. In addition, the GPAI is valuable because it has the ability to measure, not only on-the-ball skills, but also off-the-ball skills, with other assessment instruments lacking in this capacity (Memmert & Harvey, 2008). Furthermore, the researcher chose to use the GPAI as it has been widely used with Invasion/Field Territory Games (Arias-Estero & Castejon 2014) and the components of Decision-Making (DM), Skill Execution (SE), Support (SUP) and Base/Adjust (B/A) have been validated for assessing Invasion/Field Territory Games that have similar characteristics to the pre- and post-test game used in this study (Arias-Estero & Castejon 2014).
The most common method of analysing game play when using the GPAI is a tally system using pen and paper (Memmert & Harvey, 2008). However, within this study, the researcher utilised Prozone software and a program called Gamelens for all game play analysis. Prozone is the official data provider to the NRL and their technology facilitates the comprehensive and objective evaluation of every aspect of performance in Rugby League (Prozone Sports, 2015). Furthermore, Prozone analysis software has been used and validated in a number of studies (Di Salvo et al., 2006; Schoeman & Coetzee, 2014; Castellano, Alvarez-Pastor & Bradley, 2014) to examine a range of outcomes in various games and sports. This made the program an extremely valid and reliable tool to use in conjunction with the GPAI for assessing students’ GPU.

The lead researcher, research supervisor and two Prozone support officers designed the appropriate coding window, based on the elements of the GPAI (see Appendix Seven). The program allowed the researcher to link the pre- and post-test videos to a coding timeline. Once this had been done, the researcher and assistants used the coding window that they had developed to analyse all the videos on a designated coding day.

### 3.11.1.2 Analysts’ Training on Coding Using GPAI and Prozone (Gamelens) Software

The pre- and post-test videos were analysed by the researcher and four trained coders (third- and fourth-year Bachelor of Health and Physical Education students). Prior to analysis, each coder engaged in a three-hour training session on using the GPAI to assess game play in Invasion/Field Territory Games. Within this training session the assessment criteria were explained to coders, and a demonstration was conducted on how to use the assessment criteria to analyse students’ game play responses (e.g. when to code a response and what rating to give a response), using a post-test game. Coders were then instructed on how to use the Prozone software (Gamelens) in conjunction with the assessment tool. This was done by two Prozone support technicians. Following this, coders were each provided a video of a pre-test game in order to apply what they had been taught in the training session, and to practise coding an assessment video. During this time, the researcher and Prozone support technicians
were able to provide each of the coders with additional support on their utilisation of the marking criteria and the Prozone software (Gamelens).

By observing each analyst’s coding and comparing the analysts’ results, at the end of the session it was deemed that each of the coders had a strong understanding of the assessment criteria and the Prozone software. Coders were also provided with an information pack that included Prozone instructions and coding protocols (see Appendix Eight). Coders were asked to review this information along with the assessment criteria prior to returning on the designated coding day.

3.11.1.3 Coding Pre-Test and Post-Test Videos

All coding of game performance data was conducted during a designated coding day at the University of Wollongong’s Pedagogical Laboratory for PE and Sport. For the purposes of this study, the GPAI was adapted to assess students’ GPU in the pre- and post-test games. Each participant’s overall GPU was determined through a multi-stage approach. Initially, participants’ game play behaviours were coded into the following categories: Decision-Making (DM), Skill Execution (SE) Support (SUP) and Base/Adjust (B/A), examining their performance when their team was in possession of the ball (offence) and when it was not in possession (defence). Coding of game play behaviours required a decision on each student’s play, using a four-point scale that was used to rate each student over a 10-minute section of game play (4=Highly Developed, 3=Developed, 2=Developing, 1=Beginner). For each student, an overall score was calculated by averaging their scores for each category (e.g. Decision-Making = Combined Average Score for DM-Offence and DM-Without possession). Appendix Nine provides more details associated with descriptors and coding of game play behaviours. Figure 3 details the analysis process used for both the pre- and post-test videos. Refer to Appendix Seven for a screenshot illustrating this process.
Once coding of an entire pre- or post-test video was complete, the program then converted the timeline into a coding matrix table (see Appendix Seven for an example). The researcher was then provided with numerical data indicating how many times individual students made various responses in all four categories (DM, SE, SUP & B/A). Using the Gamelens program the researcher exported the results from this table to Microsoft Excel.

### 3.11.1.4 Inter-observer reliability (IOR)

To ensure an adequate level of reliability in the analysis of students’ game play behaviours, inter-observer reliabilities (IOR) were calculated using the following calculations: number of agreements/(number of agreements + number of disagreements) x 100. This IOR method takes into account the amount of agreement between the observers, as well as disagreements (van der Mars, 1989).
Four trained coders (Bachelor of Health and Physical Education students) and the researcher each independently analysed 20% of student game play videos. All coding was completed by either the researcher or the research assistants. Initially all four coders received six hours of training from Prozone technicians on how to use the Gamelens program. Following this the coders then received a further six hours training on how to use the Gamelens program in conjunction with the GPAI. This training was provided by the researcher who had over 500 hours of coding experience and two experts who had a PhD in the games and sports teaching realm, a combined thirty years PE teaching experience and had coded over one thousand hours of video across different sports prior to this project. Each of the four coders also received a coding protocols information pack (see Appendix Eight) to ensure consistency across coders. Following the training, each coder then had an opportunity to practice coding videos not associated with the current research for a further six hours.

All coding for the current study took place on a designated coding day, so that all analysts were able to conduct their coding at the same time in the one location, so that assistance could be provided to them by the researcher in making judgements on the game play from the videos. Each coder received 25% of the videos for the study to code. In addition they were also given 20% of the other videos for each of the other 3 coders involved in the study which were used for IOR checks. The IOR checks revealed reliabilities of between 80% and 92%. As such, the data was deemed reliable as it met the minimum 80% threshold identified by Nunnally (1978).

3.11.1.5 Statistical Analysis of Game Play Understanding Data

GPU data was exported from Microsoft Excel into the Statistical Package for the Social Sciences (SPSS) (Version SPSS 21) program. Game play data (e.g. scores for base/adjust) were entered into SPSS.21 by the researcher and double-checked for accuracy. Descriptive statistics (means and standard deviations) were calculated on all pre- and post-test dependent variables (e.g. skill execution, decision-making, base/adjust and support). Next, Cronbach’s alpha coefficients were calculated to assess the level of reliability of the research variables. To examine the research question focused on change in game play performance, a linear mixed model for repeated measures was used, whereby the effect of Time (Pre-test versus Post-test), School (HE, CE, BH, SC, TUL & PRS) and the interaction of Time and School on
the outcome measures (GPU) were assessed. Data for each dependent variable was fitted over Time, with School as a fixed factor.

### 3.11.2 Student In-Class Physical Activity

#### 3.11.2.1 Downloading, Condensing and Analysis of Accelerometer Data

To examine participants’ in-class PA levels, data from the accelerometers were downloaded into ActiWeb Software (ActiGraph LLC, Pensacola, Florida) and calculated into metabolic equivalents (METs). According to Trost et al. (2002) METs are a measure of activity intensity and can be categorised into time spent in TPA (TPA > 1MET) and MVPA (MVPA > 3 METs). Daily lesson time spent in TPA and MVPA, were established using age-related cut points (Trost et al., 2002). As a result, the time each student spent in TPA and MVPA per lesson was derived. Times spent in TPA and MVPA per lesson were averaged for each lesson and then over the six-lesson unit, providing both a unit average and a per lesson analysis. This was done to enable both a contextual and situational analysis of in-class PA. Average time spent in PA variables (i.e. TPA and MVPA) across the unit was calculated as a percentage to examine whether students met the prescribed in-class PA thresholds identified in the PA hypothesis of this study.

### 3.12 Ethical Considerations

A number of ethical concerns were identified before conducting this study, and throughout the research process measures were taken to reduce or eliminate these concerns. One such ethical concern was regarding gaining the informed consent of both students and their parents/guardians. The consent process has been explained in the earlier procedures section, and therefore further explanation is unnecessary. Because students were being video recorded, it was also essential that the researcher undertook measures to ensure their confidentiality, which was achieved by the researcher undertaking a number of processes. Firstly, the researcher ensured that all students who did not consent to their participation in the study were not video recorded. These students were required to play on another field that was not videoed during the pre- and post-test games.
Secondly, a number of steps were taken to ensure the privacy and confidentiality of the students that did consent to participating in the study. As Miller and Zhou (2007) argue, videos of students can be very personal, and if they were to fall into the wrong hands a number of serious issues would arise. Understanding this, the researcher made sure that he and his assistants stored the videos in a manner that ensured only they would have the ability to access them. This was achieved by storing the videos in a confidential file on a password protected computer, and storing the back-up hard drive in a locked cabinet. The same procedures were used in the storage of all data obtained from the accelerometers. Not only did the researcher have to make sure that the data was stored correctly, but they also needed to ensure that no student could be identified during the dissemination of the results. This ethical concern was managed by the researcher assigning each student an individual pre-determined code. These codes were used during data analysis and in the reporting of results. This meant that the identity of participants could not be revealed and confidentiality was established.

Author and researcher bias was a further ethical consideration that needed to be managed by the researcher. In order to manage this concern the researcher and supervisors identified all opinions held by the author and researcher that could impact on the research or discussion of the results in the current study. It was noted that the researcher held no proclivity towards GCAs and as a PE teacher had used a variety of strategies for teaching the games and sports components of various HPE syllabi, indicating an understanding that there is potential merit to GCAs just as there are other teaching approaches. This identification process then allowed the researcher and author to make a concerted effort not to allow any previously held beliefs or opinions to influence the research. In addition to this, the researcher maintained a process of constant reflection and discussion with their supervisors to ensure that bias did not impact any aspect of the study. Author bias was also controlled through examining the research questions through a quantitative lens which meant that there was less room for bias due to the more concrete nature of the results. Furthermore, the current thesis was reviewed by the supervisors and four independent reviewers who identified any language that could be deemed as potentially displaying bias and this language was either altered or removed.

The lessons in the unit covered PDHPE Syllabus (BOS NSW, 2007) outcomes for Stage 3 students. Furthermore, participants were not required to do anything more than what would
be expected of them in a normal PE lesson, and therefore no ethical concerns arose in regard to the lessons taught.

3.13 Conclusion

This study was conducted using a quasi-experimental design. Pre- and post-tests and activity monitors were used to explore the research questions of this study. The quantitative nature of the methodology provided the researcher with numerical data which indicated the influence of using a GCA when teaching Stage 3 primary school students. The data measured the students’ GPU and in-class PA levels in an Invasion/Field Territory Game. It has also been made clear throughout this section that the researcher undertook measures to ensure that this research was conducted ethically and in a manner which ensured the validity of the results.
Chapter Four
Results

4.1 Student Game Play Understanding (GPU) Assessment Results

Descriptive statistics (means and standard deviations) for pre- and post-test GPU dependent variables (DM, SE, SUP & B/A) are displayed in Table 3. The results of the mixed modelling yielded significant main effects of Time for the dependent variables of Decision-Making ($F(1, 10.290) = 110.294, p < .001$), Skill Execution ($F(1, 15.696) = 100.924, p < .001$), Base/Adjust ($F(1, 14.685) = 107.485, p < .001$) and Support ($F(1, 10.875) = 99.187, p < .001$). The results of mixed modelling yielded insignificant main effects of School for the dependent variables of Decision-Making ($F(1, 4.213) = 2.246, p = .205$), Skill Execution ($F(1, 4.814) = 2.572, p = .172$), Base/Adjust ($F(1, 4.439) = 1.704, p = .255$) and Support ($F(1, 4.521) = 1.822, p = .241$). In addition, the interaction effect of Time by School was also deemed insignificant for Decision-Making ($F(1, 4.127) = 2.871, p = .163$), Skill Execution ($F(1, 4.219) = 2.332, p = .198$), Base/Adjust ($F(1, 4.095) = 2.785, p = .169$) and Support ($F(1, 4.262) = 2.730, p = .169$). These results suggest that students developed their game performances across time, yet the level of school effect could be deemed as an insignificant factor. Figures 4–7 illustrate the simple main effects for DM, B/A, SE and SUP.

Table 4: Descriptive Statistics and Reliabilities for Game Play Understanding

<table>
<thead>
<tr>
<th>Dependant Variable</th>
<th>M</th>
<th>SD</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM – Pre-test</td>
<td>1.63</td>
<td>.627</td>
<td>.89</td>
</tr>
<tr>
<td>DM – Post-test</td>
<td>2.90</td>
<td>.765</td>
<td>.90</td>
</tr>
<tr>
<td>B/A – Pre-test</td>
<td>1.56</td>
<td>.637</td>
<td>.90</td>
</tr>
<tr>
<td>B/A – Post-test</td>
<td>2.84</td>
<td>.823</td>
<td>.93</td>
</tr>
<tr>
<td>SE – Pre-test</td>
<td>1.78</td>
<td>.683</td>
<td>.83</td>
</tr>
<tr>
<td>SE – Post-test</td>
<td>2.98</td>
<td>.762</td>
<td>.81</td>
</tr>
<tr>
<td>SUP – Pre-test</td>
<td>1.56</td>
<td>.642</td>
<td>.81</td>
</tr>
<tr>
<td>SUP – Post-test</td>
<td>2.87</td>
<td>.798</td>
<td>.80</td>
</tr>
</tbody>
</table>

*Note: Each Dependant Variable was rated on a 4 point scale.
Figure 4: Mean Scores for Decision-Making (DM)

The mean scores for Decision-Making reveal a significant increase in this aspect of GPU. Pre-test scores increased from 1.69 to 2.90 Post-test.

Figure 5: Mean Scores for Base/Adjust (B/A)

The mean scores for Base/Adjust reveal a significant increase in this aspect of GPU. Pre-test scores increased from 1.56 to 2.84 Post-test.
The mean scores for Skill Execution reveal a significant increase in this aspect of GPU. Pre-test scores increased from 1.78 to 2.98 Post-test.

The mean scores for Support reveal a significant increase in this aspect of GPU. Pre-test scores increased from 1.56 to 2.87 Post-test.
Table 5: Students Rated at Beginner Pre-Test and Post-Test

<table>
<thead>
<tr>
<th>GPU Dependant Variables</th>
<th>DM</th>
<th>B/A</th>
<th>SE</th>
<th>SUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students Rated at Beginner Pre-Test</td>
<td>142</td>
<td>164</td>
<td>111</td>
<td>163</td>
</tr>
<tr>
<td>Students Rated at Beginner Post-Test</td>
<td>7</td>
<td>11</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

4.2 Student In-Class Physical Activity Results

Analysis of in-class PA data reveals that students engaged in the GCA unit spent an average (averaged over the six lessons) of 31.4 minutes per lesson in TPA and 22.7 minutes per lesson in MVPA. The PA times revealed that students engaged in TPA on average for 78.5% of each lesson. In addition, students engaged in the GCA unit spent an average of 56.76% of class time in MVPA. MVPA descriptive statistics (means, standard deviations and range) for each lesson are displayed in Table 4.

Table 6: Descriptive Statistics for MVPA for Lessons 1-6

<table>
<thead>
<tr>
<th>Lesson Number</th>
<th>M</th>
<th>SD</th>
<th>Time (Minutes)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59.96%</td>
<td>.072</td>
<td>24</td>
<td>26.12%</td>
</tr>
<tr>
<td>2</td>
<td>53.01%</td>
<td>.091</td>
<td>21.2</td>
<td>25.94%</td>
</tr>
<tr>
<td>3</td>
<td>54.65%</td>
<td>.100</td>
<td>21.9</td>
<td>28.63%</td>
</tr>
<tr>
<td>4</td>
<td>50.14%</td>
<td>.079</td>
<td>20.1</td>
<td>28.26%</td>
</tr>
<tr>
<td>5</td>
<td>58.75%</td>
<td>.046</td>
<td>23.5</td>
<td>16.27%</td>
</tr>
<tr>
<td>6</td>
<td>64.06%</td>
<td>.093</td>
<td>25.6</td>
<td>21.98%</td>
</tr>
</tbody>
</table>

*Note: Each lesson was 40 minutes in length*
Chapter Five
Discussion

5.1 Introduction

Throughout the implementation of the GCA unit, the researcher aimed to determine the unit’s influence on participants’ GPU, and on their in-class PA levels. This influence was determined in two ways: through numerical data obtained from examining the differences between the pre- and post-test data, and the use of accelerometers worn by participants throughout the unit. This data will be used throughout this discussion to answer both primary research questions of this study. This section will also discuss: the implications that the research findings have for educational practice and the limitations of the study.

As noted in the results chapter, the interaction effect of time by school was controlled through mixed-level modelling for each of the GPU components. This result suggests that student improvements in their GPU developed across the time of the unit. From this, one can infer that the changes students underwent over the course of the study were likely the result of learning experiences within the unit.

5.2 Primary Research Question One: What is the Influence of a GCA on Game Play Understanding (GPU) (i.e. student learning) in an Invasion/Field Territory Game Unit, for Stage 3 Students?

As has been identified in previous chapters, for the purposes of this study, overall GPU and student learning was determined by assessing four different components (B/A, DM, SE & SUP), as suggested by Oslin, Mitchell and Griffin (1998). As such, it is necessary to discuss the results obtained in each of these categories to provide a clear picture of students’ overall GPU. Considering the results in this manner will allow determinations to be made on outcomes in relation to the first primary research question.
5.2.1 Decision-Making

The data relating to the GCA group’s Decision-Making (DM) illustrates marked improvements in this aspect of GPU in the post-test, compared to the pre-test. This was one of the main strengths of the GCA unit, as improvements were statistically significant, with participants, on average, improving their scores by 31.75%.

DM in offence was assessed on two criteria; ‘Player runs an appropriate line when delivering, creating or receiving a pass’ and ‘Player attempts to pass to a teammate when appropriate’ (See Appendix Nine). When examining the results with these criteria in mind they indicate that DM with possession improved because players passed the ball at more appropriate times and/or were in better positions to advance the ball when receiving a pass. Students’ decision-making competencies were at a level between ‘beginner’ and ‘developing’ in the pre-test, suggesting that prior to the unit, many students were making decisions in a reactive manner (e.g. see and then do), moving away from defenders or attackers and often running backwards or sideways as the available space was reduced. Gréhaigne, Richard and Griffin (2005) suggest that this is a common practice for the novice player in games and sports. DM results also suggest that many students were passing the ball at inopportune times, possibly with little thought of their teammate’s positioning or more commonly, to simply avoid being in possession of the ball when someone was about to tag them. According to Gréhaigne, Richard and Griffin (2005) this is often due to the pressure from the opposition, feeling unsafe with possession and perhaps even passing in a social manner (e.g. passing so that all team members get to touch the ball). These reasons for decisions in play are counterintuitive to the aims of Invasion Games outlined earlier in this thesis (e.g. run straight at the defensive line & pressure the ball carrier and receiver) and would have caused the high number of errors and breakdowns in game play.

Conversely, from the higher post-test results it is clear that students made decisions in a way that allowed them to shift up the game performance assessment criteria, in relation to the offensive action rules. In order to improve in decision-making in the post-test, students needed to follow the offensive action rule for Invasion/Field Territory sports such as Rugby League, Rugby Union, Touch Football and Oztag – that is ‘Run straight at the defensive line’ in order to achieve the aim of advancing to score. This play would have allowed the team to
make more ground, to move away from the opposition’s scoring area (try line) and to progress the ball closer to their own team’s scoring area (try line), thus closely aligning their decisions with the action rule and demonstrating that students moved away from making reactionary decisions. The improved DM results indicate that in the post-test students demonstrated a greater propensity to retain possession, even when about to be tagged, and were much more comfortable running the ball at the line. This is reasoned by the fact that students could not have been coded at a more developed level, as demonstrated in the Post-test results if they did not exhibit the aforementioned responses, as one of two criteria for assessing DM in offence ‘Player attempts to pass to a teammate when appropriate’ would not have been met. Changes in decision making can be attributed to the game play and associated rules, whether primary or action in the GCA unit. For example, in initial games, no contact could be made to students in possession of the ball. This rule allowed students to have more time when making decisions about passing when they had the ball (e.g. who to pass to, when to pass, advantages / disadvantages of the pass) and removed concern about losing possession or making an immediate decision. Gréhaigne, Richard and Griffin (2005) suggest that beginner players need more time and space (i.e. need to feel less confronted) than experts in relation to DM in Invasion Games and sports. It is logical that a relationship could exist between focusing on addressing a key issue with beginners: that of confrontational space (e.g. the space between a player and an opponent) (Gréhaigne, Richard & Griffin, 2005) and improved DM results, especially for those who were beginners. While these rules were modified in later games, there were always aspects of play where students in possession could not be tagged. Therefore from the DM results, it is apparent students felt more comfortable with possession as they moved in and around a range of players, a feeling which was then transferred into game play as evidenced in the improved understanding seen in the post-test results.

The GCA unit also placed a strong emphasis on providing students with game play experiences that allowed experimentation with different types of passes (e.g. hand offs, flat short passes and longer spiral passes). Moreover, the teaching unit also facilitated regular discussions about when to make certain passes and the types of passes that were appropriate in various situations. Whilst no data was collected on the efficacy of questions used by GDOs, the range and nature of these questions are provided in the GCA teaching unit (see Appendix Two) and were also noted in video recordings taken of each lesson used to determine if the lessons were reflective of GCA pedagogy. Some of these questions included:
‘What kind of pass was most effective and why?’, ‘What do you look for when making a pass?’, ‘How do you decide who to, where to and when to pass the ball?’ and ‘When is a long pass a risky pass and when is it worth the risk?’. The DM post-test results support that these elements of the GCA unit were effective, as they reflect that students were passing far more often when their teammates were in an appropriate position and ready for the ball. This result is similar to that found by Harvey et al. (2010) when they investigated this outcome in another Invasion/Field Territory game, Soccer. In the current study, these more appropriate passes were utilised by students to create an opportunity to advance the ball (for example by putting a runner through a gap in the defence), to create a positive force ratio or exploit a negative one (e.g. creating an overlap in player numbers by using a draw and pass option) or at a simpler level, reflecting that the decision to simply advance the ball forward was a valued part of play If this was not the case then the improved DM results seen in the post-test could not have been achieved, as students would not have been coded at a more developed level, as they would not have met one of the DM assessment criteria ‘Player runs appropriate line (e.g. straight rather than sideways) when delivering or receiving pass’.

The other two criteria used to assess students’ DM were related to the decisions they made without possession of the ball whilst their team was in defence (e.g. player attempts to stop a pass being made, player stays in defensive line & only rushes to put immediate pressure on ball carrier or receiver). Results indicated that the GCA unit increased students’ DM capacity in the post test. As noted above, initial game play allowed the student in possession to move freely. Thus, when the team was not in possession of the ball, they were required to focus on both a freely moving student and possible passes, as well as where the receivers may have been moving to either create or receive a pass. Based on the improved DM results the movement of the student in possession must have given students more time to track the movement of players in possession, while removing the ability of one player to stop most of the play action. Therefore, students without possession needed to constantly track both the opponent with the ball and possible receivers in ever-changing circumstances, but in a timeframe that was more conducive for beginners, who are noted by Gréhaigne, Richard and Griffin (2005) to be as accurate as highly developed players but slower. The focus on three principles of play without possession throughout the unit, especially ‘track the ball and receivers’ and ‘pressure the ball and receivers’, may have also led to improved decision making in the post test. Students, especially those who are inexperienced, are noted as having greater difficulty prioritising game information compared to experts (see Magill, 1990),
therefore the fact that that students only had two aspects of play to prioritise when not in possession and had the opportunity to repeatedly explore and practice these aspects through discussion throughout the unit and in later game play, appears to have led to improved DM results.

In addition, it can be argued that the lower pre-test results were partly due to participants making poorer decisions in defence by not remaining in the defensive line and instead rushing out of the line to tag only the player with the ball, regardless of potential receivers. This indicated a lack of understanding of tracking the ball and receivers with a focus on the object (ball) only. Furthermore, it highlighted a lack of game play awareness and understanding of the ramifications of this action, such as leaving a gap in the defensive line. All of these actions are typical of beginners, who tend to see, then do and complete one play action at a time (Gréhaigne, Richard & Griffin, 2005). However, the significant improvement in decision-making results seems to indicate that the GCA unit and its focus on principles and action rules such as ‘don’t rush at the player you’re marking’ that were applicable across all games in the unit, had a positive influence. For example, if a student did not rush at a player in the game ‘10 Passes’ which was in a three dimensional (e.g. can move in any direction) context and was successful in preventing a pass, they were able to use the same principle in other games, including the post-test game. Thus, the importance of applying the ‘don’t rush’ principle in defence was able to be examined and discussed, regardless of whether the students were in individual spaces or using line defence.

Developing students’ understandings of strategy and tactics was an integral component of the GCA unit and may have also had a positive influence on DM. The literature (Gréhaigne, Richard & Griffin, 2005, Light, Harvey & Mouchet, 2014 Griffin & Butler, 2005 and Slade, 2010) suggests that developing understanding in strategy and tactics has the potential to improve DM. The improvements that students demonstrated in DM indicate that in the post-test, they applied greater cognitive effort and were engaged in higher levels of planning in their game play responses. As Gréhaigne, Richard and Griffin (2005) expound, strategy and tactics in games and sports are inextricably intertwined with a players’ DM skills. From this, one can infer that because strategical and tactical understandings are so closely linked to a players DM the higher DM results suggest that the unit did enhance participants’ knowledge in this area as it placed the decisions made in the game into a larger context. It is therefore reasonable to conclude that the purposeful game play responses, indicated by the DM post-
test results, were likely a product of students applying the planning skills (e.g. where to position players based on individual strengths and the strengths of their opponents) that they learnt during strategic and tactical experiences throughout the unit.

Additionally, learning about strategy and tactics, and the improved understanding that the DM results indicate this facilitated, should have prompted participants to think more about the decisions they were making in the post-test due to the interconnected nature of DM and strategy and tactics (Gréhaigne, Richard and Griffin, 2005). For instance, in the unit students were asked to develop an attacking strategy for the game ‘10 Passes’. In doing so they were required to consider the types of passes they should make, the length of the passes and when to run the ball and not pass. In essence, this should have prompted students to think and focus on their passing decisions, and this seems to have resulted in them playing with greater purpose, which potentially led to the better DM results.

Specific questioning techniques are also a major pedagogic tool used by PE teachers to assist students in developing DM skills (Forrest, 2013). The fact that questioning was used frequently throughout the GCA unit may be another reason for the improvements in students’ DM. Throughout the GCA unit, students were encouraged to reflect on their game play via questioning techniques. This reflection required them to think about the decisions that they could make in different game play situations, and why they would make these decisions. However, it is important that the questions are targeted at the learning outcomes (Harvey and Light, 2015), in this case the principles and action rules and the influence that the four concepts (Decision-Making, Strategy and Tactics, Movement Skill Execution and Communication and Concentration) in the unit had on play. The targeting of these areas would have assisted the students to focus on certain concepts (Forrest, 2013), despite the changes in game play through the progressions, and this should have encouraged them to take on these habits in the lesson, while also assisting the focus of the GDOs in play. The improved DM results highlight that the students were then able to apply the same thought processes during the post-test, otherwise the significant improvements in DM results would not have been achieved, supporting the work of Pill (2013). As Light, Harvey and Mouchet (2014) infer, that for beginners to improve in their DM, they need to be faced with various game play situations and they need to be given the opportunity to conceive, find and enact a range of decisions. In addition, the high percentage of time students spent in modified game play exploring and practicing their decisions, and their active discussions on decisions in
game play concepts could also have contributed to their improvements in DM, supporting the assertions of (Oslin & Mitchell, 2006, Light 2013a & Light, Harvey and Mouchet, 2014).

The significant improvements in DM shown by data from the results section of this thesis, indicate the positive influence that the GCA had on students in this study. The results are interesting, as they highlight that the GCA unit influenced students to the extent that the games used, the focus areas and the questioning/reflection techniques used by GDOs (See Appendix Two) had a positive relationship with the improved DM in a relatively short period (six lessons). This supports Mitchell’s (2005) assertion that students’ development of DM skills is one of the most championed benefits of GCAs. As such, there is research (Allison & Thorpe, 1997; Griffin, Oslin & Mitchell, 1995; Mitchell & Oslin, 1999; Gabriele & Maxwell, 1995) that has found connections between teaching students using GCAs and improvements in DM. The claims made in these studies are further supported by the positive results obtained from the current research, indicating that using a GCA has the potential and the capacity to improve Stage 3 students’ DM in the Invasion/Field Territory Game category.

5.2.2 Base/Adjust

The data indicates that in the Base/Adjust (B/A) category students achieved statistically significant improvements. The findings show a 32% improvement within this category, which was similar to the improvements in the DM category.

Pre-test results in B/A demonstrate the majority of students were assessed at a level between beginner and developing. Two criteria for assessing B/A were a ‘Player moves back to a position of readiness between attacking plays’ and ‘If player doesn’t receive first pass they ready themselves for the next’. When examining the results based on these criteria, a number of reasons can be offered for students’ lower capacity in B/A in the pre-test. One such reason is that students were completing only single movements (e.g. only starting to run with the ball when it is passed to them) in attacking or defensive plays as this would have led to them being coded more towards a beginner performance, based on the aforementioned criteria. These actions included making a single pass and stopping, or even stopping if they did not receive the ball. This could have led to students being out of position in offence (e.g. too close, in line, or in front of the ball carrier) for subsequent sequences of play. Gréhaigne,
Richard and Griffin (2005) note this is common for the beginner player as many of the students were in the B/A category in the pre-test of the current study (N=164). Gréhaigne, Richard and Griffin (2005) explain beginners may recognise the correct response (e.g. point to where they need to move) but as they are behind the speed of the game, their responses are not always paired with action. This then flowed onto other areas of play, and may have led to the ball carrier taking poor options or making poor decisions, creating more errors and using up ‘tackles’. Students’ not adjusting and moving during the pre-test game would also have had ramifications for their actions in defence, resulting in gaps in the defensive line, and putting pressure on the students around them to cover for these deficiencies. This would have meant that more competent students were able to simply run around an entire team or exploit the gaps left in the defensive line. It is pleasing that these limited game play responses were improved in the post-test.

Two additional criteria that were used when assessing students’ ability to adjust in game play were ‘Player demonstrates a range of responses according to the game play situation’ and ‘Player shifts to cover gaps or numbers’ (See Appendix Nine). These criteria are important because when they are considered in tandem with the improved results in the B/A category, we can infer that students’ ability to adapt to the uncertainties of the game play situation, their capacity to adjust their responses accordingly, and the speed at which they were able to do so, all improved. These abilities are essential for success in all Invasion/Field Territory Games that are inherently dynamic in nature (Mitchell, Oslin & Griffith, 2006) and therefore it is interesting that the GCA unit was likely the impetus for this improvement, and it appears that the games provided a setting for students to experiment with different responses in a range of situations.

As noted earlier, the lessons in the GCA unit placed a strong emphasis on the underlying principles of play and the action rules that underpin many Invasion/Field Territory Games and had progressions embedded in them to help students to understand their purpose and application. It can be argued that students’ improvements in the B/A category were associated with their understanding these key concepts through application in action in a range of environments. For instance, in both games within the GCA unit (‘10 Passes’ and ‘Kangaroos and Jillaroos’ and the associated progressions within each) a key focus in offence was on students applying the action rule in attack, ‘If you don’t get the first pass, be ready for the next’ to achieve the principle of ‘moving to create, receive and or deliver a pass’. As
indicated in the improved B/A results this focus appeared to allow students to understand that moving back to a position of readiness after making a run, or providing an option for the ball carrier, gave them the best opportunity to follow the abovementioned action rule. As a result, students were ready for more passes, or still felt that they were in the play if they did not receive the ball, this is because they would not have been coded at a more developed level seen in the post-test results, as they would not have met the developed-highly developed descriptors in the ‘player moves back to a position of readiness’ criteria for B/A. It can be noted that the decisions of students to run forward with the ball from acting half (where they pick the ball up after a tag) and associated improvements in DM results, also seemingly allowed students without possession to improve their ability to adjust in attack.

In addition, B/A in both games and progressions within the unit focused on principles of play in defence, such as ‘mark a player or an area or both’ and ‘track and pressure the ball and the receiver/s’. It is reasonable to suggest that focusing on these principles in games like 10 Passes, and then providing students with opportunities to reflect on how the principle is beneficial in play through questioning and discussion, helped students to learn two main lessons. The first is that in order to act in accordance with the above principle, students need to adjust when their team loses possession or achieves 10 passes. The second is that students needed to return to their base positions to pressure the passer and the receiver. It is also interesting to note that even though the game of 10 Passes is a three dimensional (e.g. can pass the ball in three directions, forward, back and to the side) game, students were able to transfer and apply their understanding of the principle of play and action rule to the post-test game which was a two dimensional game (e.g. can only pass the ball backwards or sideways), and it is probable that this is what facilitated some of the improvements in the B/A category. It could be suggested that moving from a game where a student had to have ‘all-round awareness’ (a concept not necessarily specific to the game requirements of sports such as Rugby League and Touch Football) to one where a student was able to concentrate on what was in front of them made B/A slightly easier in the post-test. This result suggests further benefits associated with GCAs and the potential value of thematic units in schools.

The improvement in B/A is extremely pleasing from a teaching perspective, because it indicates that the majority of students gained a strong understanding of one of the most central concepts of the unit and applied it to the context of the sport itself. It also suggests that students began to value plays in the game that did not necessarily involve having the ball
and perhaps signalled an emerging understanding of the importance of a range of roles within a team. It could also suggest that by providing guidance for deciding what to focus on, such as the action rules in offence and defence, the GDOs enabled students to devote attention to these aspects of play. Furthermore, it may be the case that for such significant improvements to be realised, many students must have begun to utilise the kinds of movement responses that are important in overall team play, such as side-steps, dummy/fake passes or even using decoy runners, or acting as decoy runners. Arguably, such responses are indicative of more sophisticated students and play action, and it is interesting that students who were mostly novices in the pre-test, had apparently begun to exhibit some of these responses.

Studies that have examined B/A in Invasion/Field Territory Games using the GPAI are scarce. Oslin and Mitchell (2006) suggest that this is due to foundational studies not assessing B/A. However, studies that have examined the concept of B/A (Harvey, 2003, Harvey et al., 2010 and Bohler, 2011) have found that using a GCA in PE/coaching games lessons helps students to improve their ability to move as required by the flow of game play, and their ability to return to a position of readiness between plays. This finding is supported by the results of the current study. The current study both extends and reinforces prior research in the B/A area, as it includes an assessment of students’ usage of action rules in an Invasion/Field Territory Game. This is something that previous studies (Allison & Thorpe, 1997, Gabrielle & Maxwell, 1995, Griffin, Oslin & Mitchell 1995, Light, Harvey & Mouchet, 2014, Mitchell, Griffin & Oslin, 1995, 1997) have not assessed and the improvements that students realised were more pronounced in the current study, making the findings in this area significant.

Overall the data obtained suggests that the GCA unit had a positive influence on the GPU component of B/A. Furthermore, the results indicate that teaching students in Stage 3, using a GCA that focuses on particular concepts such as the principles of play and action rules, is an effective way to: a) improve students’ ability to return to a position of readiness between plays in both offence and defence and b) assist them in developing their capacity to adjust to the dynamic nature of Invasion/Field Territory Games.
5.2.3 Support

The improvements realised in the SUP category were the largest of all the categories with participants demonstrating a significant 32.75% improvement in their SUP score.

Similar to the DM and B/A categories in the pre-test, students were assessed as being at a level between beginner and developing. Using the first criteria that was used to assess SUP as a guide (‘player moves to create or receive a pass’), it can be suggested that prior to the unit, students were not moving to create or receive passes, and must have been moving in a piecemeal or reactive fashion with little thought and planning in their responses as evidenced by the lower SUP pre-test results. When considering the second criterion (‘player is moving when they receive a pass’) used to assess SUP, the low pre-test SUP results indicate that students were stationary when they received a pass, meaning that it was more difficult for them to progress the ball, often being tagged quickly and possibly resulting in students struggling to catch the ball when a pass was not thrown directly at them. This is because for students to be coded at the lower levels seen in the pre-test they had to be less competent in this criterion. Furthermore, when the third criterion (‘defender marks a player or an area’) used to assess SUP is taken into account, it becomes apparent that the low pre-test results were a product of students bunching in defence, not marking a player or an area and simply only tracking the player with the ball as these are beginner-developing responses which the pre-test results indicate many students were coded at (e.g. students rated at beginner in SUP in pre-test N= 163). This would have resulted in a number of students converging on one attacker, unaware of other potential receivers, resulting in significant overlaps for the attacking team.

Students using verbal and non-verbal cues in offence and in defence were further guidelines to determine their performance in the SUP category (e.g. use of verbal and non-verbal cues to demonstrate intent in offence and defence). Considering this criterion and the pre-test results (e.g. students assessed as being at a level between beginner and developing) it becomes apparent that in order for students to be coded as providing lower levels of support in gameplay they must have been displaying body language such as putting their hands in their pockets or placing their arms by their sides, instead of having their hands up ready for a pass. Furthermore, based on the aforementioned criteria the results in the pre-test were also due to
students using inappropriate verbal cues like calling for the ball when they weren’t in an appropriate position, leading to ball carriers making poor passing choices or to players not communicating when there was a gap or overlap in defence. The significant improvement that students made in the SUP category in the post-test indicate that many of the abovementioned errors and misunderstandings decreased as a result of the GCA unit.

Students’ improvement in SUP signify that in the post-test they moved into a position to create passes for teammates, or to receive passes from teammates more regularly in offence, and were regularly moving when they received a pass. Each of the abovementioned aspects of play were used as criteria (see Appendix Nine) to assess students’ performance in this category. Therefore, they could only have achieved better results if they improved in relation to both criteria. The fact that students were moving to create or receive passes more regularly in the post-test is a highly significant outcome because understanding support play is arguably one of the most essential game play skills for success in all Invasion/Field Territory Games (e.g. it applies to hockey, soccer, basketball and Australian Rules Football, along with many other sports) (Mitchell, Oslin & Griffin, 2006). Therefore, one can infer that by enhancing students’ understanding of this concept, the GCA unit in the current study may promote greater success in many other Invasion/Field Territory Games. This in turn has the potential effect of greater participation in these sports and improves the potential for students to develop a lifelong commitment to physical activity.

One possible reason for the improvement in support play was the use of modified games in the GCA unit, which aligns with a range of current research and literature (Owen, Twist & Ford, 2004, Gabbett, 2006, Light, 2013a & Silva et al., 2014). The modified games utilised in the teaching unit of the current study and their progressions (see Appendix Two), coupled with feedback from GDOs on the importance of support play and positioning, focused and guided students towards the development of their support play abilities. For example, one progression in 10 Passes was that students could run with the ball from acting half (player who stands behind the play-the-ball and collects the ball, usually for distribution) but could not be tagged. This rule may have led to students running from this position more readily rather than just passing. This action shifted the emphasis on support from the receiver to the passer. As noted in the DM discussion, the movement forward from acting half made a considerable difference in placing students without the ball immediately in positions of support, as the ball carrier was able to move to create a pass and put their teammates into
better positions, which was then applied to the post-test game. This example further highlights the benefits of using modified games and strengthens other research that reports similar benefits (Owen, Twist & Ford, 2004, Gabbett, 2006, Light, 2013a & Silva et al., 2014).

Students’ ability to support other players in defence also improved in the post-test. A simple explanation can be given for the improvement: that the students’ understanding of the principle of ‘marking a player or an area’ improved, which was another key criterion used to assess support. This type of support was heavily emphasised throughout the modified games in the unit, therefore it is likely that this is what facilitated improvements in this aspect of SUP. In addition, throughout the unit students were taught to defend in a three dimensional game, where the ball could be passed in any direction. Students understanding how to defend in this manner can also be offered as a reason for their improvement, as they went from more complex defence to a simplified line defence in the post test, where they only had to support the students next to them and the defensive line was demarked by a referee.

As noted in B/A discussion, improvement in support during defence highlights that students were able to transfer and apply what they learnt in the games during the unit (10 Passes) to a different game in the post-test (Modified Touch Rugby League/Backyard League). Improvements in support can further strengthen this argument. By learning and understanding action rules in a more three-dimensional environment may have expedited their understanding of line defence in the post-test. This ability to transfer their understanding meant that students could have found the line defence less complicated within the post-test game, allowing them to improve their support in the post-test.

From the results it is also evident that improvements in students’ DM, may have been due to participants’ progress in SUP and vice versa. As previously discussed, aspects of the GCA unit (e.g. specific questioning and reflection techniques on action rules and modified game play, coupled with specific progressions to emphasise principles of play) appears to have led to students adopting a mindset where they passed far more regularly when their teammates were in an appropriate position and ready for the ball. Students moving themselves into a better position was emphasised in the games throughout the unit during discussions around the principle of play ‘move to create, receive or deliver the object (ball)’. The importance of students moving themselves into a support position was examined through questions like
‘what can you do as an attacker, when you don’t have the ball?’ and ‘what can you do as an attacker, if you move into space to receive the ball and are not passed the ball?’ Students were encouraged to review the action rules or principles as part of their reflection and then apply these answers to the game.

It is probable that student’s improvement in DM resulted from their enhanced understanding of SUP play in Invasion/Field Territory Games. For instance, if ball receivers place themselves in a better position to receive a pass through their support play, this will then provide the ball player/passer a better opportunity to make an appropriate pass. Therefore, one can infer that in all likelihood improvements in support contributed to improved DM, as passers would have had more options available to them, as runners were putting themselves into positions were they could more easily receive a pass. Furthermore, this cements the notion that game play components in GCA lessons are interdependent of one another, as advances in one category of students’ GPU can also develop other components, therefore indicating the benefit of teaching concepts of game play in in a cyclical manner (Gréhaigne, Richard & Griffin, 2005).

On a whole, the results indicate that the GCA unit had a very positive influence on the Stage 3 students’ SUP in Invasion/Field Territory Games. This claim is supportive of Harvey et al. (2010) and Bohler (2011) who also found that using a GCA can improve students’ off-the-ball support play in Soccer, Volleyball and Badminton. Mitchell, Oslin and Griffin (2006) note that off-the-ball movements are an essential component to students’ success in Invasion/Field Territory Games. As such, it is extremely pleasing that students improved in this GPU component and this helps to further answer the first primary question of this study.

5.2.4 Skill Execution

The results reveal that the Skill Execution (SE) scores of students improved by 30% over the course of the unit. This improvement is slightly less marked than the improvements in other categories; however, it is nonetheless just as significant.

In order to determine an overall score in the SE category, students were assessed on their catching, passing and tagging abilities within the context of the pre- and post-test games.
Despite students’ SE being higher than the other GPU variables in the pre-test, their movement skills were still reflective of beginners and developing students. Considering the criteria used to assess passing skills (e.g. Pass to teammate demonstrates control/appropriate time/reaches intended target) the low pre-test results were due to a range of reasons; passes were either too hard or too soft, didn’t reach their intended targets, or passes were thrown for reasons not associated with game play, which highlights that students had only basic control over their passes and their trajectories, or had other game play concepts impacting on execution. The results from the pre-test also indicate that often passes were too high or too low, and the students were unable to recognise that this was inappropriate based on the aforementioned assessment criteria, which would have led to a large number of errors. Based on the criteria used to assess students catching ability (e.g. controls the ball/correct hand position/moves appropriately to catch pass) low pre-test results indicate that students were catching the ball out in front of their bodies with stiff arms, rather than letting the ball come to them, which Gallahue and Donnelly (2003) highlight is a common error of beginners in sports. Moreover, the SE pre-test results reveal that students must not have been tagging the offensive ball carriers straight away as this was the criteria used to assess students tagging abilities. Understanding the second criteria used to assess tagging ability (e.g. demonstrates appropriate movement when tagging opponent) it becomes clear that students were waiting until ball carriers approached them in a standoffish manner, reacting to the offence, as in DM. Data and results on SE from the current study illustrate that students’ SE was not yet refined in the pre-test. However, from the post-test it is apparent that each of the aforementioned skills were enhanced as a result of the GCA unit.

From the post-test results, one can identify marked improvements for students in all three movement skills assessed (pass, catch, tag). This result is consistent with other studies (Allison & Thorpe, 1997, French et al., 1996, Mitchell, Griffin & Oslin 1995, 1997, Turner and Martinek, 1992 & Harvey et al., 2010) that found students taught using a GCA improved in their movement skills. From the post-test results and the criteria used to assess students passing (e.g. Pass to teammate demonstrates control/appropriate time/reaches intended target) it is interpretable that students’ passes were reaching their intended targets and were being thrown with an appropriate amount of force for the situation. Moreover, improvements also indicate that students absorbed force more appropriately when catching, and were then able to better control the ball, when considering the criteria used to assess catching skills (e.g. controls the ball/correct hand position/moves appropriately to catch pass). Furthermore, the
post-test results in conjunction with the criteria used to assess students tagging abilities (e.g. demonstrates appropriate movement when tagging opponent) also indicate that when defending, students were more assertive and moved up in a line to meet offensive students, pressuring the ball carrier and reducing the time they had to make decisions if this was not the case, improvements as seen in the post-test data could not have been realised.

Interestingly, despite the students in the current study not taking part in any specific skill practice or drills, and only receiving key teaching points and tips from the GDOs, they were still able to realise improvements in their catching and passing skills. Therefore, one can infer that these improvements resulted from repetition of movement and consistent experiences in skill execution in game play environments. For instance, the initial rule in ‘10 Passes’, which requires that students could not be tagged in possession, aimed to allow students to focus on the quality of the pass they made and reduced the pressure in making this pass. Additionally, the fact that the ‘10 Passes’ game was 4 vs 4 would have allowed students more opportunities to respond and in this modified environment they could have received more teaching cues and tips, which may have led to the improved SE results. Furthermore, the primary objective of the game (to complete 10 Passes) meant that there was a high amount of repetition of student passing, and that the focus of the game was on the passing and catching. This is particularly thought-provoking, as it suggests that catching and passing skills can be developed without the use of drills or focused skill practice by altering the intent and purpose of games. This result differs from other GCA studies that have examined improvements in SE (Allison & Thorpe, 1997, French et al., 1996, Mitchell, Griffin & Oslin, 1995, 1997, Turner and Martinek, 1992) as they all allocated time to skill practice in lessons. However, the results of the current study do support the notion that executing movement skills in modified games may be advantageous to skill development, as it requires students to adapt to an authentic context (e.g. directly related to performance in sport) where the cognitive and movement demands are similar to actual sports (Ford, Yates & Williams, 2010). Therefore, students may be more likely to be proficient in the skill during actual game play, as opposed to simply executing a skill devoid of context and in isolation (Ford, Yates & Williams, 2010 and Williams & Hodges, 2005).

The results of the current study suggest that on average, participants were more proficient in their movement skills in the pre-test, and started from a higher base in this category, compared with their proficiency in other GPU categories. This finding is highly supportive of
GCA studies summarised in Oslin and Mitchell (2006). It also highlights that many students came into this unit with movement skills that were sufficient for them to be able to achieve some success in the outcomes of the sport, whereas it would appear that other components (DM, SUP, B/A) needed greater development. Arguably, this indicates that depending on the sport and the specific requirements of the movement skill, it may not be essential, or perhaps even necessary to start a teaching unit on games and sports by learning the specific movement skills required for the game or sport. The results of the current study therefore support the view that as students progress through a GCA unit, the importance of movement skills to the achievement of the game outcomes increases if students learn and understand the concepts of game play (Forrest, 2015b), which is likely what occurred in this study.

As previously discussed, the aspects of GPU can be seen as interdependent, and as such, a number of inferences can be made about how the aforementioned improvements in SE may have elicited advances in other areas of GPU. For instance, students in the unit clearly improved in their passing skills. This in turn may have improved their DM, as many developed the ability to enact more of the possible passing options available to them, and could then perform the most appropriate pass for the situation. In contrast, in the pre-test, students may have been limited in their decisions, because they didn’t have the skill (e.g. couldn’t pass far enough) to execute the best option. This argument aligns with skill acquisition theory (Fitts & Posner, 1967) when viewed simplistically, as it appears that students progressed from the cognitive or associative stage, to the autonomous stage of skill acquisition, where they could perform the skills automatically with few errors, thus allowing them to pay more attention to other tasks such as DM (Wulf, 2007). However, another argument is that students’ DM improved their SE, a viewpoint that more closely aligns with various literature (Griffin, Brooker & Patton, 2005, Kirk, 2010, Harvey & Jarrett, 2014 and Stolz & Pill, 2014) which suggests cognitive ability (e.g. knowing what to do) may develop before movement ability. This is because if students become more adept at deciding when and how to pass according to the run made by the receiver, and the receivers are running the correct line, this reduces the pressure associated with executing that movement. It could also be argued that the decision regarding whether to pass or hold onto the ball and accept the tag, or to run with the ball without feeling the need to pass, as encouraged in the GCA unit, meant that fewer passes were made, but that these passes were more effective. Therefore, the improvements in students DM discussed throughout this chapter would allow students better opportunities to execute more skilful passes at the appropriate time.
Similarly, improvements in students’ catching skills may have enhanced their support play and vice-versa. For example, a player may be more willing to move into a support position and have the confidence to be moving when they receive a pass, if they know they have the ability to catch a pass that could come to them in that position. On the other hand, a player who places themselves in a better position, makes it easier for the ball carrier to pass them the ball, and will likely receive a higher quality pass which is easier to catch. Again, games in the GCA unit did encourage the development of movement skill and support play simultaneously, from game play allowing students to run with the ball until they found a pass, along with assisting them to understand what a highly developed pass looked like and how to communicate they were ready for a pass (e.g. hands up, focused on the ball). The abovementioned examples again highlight the potential advantage of teaching GPU concepts in an interrelated fashion, and of placing equal value on learning and understanding each of the concepts in a unit. As noted in the SUP discussion, from the results it can be argued students’ understandings of the individual concepts develop simultaneously, and that understanding any individual concept is beneficial to their understanding of each of the other concepts (Gréhaigne, Richard & Griffin, 2005).

From the current study, it is evident that focusing on teaching other aspects of game play such as DM does not impede students’ development of movement skills, and can also facilitate improvements in SE. This result is important because it challenges the notion discussed by McMorris (1998), that GCAs are a less effective way to develop movement skills. Moreover, it can be argued that at a beginner stage, using a GCA is an effective way to develop student’s movement skills more authentically (e.g. greater connection to games and sports), and may provide a more appropriate foundation for later educational experiences. Overall, the results from the current study affirm that being taught using a GCA in the Invasion/Field Territory Game category, can have the effect of improving the movement skills (pass, tag and catch) of Stage 3 students.

### 5.2.5 Overall Game Play Understanding (GPU)

Students experienced improvements in each of the four assessment components (B/A, DM, SE, SUP) used to make judgements on their overall GPU. The data obtained from the current
study strongly supports the GPU hypothesis that Stage 3 students who are taught a unit on Invasion/Field Territory Games using a GCA, will demonstrate significant improvements in their GPU. From the results of the current study, it is clear that the GCA unit had the effect of significantly improving the Stage 3 students’ GPU, in the Invasion/Field Territory Game category, thus answering the first primary question of the current study. The results suggest that students’ GPU improved across time, and that the school attended by the student could be considered to have an insignificant impact. This strengthens the results as they suggest that the SES and location of the schools had no bearing or influence on the results.

A key conclusion that can be made when examining the results in each of the four components of GPU (B/A, DM, SE, SUP) relates to transferability of concepts examined in the GCA unit and the modified games played by students. It is apparent that in each measure of GPU, students were able to transfer what they learnt throughout the unit into their performances in the post-test. This result is interesting because throughout the unit the games the students played were different to the game they played in the pre- and post-test, yet they improved substantially in their performances. For example, the results in the B/A category indicate that students were able to transfer and apply their understanding of action rules and principles of play to the post-test, even though much of the game play had little resemblance to the pre- and post-test game. The notion of transferability supports the few studies that have investigated this phenomenon when teaching using a GCA (Mitchell & Oslin, 1999, Jones & Farrow, 1999, Martin, 2004 and Bohler, 2011). Furthermore, it is possible that by using a common language of action rules and principles of play within the unit, the GCA may have enabled students to identify and connect with their background knowledge in other Invasion/Field Territory Games. Ultimately, this could have enabled students to forge links with the unit and other experiences in Invasion/Field Territory Games, which may have accelerated their improvements.

Gréhaigne, Richard and Griffin (2005) argue that the components of GPU are inextricably interrelated, a finding that strongly aligns with the results of the current study. Improvements in the GPU components in the current study appear to be interconnected, with improvements in one category facilitating advances in others. For instance, as previously discussed, some of the improvements in students’ DM were the product of improvements in their SUP. This is an important finding, as it highlights that the interactive nature of teaching using GCAs and of game play itself (where all components of GPU are seen as equal), may have a range of
advantages over focusing on one component alone, such as SE. The current study demonstrates that improvements in all areas of GPU can occur at the same time, which is affirmed by the significant changes in all measures of GPU.

The significant results of the current study demonstrate that using a GCA when teaching Stage 3 students, in the Invasion/Field Territory Game category, can be an effective pedagogy for enhancing students’ GPU and has the potential to facilitate a range of benefits. This result further supports and reaffirms the earlier research (Allison & Thorpe, 1997, Griffin, Oslin & Mitchell, 1995, Mitchell & Oslin, 1999 and Gabriele & Maxwell, 1995) that has examined whether GCAs can improve students’ GPU, and it confirms that the assertions made in these studies are still applicable in today’s PE teaching and learning landscape. The current findings extend the abovementioned research, as these studies only examined DM and SE, whereas the current study also assessed SUP and B/A, providing a more complete picture of the influence that a GCA can have on students’ GPU. Moreover the results of the current study provide promise to the idea that if students are taught using a GCA in primary school, then the experiences in secondary schools could be further enriched by using the same approach. This would allow secondary PE teachers to continue to progress students learning and explore more advanced concepts as they would already have a foregrounding in GCAs.

5.3 Primary Research Question Two: What is the Influence of a GCA on Stage 3 Students’ In-Class Physical Activity (PA) Levels (i.e. Total Physical Activity – TPA & Moderate to Vigorous Physical Activity - MVPA) in an Invasion/Field Territory Game Unit?

5.3.1 In-Class Total Physical Activity (TPA)

The results indicate that on average in each lesson throughout the GCA unit, students were physically active (engaged in TPA) for 31.4 minutes. With each lesson lasting 40 minutes, this equates to 78.5% of total lesson time. This is an extremely interesting result, as it supports the first PA hypothesis of the current study which predicts that students will be physically active (TPA) for an average of 2/3 of lesson time. Furthermore, it suggests that for a very large proportion of the lessons, students were physically active. From this finding, a number of inferences can be drawn. As noted in the literature review, there have been few
previous studies that have investigated PA in PE lessons where a GCA is used. Therefore, the results discussed in this section are valuable to both educators and PE researchers, as they provide empirical evidence that adds to the limited existing knowledge in this area.

Notably, participants in the GCA unit were able to achieve high levels of in-class TPA whilst also experiencing substantial learning benefits, typified by the GPU results. As previously discussed, students’ improvements in their GPU resulted from lesson time being allocated to questions, discussions and designing game strategies. According to van der Mars (2006) the use of the aforementioned elements in lessons results in students exhibiting more sedentary behaviours. Moreover, Bevans et al. (2010a) note that management and demonstration also absorb lesson time. It is therefore reasonable to suggest that up to 25% of potential activity time was taken up with questions and discussion between the GDOs and the students, and between the students themselves (Chow, McKenzie & Lobo, 2008 and Roberts & Fairclough, 2011). In view of the above evidence, one can conclude that there was the potential for students to be physically active for 75% of the time, in warm-ups and game-play. The results indicate that on average, students were engaged in PA (TPA) for 78.5% of lesson time. Therefore, it can be inferred that throughout the GCA unit students were engaged physically for the entire time in which activity of a kinaesthetic nature was possible. This result is important in terms of justifying the use of GCAs, as it suggests that using a GCA had the effect of physically engaging students, whilst facilitating quality learning experiences.

The finding that students were physically active for the majority of lesson time is possibly linked to higher levels of engagement and motivation. One of the foremost advantages of GCAs is that they can increase students’ motivation for playing games (Chen & Light, 2006, Gray, Sproule & Morgan, 2009 and McNeill, Fry & Johari, 2011). The results of the current study are supportive of this claim, because in order for students to achieve high levels of in-class TPA, they must have been actively participating in the games throughout the unit. High levels of participation in PE are only possible if students are engaged (Bevans et al., 2010b). Although the current study did not directly test students’ engagement or motivation, it can be surmised that the GCA unit must have engaged and motivated the students to participate otherwise the PA levels would not have been as high as the data from the current study suggests. However, as van der Mars (2006) declares, just because students are participating does not mean they are learning. It is therefore pleasing that the GPU results suggest that learning occurred in this study whilst students were participating.
As emphasised earlier in the GPU discussion, the GCA unit in the current study was designed to help students to understand principles which apply to a range of different Invasion/Field Territory Games (i.e. Principles of Play and Action Rules) rather than treat the sport as an independent concept. The GCA used posits that this approach allows greater initial understanding in lessons, as students can link new concepts to prior knowledge and therefore they develop a solid foundation of knowledge to build from, based on their previous experiences in games and sports (Kirk & McPhail, 2002 and Garcia Lopez et al., 2009). The implications of this are that there is greater capacity for involvement, as the links students can make between their own experiences and the game play situation presented in a new lesson may facilitate an increased level of competency and confidence in their game play (Forrest, Wright, & Pearson, 2012). It can be argued that by creating such an environment, using a GCA provides increased potential for physical activity, because it aligns learning with what students may already know, rather than beginning a unit with what they do not.

The in-class TPA results can also be viewed as significant from a health perspective. The Australian Department of Health and Ageing (2014), advocates that young people should engage in at least sixty minutes of MVPA every day. Unfortunately, currently only 19% of Australian children and young people, aged 5 to 17 years meet this recommendation (Australian Bureau of Statistics (ABS), 2013). In addition, as was evident throughout the literature review, students in NSW primary schools currently also struggle to achieve beneficial levels of MVPA during school time (Audit Office of NSW, 2012). The results of the current study support that using a GCA in the Invasion/Field Territory Game category can have the effect of allowing Stage 3 students the opportunity to be more physically active, as the game play in the lessons is able to provide them with the opportunity to accumulate roughly half of their recommended daily TPA (31.4 mins). It is pleasing that students were physically active for this period of time, as it is a finding that can be used as a basis to propose that using GCAs in games lessons can contribute to students achieving some of their daily PA, thereby assisting in maintaining their health and wellbeing, whilst facilitating learning.

Overall, the findings of the current study reveal that using a GCA in the Invasion/Field Territory Game category when teaching Stage 3 students can have the positive influence of engaging them physically (TPA) for a large proportion (78.5%) of lesson time. When viewed
in combination with the positive GPU results, this finding may have important implications for teaching practice.

5.3.2 In-Class Moderate to Vigorous Physical Activity (MVPA)

MVPA results indicate that this variable was high, with students engaging, on average, in MVPA for 56.76% of lesson time. This result supports the second in-class PA hypothesis, as students were engaged in MVPA for more than the recommended 50% of lesson time throughout the unit. This result is extremely pleasing from a student health perspective and can be used as another drawcard to position GCAs as an effective pedagogical method for teaching games and sports, whilst corroborating existing research (Bell et al., 2011, Hannon & Ratliffe, 2005, Owen, Twist & Ford, 2004, Van Acker et al., 2010, Gamble, 2004 and Gabbett, 2006) on the ability of small-sided, modified Invasion/Field Territory Games to elicit high levels of MVPA.

Interestingly, the findings of the current study reveal that students were engaged in MVPA for the majority of the time that they were physically active (i.e. engaged in TPA). There are a number of possible reasons as to why the GCA unit achieved this interesting result. One such reason could be the use of small-sided, modified games. Within the GCA unit, participation in small-sided, modified games with few rule changes were a focal point of each lesson. Therefore, it is plausible that this is what led to high levels of MVPA. This is because students would have had more opportunity to be involved in game play, and as is inherent of small-sided games, they would have been required to participate due to the limited number of players on their team (Gréhaigne, Richard & Griffin, 2005). Moreover, the limited number of rule changes may have facilitated a greater sense of familiarity in the learning environment, allowing students to be active earlier when progressions were made in each game. This result corroborates other studies (Bell et al., 2011, Hannon & Ratliffe, 2005, Owen, Twist and Ford, 2004, Van Acker et al., 2010) that have investigated small-sided and modified games and their potential to elicit higher levels of MVPA. Ultimately, the findings of the current study also support the use of GCAs in stimulating higher levels of MVPA, as small-sided games are an intrinsic aspect of the teaching approach.
From the GPU results one can conclude that there was significant improvement in overall GPU during the unit. This progress can also be presented as a reason for students’ higher levels of in-class MVPA. In essence, one can assume that if a player understands how to play a game and how to achieve its aims, they will spend less time being inactive thinking about what to do, (e.g. while asking questions of the teacher or standing around trying to work out the rules). Instead, they will spend more time actually involved in performing the movements required and enacting decisions to achieve the game’s aim, meaning that they will most likely be active. This appeared to be the case in the current study. Moreover, the improvements in GPU make it conceivable that students made fewer errors in the games, as their understanding progressed. A smaller number of errors could be presented as an additional reason for higher levels of MVPA, as most of the time when there is an error in play, a game will have to stop, reducing the flow of the game and the amount of time for physical activity. It is then reasonable to assume that if there are fewer errors in a game (a potential by-product of better GPU) the level of physical activity will be higher. Importantly, the above points and the MVPA results triangulate with the GPU results, as they can be used to explain why students improved in their GPU.

The nature of the Invasion/Field Territory Game category, which the GCA unit in the current study focused upon, can also be used as a logical explanation for the high levels of MVPA within this study. All of the modified Invasion/Field Territory Games in the unit required students to move in ways that would elicit high levels of MVPA. For instance, the activities had quick restarts and a limited need for stoppages, and provided opportunities for all students to be involved in the game simultaneously. In addition, the games’ action rules and principles of play innately encourage movement (e.g. ‘move to create or receive a pass’, ‘be moving when you receive a pass’ and ‘mark a player’ who will most likely be moving). Therefore, the MVPA result of this study might indicate that using games in the Invasion/Field Territory Game category may be more effective in promoting high levels of in-class MVPA, a finding that is supportive of the recent research of Perlman and Forrest (2015) and Smith et al. (2015).

When students’ MVPA is examined in the context of individual lessons, an interesting trend can be identified that warrants discussion. In the first lesson of the unit, students’ MVPA on average was recorded at 59.96%. This dropped to 53.01% and 54.65% in lessons two and three respectively, and a further drop occurred in lesson 4 (50.14%). This was a particularly
intriguing finding because from lesson 1-4 students played the same modified game in each lesson with different progressions added to enhance student learning. However, the functionality of the game itself remained relatively unchanged. From this, it can be suggested that as students’ understandings of the concepts improved and their game play became more efficient and effective, their MVPA was reduced. A suggested reason for this is that if a player is more effectual in their game play and has a better GPU, they will be able to complete movements in a more efficient manner. This idea is suggested throughout games and sport literature (Gabbett, Carius & Mulvey, 2008 and Gréhaigne, Richard & Griffin, 2005). Moreover, as Gréhaigne, Richard and Griffin (2005) expound, if each individual player is competent in their role on an individual and team level, then as a whole, the team will exhibit a higher degree of homogeneity and that in turn reduces the amount of PA required by individual players. When the GPU results of the current study are considered in conjunction with the abovementioned literature it becomes apparent that improvements in GPU might have actually increased the amount of movement relevant to the game context but reduced the amount of total movement on the field. This resulted in gradual reductions in students MVPA as their levels of expertise grew, which appears to be the case. This suggests that the reduction in the levels of student MVPA from lessons 1–4 is in fact a positive result if aligned with the GPU results, as it could signify improved efficiency within the cohort’s game play.

Interestingly, in lessons five (58.75%) and six (64.06%) students’ MVPA levels increased, contrary to the trend in the previous four lessons. This finding is thought-provoking as it correlates with the stage of the unit where a new modified game was introduced. This and the aforementioned results highlight that once students become comfortable with and understand how to play a game, their MVPA levels drop, compared to when they play an unfamiliar or new game where they rise. The increase in students’ MVPA in lessons five and six is significant, as it demonstrates the benefits of using a range of modified games that examine similar concepts in a game category, as opposed to focusing on just one specific sport in a teaching unit. The ability to utilise a variety of modified games in a thematic approach that draws on the characteristics of a variety of sports in a particular games category is seen as a key ingredient in the implementation of GCAs (Mitchell, Oslin & Griffin, 2006). Therefore, the reduction and then increase in students MVPA is valuable in further justifying the use of GCAs which advocate using a variety of modified games as best practice when teaching games and sports in PE.
Numerous studies have investigated students’ in-class MVPA in PE. In many of these studies, students were not engaged in MVPA for the recommended 50% of lesson time (Lonsdale et al., 2013 & Fairclough & Stratton 2006). Moreover, it should be noted that the activities in these studies were designed specifically with the goal of promoting MVPA for 50% of lesson time in mind, yet they were still unable to achieve it. The aforementioned studies and the results of the current research can be used to highlight the significance of the MVPA result in the current study and its associated links with improved GPU, as the MVPA threshold was met in every lesson in a unit that was not designed to specifically meet the abovementioned thresholds but was focused rather, on improving GPU.

One of the most championed benefits of GCAs is their ability to facilitate higher levels of student engagement in PE lessons (Light, 2013b). The MVPA results of the current study support the view that GCAs increase student engagement, as it can be assumed that for students to surpass the 50% of lesson time in MVPA, as recommended by the USDHHS (2010), they must have exerted themselves at a substantial physical level. It can be argued that many students would only participate at a substantial physical level if they were engaged and motivated (Lonsdale et al., 2009) in the learning activities presented to them throughout a lesson and unit. Although the study did not directly test students’ engagement or motivation, their high levels of MVPA can be used to bolster the claims made in numerous studies (Mandigo et al., 2008, McNeill, Fry & Johari, 2011, Gray, Sproule & Morgan, 2009, Jones, Marshall & Peters, 2010 and Chen & Light, 2006) that GCAs are effective in improving affective outcomes for students in PE lessons.

In summation, it would appear that the GCA unit had a significant influence on students’ in-class MVPA levels in the current study. This result is extremely positive, as it indicates that the GCA was effective in enhancing students’ in-class MVPA. More pleasing still is the fact that these high levels of MVPA didn’t come at the cost of student learning, as students still experienced significant learning outcomes whilst they were physically active. There has been only one previous study that has examined whether both outcomes can be achieved concurrently – a pilot study by Miller et al. (2016). This makes the findings of the current study more significant as it provides new evidence in support of using GCAs in PE lessons.
5.4 Limitations of the Study

Like all studies, this one had limitations. One potential limitation is the absence of a comparison group. The reasoning behind this has been explained in the methodology chapter, and further explanation would be repetitious. Nonetheless, the fact that there is no comparison group does act as a limitation. This is because it is difficult to ascertain if some of the students’ improvement in their GPU was the result of them playing the assessment game in the post-test for the second time. However, the extent of the students’ improvement would suggest that even if playing the game twice facilitated some enhancement in results, it would only be marginal, and it is unreasonable to suggest that simply playing a game twice would elicit such significant improvements. Furthermore, it should be noted that the current study was not designed to compare GCAs with traditional skill-drill lessons, or with lessons currently implemented in primary schools.

A further limitation of this study was the inability to give every student involved an accelerometer. The justification for this was discussed in the methodology chapter. Nevertheless, this does limit the results as the PA sample size was smaller than the GPU sample and therefore, the study did not collect PA data on all students involved in the GCA unit. Students from each group were randomly provided with accelerometers, which aimed to reduce this limitation. However, the fact that not all students in the study wore an accelerometer limits the ability to argue that the PA results are applicable to all Stage 3 students in NSW.

One of the interesting elements of the current study was the use of Gamelens technology for video analysis. The current study did not collect data on the limits, constraints and possibilities for this use of technology for game assessment in PE and this too could be seen as a limitation. However, the researcher and supervisors felt that examining the Gamelens program in detail would detract from the results of the current study and as such exploring the possibilities of the Gamelens program has been added to the directions for future research section of this thesis.
Chapter Six
Conclusion

6.1 Implications and Recommendations for Practice

The results of the current study have important implications for pedagogic practice and can be used to make a number of recommendations. The results provide further evidence that using a GCA can be effective in teaching Invasion/Field Territory Games in an authentic school setting. As the study utilised a relatively large sample (N= 316), and schools from different demographics, the results can to a certain degree be generalised to most NSW Primary School Stage 3 students. The findings show that significant improvements in students’ GPU in a specific game category can be achieved in a relatively short period of time when students are taught using a GCA. The implications of this are that if improvements can be achieved in only six lessons, one can only imagine the progress that students could make if the approach was used regularly in school settings. Moreover, if students are exposed to GCAs earlier in primary school, and begin to develop GPU at an earlier age, it can be inferred that this may in fact strengthen GPU results in secondary PE, where more specialised teaching of sports is provided (ACARA, 2015a). Furthermore, based on the results of the current study, the notion of ‘foundational’ (e.g. students earliest learning on games and sports) understanding in primary schools could be aligned with GPU and expand from the present focus on movement skill development as the key foundation of games and sport understanding. As such, the results are important for PE practitioners, as they provide further support for the use of GCAs in achieving a range of PE goals and outcomes in actual practice and there is scope for the approach to gain greater traction in Australian primary schools.

The ability of students in the current study to transfer their learning from the games in the GCA unit (‘10 Passes’ and ‘Kangaroos and Jillaroos’) to the post-test game (Modified Touch Rugby League/Backyard League) also has significance for teaching practice. Within the current study, the students improved in the post-test game without even playing it throughout the unit. The demonstrated improvement supports one of the underlying assumptions of GCAs: that by teaching students the underlying principles of games within a category rather than viewing sports as individual entities that must be taught and understood, we can provide
them with a greater opportunity to be successful in a variety of games and sports (O’Connor, 2006). This notion may also be important from a lifelong physical activity standpoint, as students in the study gained a better understanding of many concepts that underpin all Invasion/Field Territory Games. In essence, through the understanding students developed in the GCA unit, they did in fact learn many concepts that may be applicable to a number of different sports, thus furthering their potential to participate in these sports more easily throughout their lives. Additionally, GCAs also have the capacity to teach students how to play a range of modified games (Osling & Mitchell, 2006, Stolz and Pill, 2014, Harvey and Jarrett, 2014). Over the lifespan of an individual, game play situations may change (i.e. playing Volleyball 3v3 when 6v6 cannot occur) and the capacity to perceive that play as similar is an important skill. Based on the results of the current study it can be suggested, that when the game concepts remain the same but the game changes, students may have greater success adapting to different play scenarios through the application of similar concepts in different contexts. This ability highlights the potential of GCAs to enhance one’s capacity for lifelong physical activity and learning. Therefore, teachers should give greater consideration to using GCAs and teaching the commonalities of sports based on these arguments.

Furthermore, the results also provide grounds for potential research into whether we actually need to teach specific games or sports in order for students to improve in them.

Certain features of the GCA used in the current study have demonstrated potential to be particularly beneficial to students, and could have conceivably played an important role in the improvements in student GPU. The implications extend further than primary school PE settings, and may also have implications for the teaching of games and sports in high schools, as well as for curriculum development. For instance, if students come to secondary school with a foregrounding in GCAs the PE teacher could potentially focus more on advanced strategies and skills, thus increasing the intellectual quality of lesson. From the results, it could also be argued that the significant influence that the GCA had on GPU was the product of the emphasis placed on student learning in relation to underlying concepts common to all games and sports, such as strategy and tactics, communication and concentration, action rules and principles of play. From this it can be recommended that these particular concepts be incorporated into GCAs as content in their own right, becoming the focus of lessons, rather than the focus being on individual sports. In addition, the results of the current study provide reasons to investigate whether using conceptual approaches, with principles or concepts of
sports as the focus rather than individual sports themselves, is advantageous in school settings.

Primarily, the in-class PA results demonstrate that using a GCA has the potential to engage primary school students in TPA for the majority of lesson time. The implications of this for teaching practice are twofold. Firstly, GCAs could be identified as an effective pedagogical method to get students physically active for a large proportion of the time in games lessons, while enhancing learning and understanding. Secondly, the results provide evidence that GCAs are a valuable teaching model from an in-class PA standpoint, a benefit that prior to this study was only supported by presumptions. This finding also addresses recommendations made by The National Heart Foundation of Australia (2014) and Active Healthy Kids Australia (2014), as it provides further research into how active Australian children are when engaged in organised activities such as PE lessons.

MVPA was high among participants, and this finding has the potential to inform and guide educators. Within the current study, no additional attempts were made by the GDOs to promote in-class MVPA. As such, it was likely the use of small-sided modified games and the nature of the game category (Invasion/Field Territory Games) that produced levels of MVPA that were in line with the 50% of lesson time in MVPA guideline put forward by the USDHHS (2010). This finding can be used to suggest that if one of the goals of a games and sports unit is to provide students with high levels of in-class MVPA to enhance health and fitness as indicated in the F-10 ACHPE (ACARA, 2015a) curriculum content descriptors (e.g. Stage 3/Years 5 & 6: ‘Participate in physical activities designed to enhance fitness’ and Stage 4/Year 7 & 8: ‘Participate in physical activities that develop health-related fitness components’), then the two aforementioned elements should be a major consideration in unit and lesson planning, and that if this is not done then high levels will be difficult to obtain. The above idea is exemplified in a review conducted by Fairclough and Stratton (2006) and also research by Perlman and Forrest (2015). Moreover, the results of the current study indicate that PE units should include as much variety as possible in terms of the games being played, if MVPA is the goal, even at the expense of not playing the ‘real sport’. This recommendation is supported by the current study because it appeared that when students became comfortable with a game, their MVPA dropped. This is important for PE teachers, as it informs them that focusing on playing and developing students’ expertise in just one particular sport may not be best practice for the provision of MVPA.
The use of external providers such as development officers from various sports to provide PE lessons is a common practice in many schools (Williams, Hay & Macdonald, 2011). It can be argued that the best time for these providers to run programs is during school sport or PE, a convenient option for primary teachers who may have limited PE or sporting expertise. Many sporting bodies in Australia (e.g. the Australian Football League (AFL), the National Rugby League (NRL) Football Federation Australia (Soccer), Hockey Australia and Basketball Australia) utilise development officers to implement programs in education settings with the aim of increasing participation in their sport outside of school (NRL, 2014 & AFL, 2016). The current study has shown that when a pedagogical model (GCA) that focuses on students’ learning is used by a sporting body (NRL) and its development officers, students benefit. As such, findings from the current study support the aims of the Sporting Schools Initiative (e.g. increase children’s participation in sport, improve fundamental movement skills & engage children in high quality sporting programs) (Australian Sports Commission, 2016). However, if these sporting bodies are to be used in the provision of some primary school PE, then their programs and teaching units should aim to adopt a GCA and should undergo assessment to validate their achievement of learning and PA outcomes, as the results of the current study prove this can have significant benefits for students. It is also important that those involved in the teaching of the units actually develop skills and receive professional learning in the use of GCAs, as this was a potential key to the success of the units in the current study.

From the current study one cannot determine whether the unit would have had a similar effect had it been taught by the students’ classroom teacher. However, the positive results do indicate that there may be benefit to improving the professional learning opportunities for primary school teachers (Pill, 2011a) and improving undergraduate skills in using GCAs (Pearson & Webb, 2010). This suggestion has received support in various recent publications (National Heart Foundation of Australia, 2014 & UNESCO, 2015). Numerous authors (Morgan, 2008; Morgan & Hansen, 2008; Faucette et al., 2002; Faulkner et al., 2008; Sloan, 2010; and Sherman, Tran & Alves, 2010) suggest that because many primary school teachers can have difficulty teaching PE for a variety of reasons, it may be beneficial that primary schools and their governing bodies give greater consideration to utilising specialist PE teachers if they adopt GCA models in primary school PE. This suggestion is further supported by other studies (DeCorby et al., 2005; Ayvazo & Ward, 2011; Whipp et al.,

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with their results also confirming that primary school students would benefit from being taught PE by a specialist.

### 6.2 Directions for Future Research

The results of the current study have provided a rich foundation and numerous avenues for future research. A key direction for future research would be to investigate whether the GCA used in the current study would have a similar influence on GPU and in-class PA levels in students of different age groups. The same research could be conducted with students in earlier stages in primary school. An adapted version of the GCA unit could be assessed in a secondary school setting. Another direction of research that could flow on from the current study could be to examine the GCA used in other game categories, such as Striking and Fielding Games or Target Games. It would be interesting to examine whether using the same GCA in another game category would facilitate similar benefits in both PA and student learning, although there may be a reduction in PA depending on the category (Perlman & Forrest, 2015). This additional research would assist in further promoting and validating GCAs, as it would contribute to a more complete picture of the cognitive and physical influences that GCAs can have on all students and in all game categories.

From the results of the current study, it cannot be determined if the GCA unit could be implemented by a generalist primary school teacher. McNeill et al. (2008) posit the notion that GCAs require greater pedagogical content knowledge and are more demanding to use, compared with the traditional skill-drill approach. In Australia primary schools PE is taught by a generalist teacher, therefore, a next step in researching the influence of GCAs in primary schools could be to investigate whether the same improvements in GPU can be realised if a primary school classroom teacher, who is provided with the necessary professional development, implements the unit. In essence, the exact same study could be conducted with the students’ regular classroom teacher implementing the unit. In addition, if this hypothetical research were to take place, it would also have the potential to be compared with the results of the current project. This could then be used to compare PE lessons taught by a normal classroom teacher with those taught by a PE specialist and specialist in a sport, such as a GDO. This research could examine whether there is any difference in the effectiveness of the
two types of facilitators, and therefore whether there is any merit to the idea that PE should be taught by specialists in primary schools.

A further area of future investigation that could evolve from the current research could investigate what professional learning and support is required for specialist PE teachers, specialist GDOs and/or generalist primary school teachers to be able to implement GCA lessons on a regular basis. As identified by McNeill et al. (2008), there is a perception that GCAs are more difficult to implement than the traditional skill-drill approach, with evidence (Pill, 2011a; Pearson and Webb, 2010) to suggest that there has been inconsistent implementation of GCAs despite many years of research. This may hint at further issues beyond the difficulty of implementation, such as content knowledge in the variety of different sports or, as in the case of GDOs, whether they have the necessary pedagogical knowledge to maximise their content knowledge.

However, the current study has also demonstrated that there is benefit to using a common language and teaching students about the concepts of a game category as opposed to focusing on one particular sport as a single entity. Using this common language and focusing on commonalities between sports seems to have the capacity to allow students to link what they are learning about to their previous experiences in games and sports contexts (Forrest, Wright & Pearson, 2012). Providing professional development with this in mind may provide more ‘bang for your buck’ due to the potential to improve content knowledge and pedagogical knowledge at the same time, and it may be beneficial in providing access to GCAs for all teachers and could reduce the difficulty of implementation. In essence, rather than having to understand the rules of multiple sports, teachers would only need to learn the main concepts of different game categories. It can be argued that this would be a rich area for investigation, because GCAs have repeatedly demonstrated the capacity to promote high levels of learning, yet despite these seemingly obvious benefits, they still fail to gain traction in actual school settings (Pill, 2011a and Butler et al., 2008).

Memmert and Harvey (2008) point out that there have been numerous attempts by researchers to validate the GPAI. These studies have examined ways in which it could be modified and used in the assessment of game play in PE settings. In the current study, the GPAI was used in conjunction with a game analysis software program (Gamelens). A direction for future research relating to this software would be to attempt to further validate
and test its effectiveness in assessing game play in both recorded and live PE settings in real time. Ultimately, an entirely new study could stem from the current research. This study could compare the assessment of GPU using the pen and paper version of the GPAI, with using the GPAI in conjunction with game analysis software (Gamelens) in situ and in real time. The effectiveness of the analysis software (Gamelens), used in the current research indicates that this would be a valuable area for future investigation. This is because through its initial usage in the current study, it would appear that using technology and analysis software has the potential to provide a more in-depth analysis when assessing games and sports in PE.

In the current study the GCA unit was implemented by NRL GDOs, with consistent support from the research team. Many other sporting bodies in Australia use GDOs to implement similar programs in schools (Williams, Hay & Macdonald, 2011). Therefore, an additional area of research could aim to determine that a GCA unit should be implemented in other sports, by other GDOs, and whether learning and PA benefits could be achieved under these conditions. For instance, many of the games and concepts utilised in the current study could be applied and implemented by development officers for the AFL, Football Federation Australia (Soccer), Hockey Australia and Basketball Australia, or the state-level equivalents in each of these sports. It would be interesting to examine whether the same positive outcomes of the current study would be achieved, and this would also assist in further assessing a teaching framework that could be used by all development officers when implementing their respective programs in school settings. Moreover, this may be a flag for future investigation of GCAs in coaching and in school sport. There has already been a trend towards GCAs and promoting higher levels of learning through the Sporting Schools initiative (Australian Sports Commission, 2016).

From the current study it is also interesting to note that the improvements in students’ passing and catching skills may be transferred to other Invasion/Field Territory Games, comparable to the transferability of the understandings students gained in the DM, SUP and B/A categories. Many Invasion/Field Territory Games (e.g. Basketball, Netball, Australian Rules Football, European Handball and Gridiron) require students to catch and pass a ball to progress towards the scoring area. It is likely that students’ improvement in catching and passing skills learnt in the unit of this study could be transferred to some, if not all, of these sports, a notion that closely aligns with skill acquisition literature (Wulf, 2007). Moreover,
this would potentially reduce the time required for students to learn how to pass the ball in
other Invasion/Field Territory games and modified activities, because they have already
learnt many of the key competencies for passing and catching (e.g. watch the ball, know how
to absorb and apply force, and look where you're passing). There is potential for this
transferability to be expanded to other concepts associated with GPU, in line with the
findings on thematic units in studies such as Garcia Lopez et al. (2009) and this is a further
area of research that could stem from the current.

Although tentative links were made between the GCA unit and students’ motivation, the
current study did not directly investigate affective outcomes. As such, a further area of study
that could stem from the current research would be to explicitly asses these outcomes in a
GCA unit. This would have the benefit of providing a clear picture of GCAs’ advantages
within all three learning domains (cognitive, psychomotor and affective) and would assist in
substantiating the claims made in other GCA research on affective outcomes (Mandigo et al.,
2008; McNeill, Fry & Johari, 2011; Gray, Sproule & Morgan, 2009; Jones, Marshall and
Peters, 2010; Chen and Light, 2006). Furthermore, a study of this nature could be linked to
one that examines the potential of GCAs to contribute to lifelong physical activity. One way
in which this could be achieved would be to collect data on whether students participate in
Rugby League or similar games (Touch football, Rugby, Oz-tag) outside of school, after
participation in an Invasion/Field Territory Game GCA unit. This would indicate if the
learning outcomes from the teaching unit translate into participation outside of school and
therefore if they have the potential to facilitate students’ participation in these sports across
their lifespans.

6.3 Conclusion Summary

From the current research a number of valuable conclusions can be drawn. The foremost
purpose of this study was to investigate the influence that a GCA teaching unit could have on
students’ GPU in a primary school setting. One of the main findings from this study was that
using a GCA in the Invasion/Field Territory Game category can facilitate deep learning and
improve Stage 3 students’ GPU in a sport. This finding provides evidence that GCAs should
be considered as an effective pedagogy for teaching games and sports in primary school PE.
Although further research is needed, this finding provides strong evidence that GCAs have
the potential to assist teachers in addressing one of the chief agendas of PE: the provision of quality and enriching learning experiences in the area of games and sports.

This result is significant on a number of levels, not only for PE teachers and those interested in educating in the games and sports field, but also for advocates and researchers of GCAs. In essence, the current study provides further empirical evidence that from a student learning perspective, GCAs have the capacity to be effective in actual school settings in both improving GPU and PA. The results of the current study reinforce the findings of earlier GCA research, whilst addressing the problem that much of the evidence in this area is at least 10 years old. Moreover, the current study highlights that the claims made in foundational GCA research (Alison & Thorpe, 1997; Austin, Haynes & Miller, 2004; Gabrielle & Maxwell, 1995; Griffin, Oslin & Mitchell, 1995 and Mitchell, Griffin & Oslin, 1995; 1997) are still applicable in today’s teaching and learning landscape. Additionally, the results partially fill the void that exists in the literature regarding the effectiveness of GCAs in Australian primary schools.

The secondary purpose of the current study was to examine the influence that teaching using a GCA could have on Stage 3 students’ in-class PA levels (i.e. TPA and MVPA), in the Invasion/Field Territory Game category. In summary, the findings show that this aim was also achieved. Essentially, the results inform us that providing students with high levels of TPA and MVPA that meet prescribed PA thresholds is a secondary influence that a GCA can have on students.

The PA findings of the current research are significant because, like the GPU results, they address an oversight in the literature. Prior to the current study, there had been little research that had examined the in-class PA levels of students who are taught using a GCA. Thus, the evidence this study affords researchers and teachers is of worth, as it is completely original and provides insight into the levels of PA that can be achieved in GCA lessons. These results are also valuable because current PA levels amongst primary school students in NSW are low, both within and outside the school setting (Audit Office of NSW, 2012). Ultimately, the current study indicates that using GCAs in PE could form part of a solution to this problem. Furthermore, the in-class PA results suggest that GCAs could have the capacity to assist educators in achieving a key aim of PE, which is promoting high levels of PA during lessons in order to benefit students’ health and wellbeing.
The overarching intent of the current project was to examine whether both improvements in learning, demonstrated through student GPU and high levels of in-class PA could be achieved concurrently, in a unit where students were taught using a GCA. In essence, is it possible to balance the two main agendas of PE? There is a scarcity of prior research that has investigated whether equilibrium can be maintained between these two essential purposes of PE within games lessons, therefore clearly exemplifying the current study’s significance.

Although more research is needed, the current study provides promise that using a GCA could have the potential to assist educators to balance both the educational and PA agendas in primary school PE. It is anticipated that the results of the current research will stimulate debate and lead to further investigation to validate the abovementioned claim and the results of this study, in addition to encouraging researchers to direct their efforts towards fulfilling the potential of the approach and supporting its implementation. Moreover, it is hoped that the findings of the current study will encourage educators to further consider their use of GCAs in games and sports lessons, as it provides evidence of the substantial learning benefits the approach can afford students, coupled with the possibility for high levels of in-class PA are not merely theoretical, but a potential reality.


Australian Curriculum, Assessment and Reporting Authority (ACARA) 2015b, *MySchools: School Profile*, ACARA, viewed 12/12/2015. **Note:** Link to website has been omitted for confidentiality reasons.


Bohler, H 2011, ‘Fifth-grade students' tactical understanding, decision-making and transfer of knowledge in a tactical games model net/wall sampling unit’, PhD thesis, Faculty of Education, University of Massachusetts.


Centre for Disease Control (CDC) 2010, The Association Between School-Based Physical Activity, Including Physical Education, and Academic Performance, Department of Health and Human Services, Atlanta.


Gabbett, T, Jenkins, D & Abernethy, B 2009, ‘Game-Based Training for Improving Skill and


Griggs, G 2010, ‘For Sale–Primary Physical Education. £ 20 per Hour or Nearest Offer’, *Education*, vol. 38, no. 1, pp 39–46.


Light, R 2013a, Game Sense: Pedagogy for Performance, Participation and Enjoyment, Routledge, New York.

Light, R 2013b, ‘Positive pedagogy for physical education and sport Game Sense as an example’ in R Light, J Quay, J Harvey & A Mooney (eds.), Contemporary Developments in Games Teaching, Oxon Routledge, Abingdon, pp. 29-42.


Lodico, M, Spaulding, D & Voegtle, K 2010, Methods in educational research: from theory to practice, Wiley, San Francisco.


Mauldon, E & Redfern, H 1969, Games Teaching: A New Approach for the Primary School, McDonald and Evans Ltd.


National Heart Foundation of Australia 2014, Blueprint for an active Australia, National Heart Foundation of Australia, Melbourne.


Pearson, P & Webb, P 2010, ‘The integration of TGfU into the secondary school physical education curriculum – how successful has it been?’, in *Congreso de la asociación internacional de escuelas superiores de educación física*, pp. 1004-1015, Research Online.

Perlman, D & Forrest, G 2015, ‘An Examination of In-Class Physical Activity Across Games Classifications’, *Physical Educator*, vol. 72, no.2, pp. 266-277.


and Tactical Games Models of Games Teaching in Physical Education’, *European Physical Education Review*, vol. 21, no. 1, pp. 93-113.


Appendix One

Data Collection Tool: Pre-Test and Post-Test Game

(Modified Touch Rugby League/Backyard League)
Developing League

Activity - Backyard League Game

Aim
The aim of this game is for the attacking team to score a try over their try line. Players can still pass forward but when “tackled” they have to play the ball to the acting half. The attacking team now have to pass backwards or to the side and when “tackled” they have to play the ball to the acting half.

PLAYERS
- Approximately eight teams for a class of 32 students. 4 players in each team depending on size of class/group of students. Minimum of 3 players per team and a maximum of 5 players per team.

TEAM (DEFENDERS)

TEAM (ATTACKERS)

Equipment
- 4 x markers per grid
- 1 x football per grid
- 4 x Bibs for each team
- Whistle
- Stopwatch
**PLATING AREA**

- Use a designated area approximately 15m x 15m or larger per grid.

---

**GAME PLAY**

- The *attacking team* have **six chances** to score a "try" over their designated try-line. **Passes can only travel backwards or to the side.**

---

**Game play with Possession (Offence)**

- Play starts on try line. Starting team is selected by referee.

- Each team will receive 6 chances/touches before a handover. *(Note: Teams get 6 chances per set regardless if they drop the ball, if a player drops the ball, that ends the chance and the next play the ball will start from where the ball was dropped).*

- Players are to play the ball using their foot. This play the ball cannot take place until the referee is 5 metres back from the player who is playing the ball.

- The ball must be passed by the dummy half *(not necessarily immediately, i.e. the dummy half can run)*. If a player does not pass the ball after a play the ball and is tagged, their team loses 1 chance.

- The ball cannot come forward from the hands and can only be passed backwards, except on the last play. *(If the ball comes forward from the hands that ends a chance).*

- There is no kicking. However on the 6th play, the ball can be passed forward. If the ball hits the ground the defending team is given possession where the ball lands. If the ball is thrown over the try line the defending team is given possession on the try line.

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**Game play without Possession (Defence)**

- The game is completely non-contact. Students who do not follow this rule will be immediately substituted.

- The defence must use a 1 handed touch to stop an opponent and to end a chance.

- The defence must be 5 metres back and can move forward as soon as the dummy half takes possession of the ball.
Appendix Two

*Game Centred Approach (GCA) Teaching Unit*
### BYL GAME PLAY

**Developing League**

Moving to create or receive a pass

#### Unit Overview

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<tr>
<th>Lesson No.</th>
<th>Activity</th>
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<td>Keep Possession</td>
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<td>2 &amp; 3</td>
<td>Stop the Motion / 10 Passes</td>
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<tr>
<td>3 &amp; 4</td>
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<td>Kangaroos &amp; Jillaroos Game</td>
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</table>

**Note:** Warm Up Activity = Grid Warm Up 1 – Shuttle Relay. Use this warm-up and its progressions throughout the unit.
Developing League

Activity - Grid warm up 1 - Shuttle Relay

Aim
The aim of the warm up is to prepare the students for the activities and to minimise the risk of injury.

OBJECTIVES
- The objectives of this game for the attacking players is advance to score. The objectives for the defender is to track the ball, pressure the ball carrier and mark a player or an area.

PLAYERS
- Approximately eight teams for a class of 32 students. 4 players in each team depending on size of class/group of students.

TEAM (DEFENDERS)

TEAM (ATTACKERS)

Equipment
- 20 x markers per grid
- 1 x football per channel
- Bibs for each team
- Whistle
- Stopwatch
**PLAYING AREA**

- Use a designated area approximately 15m x 15m or larger per grid. Divide the grid into 4 channels so you have 4 channels per grid 15m x 3.75m per channel.

**WARM UP**

- Divide the class up into equal groups, within each grid have 4 teams with 4 players per team/channel.
- In each channel have 2 team members lining in one straight line on one end of the channel and on the opposite end of the channel have the other 2 team members facing their team members.
- There is one football per team, with the warm up activity similar to a shuttle relay.
- The player (Player A) with the ball starts by running with the ball correctly placing the ball down in front of the player at the opposite end of the channel (Player B).
- Player B then runs through picks up the ball, runs to the opposite end of the channel placing the ball down in front of the player (Player C) with the activity then continuing for a short period of time.
- Have all channels going at once. Have players then use the following plays:
  - Run put down, run pick up and hand off
  - Run put down, run pick up and pass
  - Run put down, run pass into the path of a runner in the middle of the channel
  - Use different combinations of the above

**PROGRESSION**

- Using the above grid set up, have players performing fundamental movement skills to practice and refine skills in different movement situations eg;
  - Side stepping, swerving & dodging
  - Passing and catching
  - Kicking – chip kicks & grubber kicks
- Give the students a task of a number of completions, e.g 20 passes/handoffs without a drop ball.

---

**Teachers Notes**

- Remind students of the decisions they have to make; when to pass, where to put the ball down, when to leave their marker, how hard to pass.
- Have students concentrate on their skill execution; how to hand-off, how to pass, how to pick up the ball.
Developing League
Moving to create or receive a pass

Activity 1 - Keep Possession /10 Passes

Aim
The aim of this game is for the attacking players to keep possession off the other team within the grid. The attacking team needs to work together to pass the ball and achieve the score (ten) passes without the defending team forcing a turnover. The defensive team needs to pressure the attacking team to force a mistake from a pass or knock down or intercept a pass.

PLAYERS
Approximately eight teams for a class of 32 students, 4 players in each team depending on size of class/group of students.

TEAM (DEFENDERS)

TEAM (ATTACKERS)

Equipment
- 4 markers per grid
- 1 football per grid
- 4 Bibs for each team
- Whistle
- Stopwatch
PLAYING AREA

Use a designated area approximately 15m x 15m or larger per grid.

15m
15m

GAME PLAY

Divide the class up into equal groups, within each square have e.g. 4 attackers vs 4 defenders.

The aim is to keep possession off the other team within the grid, and achieve the score of 10 passes. The attacking team attempts to keep the ball amongst each other, passing & catching the ball whilst dodging or evading their opponents.

Players of the opposing (defending) team attempt to catch or knock down the ball.

No physical contact is allowed and the ball should not be punched (safety rule). Players may only guard each other from 1 metre away and intercept or knock down passes.

If the ball is dropped or knocked to the ground it can be picked up by the attacking team and play continues. Nb. The defending team can not pick up the ball if it is on the ground. There is no diving on the ball on the ground.

Have all games going at once. Rotate one team from each field after an allocated time.

SCORING

A team is deemed the winner when they retain the ball for the longest time or for a designated number of passes (such as ten).

VARIATIONS

If the attacking team is finding it difficult to achieve the (10) passes have the defending team defend an area eg. Split the grid into 4 squares and have a defender in each square or split the grid in half and have 2 defenders in each half of the grid.

If the attacking team is finding it difficult to achieve the (10) passes decrease the number of defenders and increase the number of attackers e.g. 6 attackers vs 2 defenders, 5 attackers vs 3 defenders.
Questions
At the start of the game the teacher can ask the following questions:

**ATTACK**
- What strategies can be used to keep possession of the ball? As an individual and as a team?
- Why is it important to keep moving when you are the attacking team?

**DEFENCE**
- What strategies can you use to stop or get the ball from the attacking team?
- Why is it important to mark a player or space? What is the most effective strategy?

After a couple of minutes playing the game the teacher should bring the students back together and ask the following questions:

**ATTACK**
- What did you do individually and as a team to maintain possession?
- What kind of pass was the most effective and why?
- How do you decide who, where and when to pass the ball?
- Is a long pass a risky pass?
- What can you do as an attacker when you do not have the ball?
- As a receiver, what does an effective pass feel like?
- What can you do as an attacker if you move into space to receive the ball and are not passed the ball?
- What can you do to keep possession?

**DEFENCE**
- How can you apply pressure to the attacker with the ball?
- How can you apply pressure to the attackers without the ball?
- How do you anticipate/time when to knock the ball down or make an intercept?

**Teachers Notes**
- The key with each of these elements is when to intervene and when to let play go on. Play speed is the key. Once it gets faster, it is a signal that students understand the function and then first focus area can be introduced.
- The earliest intervention is with “Strategy” first. Focus on simple strategies (remember with and without possession). Watch for teams who simply keep the ball close. A good option as it is a safe pass so encourage a handoff, but then put a limit on the amount of handoffs.
- Watch if they do not run; they need to move with possession and realise that if they move, they can be really selective with the pass.
- Players also have to realise that they are just as valuable to move to create a pass as receive as not everyone can receive the ball.
Developing League
Moving to create or receive a pass

Activity 2 - Stop the Motion/10 Passes

Aim
Most games where you move allow a way to stop movement (tackle/touch/tag off belt). This game is the progression game to “Stop the Motion.” Where the attack now have six chances to achieve the score of (ten) passes.

Players
Approximately eight teams for a class of 32 students. 4 players in each team depending on size of class/group of students. Minimum of 3 players per team and a maximum of 5 players per team.

Team (Defenders)

Team (Attackers)

Equipment
» 4 x markers per grid
» 1 x football per grid
» 4 x Bibs for each team
» Whistle
» Stopwatch
PLAYING AREA

» Use a designated area approximately 15m x 15m or larger per grid.

GAME PLAY

» This game is an extension to “Keep Possession” but you now add a “play the ball” and an Acting Half. Divide the class up into equal groups, within each square have e.g. 4 attackers vs 4 defenders.

» The aim is to keep possession off the other team within the grid. The defender has to “tackle” the attacker.

» If “tackled”, the player plays the ball (PTB) to an Acting Half (AH). The AH cannot be tackled and can move anywhere to look to pass to another Attacking Player.

» The defending player who now makes the “tackle” must stand where they made the “tackle” and the attacking player who was “tackled” must return to this spot.

» The attacking player plays the ball to the Acting Half, the acting half picks up the ball and runs to attempt to find another attacking player to pass to. NB. To start this game the Acting Half can not be “tackled”. The Acting Half can move anywhere to find an appropriate pass to another attacking player.

» The “tackler” must remain at marker until the Acting Half has cleared the area (Can introduce the term “Ruck”).

» Have all games going at once. Rotate one team from each field after an allocated time.

VARIATION:

» Team without possession must mark an area not a player

» Increase the number of defenders and decrease the number of attackers e.g. 6 attackers vs 2 defenders, 5 attackers vs 3 defenders, 4 attackers vs 4 defenders

» Implement zone restrictions on players so only certain players are allowed in certain areas.
Questions

At the start of the game the teacher can ask the following questions:

**ATTACK**
- Use questions from “Keep Possession Game”, plus;
- How can you avoid being “tackled” when you have possession?
- If there is a marker the defence has one less player how can the attacking team use this to their advantage?
- What role does the acting half play?
- What should the acting half do when they have the ball?

**DEFENCE**
- Use questions from “Keep Possession Game”, plus;
- As a defender what is the best strategy to make a “tackle” on an attacker?
- If there is a marker the defence has one less player how do the defenders adjust?
- What could the role of the marker be?

After a couple of minutes playing the game the teacher should bring the students back together and ask the following questions:

**ATTACK**
- Use questions from “Keep Possession Game”, plus;
- What type of evasion skills did you use to avoid defenders?
- As an attacker when you do not have the ball how can you be in a good position to receive a pass and avoid being “tackled” immediately?
- What strategies did you use with the acting half role?
- What strategy can you use as a receiver to receive a pass from the acting half player?

**DEFENCE**
- Use questions from “Keep Possession Game”, plus;
- What strategies did you use to “tackle” an attacker?
- What was the most effective way to make a “tackle” on an attacker?
- Once you have made a “tackle” what did you do as the marker to make it difficult for the attacking team to get the pass away?
- What strategy did you use defensively with one less player (marker) defending the attacking team?

**Teachers Notes**

- The addition of the primary rule may create more panic with the ball as players try to score too quickly or do not want to get tagged. Remind players they have unlimited chances to score the (ten) passes. Defensively, it also means that the “tackled” person now has no movement option after being “tackled” which means the defender has one extra player until the pass is made.

- Make sure the groups still remember to focus on concepts explored in the game “Keep Possession” and apply to this game.

- You could elect to have certain players as the Acting Half, this is a great way to get the “non-active” players involved by nominating them as the acting half.
Developing League

Activity 3 - 10 Passes /6 Chances with Play the Ball

Aim
Most games where you move allow a way to stop movement (tackle/touch/tag off ball). This game is the progression game to “Stop the Motion”. Where the attack now have six chances to achieve the score of (ten) passes.

PLAYERS
Approximately eight teams for a class of 32 students. 4 players in each team depending on size of class/group of students. Minimum of 3 players per team and a maximum of 5 players per team.

TEAM (DEFENDERS)

TEAM (ATTACKERS)

Equipment
- 4 x markers per grid
- 1 x football per grid
- 4 x Bibs for each team
- Whistle
- Stopwatch
PLAYING AREA

» Use a designated area approximately 15m x 15m or larger per grid.

GAME PLAY

» Use a touch here (one/two handed), tag or tackle. Divide the class up into equal groups, within each square have e.g., 4 attackers vs 4 defenders.

» The aim is to keep possession off the other team within the grid. The defender has to “tackle” the attacker.

» The attacking team has six chances to achieve the (ten) passes. If the attacking players is “tackled”, that player plays the ball to restart.

» Once the attacking team has used up their six chances, swap over possession and it is the other teams turn to attempt to achieve the (ten) passes.

» Have all games going at once. Rotate one team from each field after an allocated time.

SCORING

» A team is deemed the winner when it retains the ball for the longest time or for a designated number of passes (such as ten).

VARIATIONS

» If the attacking team is finding it difficult to achieve the (ten) passes have the defending team defend an area e.g., Split the grid into 4 squares and have a defender in each square or split the grid in half and have 2 defenders in each half of the grid.

» If the attacking team is finding it difficult to achieve the (ten) passes decrease the number of defenders and increase the number of attackers e.g., 6 attackers vs 2 defenders, 5 attackers vs 3 defenders.
Questions

At the start of the game the teacher can ask the following questions:

**ATTACK**
- Use questions from “Stop the motion game”, plus;
- What strategies can you use to get the (ten) passes by six chances?

**DEFENCE**
- Use questions from “Stop the motion game”, plus;
- As a defender what is the best strategy to make a “tackled” on an attacker?

After a couple of minutes playing the game the teacher should bring the students back together and ask the following questions:

**ATTACK**
- Use questions from “Stop the motion game”, plus;
- When an attacker is “tackled” what is the best type of pass?
- What strategy can you use as a receiver to receive a pass from the “tackled” player?

**DEFENCE**
- Use questions from “Stop the motion game”, plus;
- Once you have made a “tackle” how can you make it difficult for the attacking team to get the pass away?
- Once you have made the “tackle” what is the best way to defend the attacking receiver’s?

Teachers Notes

- The addition of the “6 tackle” rule may create more panic with the ball as players try to score too quickly or do not want to get “tackled”. Remind players they have six chances to score the (ten) passes, explain that if they only need ten passes than they only need to have approximately two passes per “tackle”.

- Defensively, it also means that the “tackled” person now has no movement option being “tackled” which means the defender has one extra player until the pass is made.

- Make sure the groups still remember to focus on concepts explored in the games “Keep Possession” & “Stop the Motion” and apply to this game.
Activity - Kangaroos & Jillaroos Game

Aim
The aim of this game is for the attacking team to score a try over their try line. Players can still pass forward but when "tackled" they have to play the ball to the acting half. The attacking team has six chances to score a try. All defending players must be behind a line nominated by the teacher after each "tackle".

PLAYERS
Approximately eight teams for a class of 32 students. 4 players in each team depending on size of class/group of students. Minimum of 3 players per team and a maximum of 5 players per team.

TEAM (DEFENDERS)

TEAM (ATTACKERS)

Equipment
» 4 x markers per grid

» 1 x football per grid

» 4 x Bibs for each team

» Whistle

» Stopwatch
PLAYING AREA

- Use a designated area approximately 15m x 15m or larger per grid.

GAME PLAY

- The attacking team have six chances to score a "try" over their designated try-line. Pass can still travel in any direction to score.

- The player with the ball can run, when they are "tipped" by a defender they have to stop and complete a "Play the Ball" to the Acting Half.

- The acting half can run without being "tackled", however the acting half can't score.

- The attacking team starts with a tap off from their try line, the defensive team start behind a line nominated by the teacher (either quarter/halfway/try lines) and can move forward when the attacking team taps to start.

- In this game there will be offside, all players on the attacking team have to be behind the "tackled" person when they play the ball and the "tackled" player must wait for this to occur before they play the ball.

- All defending players must be behind a line nominated by the teacher (either quarter/halfway/try lines) after each "tackle".

VARIATION

- Implement zone restrictions on players so only certain players are allowed in certain areas.

- Players have to cross the try line with the ball (running not passing) to score a try.

- Unlimited "tackles" to score.

- Time limits to get back behind the player playing the ball.

- Variations in play by adding a kick.

- Can take a player out of the line (fullback) to be the verbal communicator.

- Increase the number of defenders and decrease the number of attackers e.g. 6 attackers vs 2 defenders, 5 attackers vs 3 defenders, 4 attackers vs 4 defenders.

- The acting half can be "tackled".
Questions
At the start of the game the teacher can ask the following questions:

**ATTACK**
- Use questions from previous games, plus;
- What can the acting half do to create opportunities to score?
- As a receiver how can you get in a position to receive a pass from the acting half?

**DEFENCE**
- Use questions from previous games plus;
- How do you defend against the acting half?
- How do you retreat to the nominated defensive line?

After a couple of minutes playing the game the teacher should bring the students back together and ask the following questions:

**ATTACK**
- Use questions from previous games, plus;
- What strategies did you use for the acting half?
- What strategies did you use for the receivers?

**DEFENCE**
- Use questions from previous games, plus;
- What strategies did you use when moving from your defensive line?

Teachers Notes
- Explain the importance of moving forward with the ball and having the team in possession to run forward with the ball and not backwards.
- Explain the importance of the acting half and how if they run forward the team will advance the ball up the field.
Appendix Three

*Game Centred Approach (GCA) Assessment Scaffold*
<table>
<thead>
<tr>
<th>Learning purpose/concept</th>
<th>Games and progressions</th>
<th>Questions and discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerging</td>
<td>Developing</td>
<td>Developed</td>
</tr>
<tr>
<td>Very broad and/or multiple concepts and/or uncertain or unclear</td>
<td>Very broad and/or multiple concepts and/or uncertain or unclear</td>
<td>Very broad and/or multiple concepts and/or uncertain or unclear</td>
</tr>
<tr>
<td>Large variety and/or change rather than progression and/or unclear relationship to previous games and/or quick progression/change through lesson and/or not related to demonstrated learning</td>
<td>Large variety and/or change rather than progression and/or unclear relationship to previous games and/or quick progression/change through lesson and/or not related to demonstrated learning</td>
<td>Large variety and/or change rather than progression and/or unclear relationship to previous games and/or quick progression/change through lesson and/or not related to demonstrated learning</td>
</tr>
<tr>
<td>General or simple and/or inflexible followed pre plan and/or single exchanges/numerous topics and/or no interaction between students and/or management/time focus</td>
<td>General or simple and/or inflexible followed pre plan and/or single exchanges/numerous topics and/or no interaction between students and/or management/time focus</td>
<td>General or simple and/or inflexible followed pre plan and/or single exchanges/numerous topics and/or no interaction between students and/or management/time focus</td>
</tr>
<tr>
<td>Wider range of structures and/or limited interactions and/or design and use influenced by management</td>
<td>Wider range of structures and/or limited interactions and/or design and use influenced by management</td>
<td>Wider range of structures and/or limited interactions and/or design and use influenced by management</td>
</tr>
<tr>
<td>Range of questions and structures and/or mix of pre planned and unscripted and/or based on demonstrated learning</td>
<td>Range of questions and structures and/or mix of pre planned and unscripted and/or based on demonstrated learning</td>
<td>Range of questions and structures and/or mix of pre planned and unscripted and/or based on demonstrated learning</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesson No.</th>
<th>Notes/Documentation of GCA elements within lesson</th>
<th>Mark based on GCA Assessment Scaffold</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Learning Purpose/Concept</td>
</tr>
<tr>
<td></td>
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<td>Emerging</td>
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<td></td>
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<td>Developing</td>
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<td>Games and Progressions</td>
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<td></td>
<td>Questions and Discussion</td>
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<td>Developing</td>
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<tr>
<td></td>
<td></td>
<td>Developed</td>
</tr>
</tbody>
</table>
Appendix Four

Letter to Principals
Dear Principal

The Stage 3 classes and teachers at your school are invited to participate in a research project conducted by the University of Wollongong. The project is entitled *The Grammar of Games and Backyard League: Balancing Two Agendas*. We write to seek your approval and assistance to conduct research.

The purpose of this research is to examine the influence of a Game Centred Approaches (GCA), known as the ‘The Grammar of Games’ on teaching Primary school students in Physical Education. The goal of this project is to assist in understanding the influence of the approach on both student learning and physical activity levels.

Approval is sought to visit your school for 6x45 minute lessons with each of your Stage 3 classes at a time when they are involved in the Backyard League Program. This will be done in order to examine the impact of using the GoG on student's learning of Invasion/Field Territory Games and physical activity levels in the lesson and unit. The lessons that will be taught have been developed by Physical Education teachers and researchers listed at the bottom of this letter, from the Faculty of Social Sciences, School of Education at the University of Wollongong. Mr Ryan’s PhD study also forms part of this project.

If you choose to approve this project the researchers will distribute information sheets and consent forms to students prior to the lessons. The students who consent to participation will be required to do the following:

- Wear an accelerometer (device like a pedometer which measures how much activity you do) around their waist during 6 lessons conducted by experienced NRL Game Development officers under the supervision of Physical Education teachers.

- Be included in the researcher’s observations, via videotaping, of game play sessions that will be used to examine student learning.

Ethics has been reviewed by the NSW DEC (SERAP Approval number 2014134) and the University of Wollongong’s Human Research Ethics Committee. Please find attached to this letter the Participant Information Sheets for the teachers, students and parents/caregivers.

If there are any ethical concerns you can contact the Ethics Officer, Human Research Ethics Committee, University of Wollongong on (02) 42214457.

Should you require any further information please do not hesitate to contact members of the research team.

<table>
<thead>
<tr>
<th>Mr. Brendan Ryan</th>
<th>PhD Candidate</th>
<th>School of Education</th>
<th>0405 277 173</th>
<th><a href="mailto:bjr769@uowmail.edu.au">bjr769@uowmail.edu.au</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Greg Forrest</td>
<td>Senior Lecturer</td>
<td>School of Education</td>
<td>02 4221 5187</td>
<td><a href="mailto:gforrest@uow.edu.au">gforrest@uow.edu.au</a></td>
</tr>
</tbody>
</table>

Yours sincerely,

Mr Brendan Ryan and Dr Greg Forrest.
Appendix Five

Participant Information Sheet (PIS) for Students and Parents
**BALANCING THE LEARNING AND PHYSICAL ACTIVITY AGENDAS IN PHYSICAL EDUCATION USING A GAME CENTRED APPROACH**

**INFORMATION SHEET**

**What is the ‘Balancing the Learning and Physical Activity Agendas in Physical Education Using a Game Centred Approach’ project?**

The project ‘The Grammar of Games and Backyard League – Balancing Two Agendas’ is a study examining whether using an innovative Game Centred Approach to teaching games and sports can both increase student learning but also improve physical activity outcomes in Physical Education lessons.

**What is the purpose of this project?**

The research team will be examining the impact of the Grammar of Games and Backyard League Unit on teaching Invasion/Field Territory Games (e.g. touch football) to K-6 students. The goal of this project is to assist in understanding the influence of the approach on both student learning of Invasion/Field Territory Games and physical activity levels in class. Mr. Ryan’s PHD study into K-6 student’s game play understanding and physical activity will form part of this study.

**What is expected of your son/daughter in the study?**

The study will take place in your sons/daughters normal lessons that will be implemented as part of the National Rugby League’s ‘Backyard League’ program. If your child volunteers to be involved in this study, they will be asked to:

- Wear an accelerometer (device like a pedometer which measures how much activity you do) around their waist during 5 lessons conducted in their school by experienced NRL Game Development Officers, whilst supervised by their regular classroom teacher.
- Be videoed in Backyard League lessons during the program.
- Be included in the researcher’s observations, via videotaping, of game play sessions that will be used to examine game play understanding.

**When will the study take place?**

The study will commence in week 4 of Term 2, 2014 and will continue to the end of term 2. Lessons will be taught by ‘Backyard League’ Game Development Officers and will be part of your child’s normal school program.

There will be low or negligible risk to you through participation in the study apart from the normal risks associated with a school PE lesson and the possible potential of discomfort from wearing the accelerometer. Participation in the study is voluntary and you may withdraw yourself from the study or withdraw information at any time. We ask that withdrawing from the study be done either verbally or through a written letter to the head researcher (Dr. Greg Forrest), indicating your desire to withdraw yourself from the study. However, withdrawn students will still be part of the lessons as it is part of your school program. However, they will not be used in the study in any way.
The results of this study may be published, however, the identity of participants will not be revealed. During video analyse individual student’s will be allocated codes to increase confidentiality. Access to all data will be restricted to the researchers participating in the study.

This study has been reviewed by the Human Research Ethics Committee of the University of Wollongong and the NSW Department of Education and Communities (SERAP Number 2014134). If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UOW Ethics Officer on (02) 4221 4457 or rso-ethics@uow.edu.au

Thank you for your assistance

<table>
<thead>
<tr>
<th>Dr. Greg Forrest</th>
<th>Lecturer</th>
<th>School of Education</th>
<th>02 4221 5187</th>
<th><a href="mailto:gforrest@uow.edu.au">gforrest@uow.edu.au</a></th>
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<td>0405 277 173</td>
<td><a href="mailto:bjr769@uowmail.edu.au">bjr769@uowmail.edu.au</a></td>
</tr>
</tbody>
</table>
Appendix Six

Consent Form
I have received the information about the project titled ‘Balancing the Learning and Physical Activity Agendas in Physical Education Using a Game Centred Approach’

I understand that if my son / daughter decides to be involved in this project he / she needs to do the following:

- Wear an accelerometer (device like a pedometer which measures how much activity you do) around their waist during five lessons conducted in their school by experienced NRL ‘Backyard League’ Game Development Officers supervised by their regular classroom teacher.

- Be videoed in Backyard League lessons during the program

- Be included in the researcher’s observations, via videotaping, of game play sessions that will be used to examine student learning.

I understand that this project will run in Term 2 2014. I have been told there is a low or negligible risk son/daughter above and beyond those encountered in a normal school Physical Education lesson. I am aware that participation in the study is voluntary and I may withdraw myself from the study or withdraw information from the study at any time. To withdraw my information I can either verbally or through a written letter indicate my desire to withdraw from the study. My refusal to participate or withdraw consent will not affect my relationship with the research team or university but I must continue to participate in the lessons, as they will be part of my normal school program. I will still be videoed but not used in the study in any way.

I understand the results of this study may be published and presented at research conferences, however, the identity of participants will not be revealed. I agree for it to be used in this way.

I understand that the researchers conducting this study have my child’s protection, interests and safety as their first priority at all times. Your signature below indicates:

1. You and your son / daughter have received and read the information provided about this project;

2. You have gone through the information sheet with your son / daughter and clearly understand the procedures of the project;

3. Your son / daughter voluntarily agrees to participate in the project and understands that he / she may withdraw at any time but will continue to participate in the lessons.

I (name) __________________________ agree for my son / daughter __________________________ to take part in the study titled: ‘Balancing the Learning and Physical Activity Agendas in Physical Education Using a Game Centred Approach’

__________________________________________ Date: __________ 2014

Parent / Care Giver
Appendix Seven

Screenshot of Analysis Software (Gamelens) Coding Template and Coding Process
Player Selection

Video Recording of Game play

Coding Timeline

Measure of GPU

Rating on GPU measure
Appendix Eight

Coding Protocols Information Pack
Gamelens Instructions

**Step 1: Convert Video**
Most of the videos need to be converted into MP4 format, to do this:

- Transfer 1 video from thumb drive to desktop or folder on your computer.
- Open Gamelens and Click **Manage Video**.
- Find export video section (bottom right) and click add.
- Select the video from its file destination on your computer.
- Click export. This will convert the video into MP4 format.
- Return **Home**

**Step 2: Setting up the game to code**

- Click **Create New Game** button
- Write in serial number, start at 01. Every game you code needs a different serial number. The program will not let you use the same serial number twice.
- Name the competition. Use the code that relates to the game you are watching e.g. CE PRE Test. This needs to be the same every time you code a pre-test, so you can find the video in the next step. Competition name will change when you code post-test e.g. CE Post Test.
- In the Select Home Team and Select Away Team Section, just write in Home Team and Away Team.
- Leave all other sections empty and un-tick code location.
- Click next and then click load template. Select GPU template and click load.
- Click create at which point you will return **Home**
**Step 3: Matching Video with Template**

- Click **Manage Video**
- Under where capture video is written (top left) click on the folder and look for the folder where the video is kept on your computer.
- Click on the folder (it will appear empty). Click on the select button and this will bring all the converted videos into Gamelens.
- Highlight the file (video) that you want to code by clicking on it.
- On the bottom left of program click load game info.
- You will then be taken to another part of the program, where you will select the game you wish to code. It should be under the competition name you entered in the previous step (e.g. CE Pre test).
- Click on this game and select load
- On the bottom left of the program the video should appear.
- Click rename to naming convention and this will change the name of the file so Gamelens can recognise it.
- Return **Home**

**Step 4: Setting up to Code a Game**

- Click **Code a Game**
- Select the Game you want to code. It should be renamed from the previous step.
- Click load (the Game/video is now ready to code)

**Step 5: Coding**

- Select the play button to begin the game.
- Choose a player to code and allocate them a number (in your head or write down on paper)
- When that player makes a response based on the assessment criteria, click on the player button (e.g. player 1)
- Click on component that you have assessed (e.g. Decision-Making)
- Click on rating (e.g. Developing)
- This will then be marked in the coding timeline below the video.

- Continue this process for all students. Watch each student for about 5 mins.

- If you make a mistake you can pause the video. Click on the instance in the timeline and change it by clicking on the buttons (e.g. change player 1 to player 2)

- It is advised that you code one player at a time and pause the video to record the responses in the timeline.

- Once finished coding all students for that game click **home**

**Step 6: Exporting the Video to Microsoft Excel**

- Click **Review a game**

- Select the game that you have coded.

- Click **Home team**

- You will be taken to another section of the program

- Click **export list to CSV**

- The program will then prompt you to name the CSV file

- Name the file based on the original name of the video (e.g. CE 1 PRE). This is so it can be understood later and is very important.

- Complete this process again, however the second time click on the other team (Away Team)

- These will be saved into the (c) drive on your computer. Click on this drive.

- Click on Verusco Folder

- Click on Gamelens folder

- Click on Data Extracts folder. In here you should see the CSV files that you have saved.

- Send these files via email to Brendan Ryan: **bjr769@uowmail.edu.au** and Greg Forrest: **gforrest@uow.edu.au**

- Send each of the files as you complete them so both Greg and myself have a copy.
Analyzing Tips

- Before you start analysing any videos. Go over the assessment criteria a few times. Try to become familiar with what you are looking for.

- Watch some of the videos through without analysing them. So you can get a general feel for what you are analysing and students abilities.

- The videos are quite large in size. Download 1 at a time onto your computer. Complete analysis then remove.

- Many of the games have more than 1 view. Look at each and then decide the best view to use. You may wish to use 2 views if you feel you haven’t seen a student enough in 1.

- Try to analyse 2 students at a time. Students are wearing bibs which will help you to identify them. However, many students look the same so you may need to look at their features (e.g. hair colour) so you can keep track of who you’re analysing. This is why it is advised that you don’t analyse more than 2 students at a time.

- Watch each student for 5 minutes of Game Play. This may be longer than 5 minutes of video footage, because at times students will be inactive (e.g. talking to Game Development Officer).

- You may need to stop and go back to watch a response again to make your decision.

- Make sure you don’t analyse the same video twice.

- Try to make sure the data you return is easy to make sense of. This means naming files so someone other than yourself can understand.
Appendix Nine

Adapted Game Performance Assessment Instrument (GPAI) Descriptors
Game: Modified Touch Rugby League

<table>
<thead>
<tr>
<th>Offence</th>
<th>Defence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decision-Making</strong></td>
<td><strong>Decision-Making</strong></td>
</tr>
<tr>
<td>Player attempts to pass to a team mate when appropriate.</td>
<td>Player attempts to stop a pass being made. <em>(by tagging or pressuring ball carrier or receiver)</em></td>
</tr>
<tr>
<td>Player runs appropriate line (e.g. straight rather than sideways) when delivering or receiving pass.</td>
<td>Player stays in defensive line and doesn’t rush out.</td>
</tr>
<tr>
<td>Player only rushes a defender to put immediate pressure on ball carrier or place receiver under pressure.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skill Execution</th>
<th>Skill Execution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pass to teammate:</strong> Control / appropriate time / reaches intended target.</td>
<td><strong>Tagging opponent:</strong> Appropriate movement / Tags player straight away.</td>
</tr>
<tr>
<td><strong>Catching:</strong> Controls the ball / correct hand position / moves appropriately to catch pass.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Support</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player moves to create or receive a pass.</td>
<td>Player is moving when they receive pass.</td>
</tr>
<tr>
<td>Defender marks a player or an area. <em>(Fulfills their role in defence)</em></td>
<td>Use of verbal and non-verbal cues to demonstrate intent in defence.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base/Adjust</th>
<th>Base/Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player moves back to position of readiness between attacking plays. <em>(To a position where they can receive pass)</em></td>
<td>Player moves back to position of readiness between attacking plays. <em>(Back into defensive line)</em></td>
</tr>
<tr>
<td>If player doesn’t receive 1st pass they ready themselves for the next</td>
<td>Player shifts to cover gaps or numbers</td>
</tr>
<tr>
<td>Player demonstrates a range of responses according to game play situation.</td>
<td></td>
</tr>
</tbody>
</table>
**Instructions:**

Using the GPAI descriptors and Gamelens, rate student’s responses in each Game Play Understanding (GPU) component (Decision-Making, Skill Execution, Support & Adjust), during 10 minutes of Game play for each student. Give students responses a rating based on the following criteria.

<table>
<thead>
<tr>
<th>Game Performance Mark</th>
<th>Assessment Criteria</th>
</tr>
</thead>
</table>
| **Highly Developed (4)** | - Few errors in game component.  
- Replication and adaption according to game situation with own and other team.  
- Adapts to different patterns of play. |
| **Developed (3)** | - Replication and some adaption.  
- Some errors in game play but generally correct, especially with some adaption to own team and other team’s play. |
| **Developing (2)** | - Replication of responses but struggles to adapt to different patterns.  
- Can replicate same pattern.  
- Recognises response but not always paired with action. |
| **Beginner (1)** | - Large errors in game component.  
- Little or no replication of response or follows same pattern repeatedly.  
- No recognition of appropriate response for game component. |