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THE "TEACHING GAMES FOR UNDERSTANDING" PHYSICAL EDUCATION INSTRUCTIONAL MODEL - A COMPARATIVE STUDY INTO THE EFFECTS ON KNOWLEDGE AND GAME PERFORMANCE -

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ABSTRACT

This purpose of this study was to investigate the effectiveness of the alternative "Teaching Games for Understanding" (TGFU) instructional model for education in sport and games. The model was compared to a traditional approach to instruction that has been and continues to remain dominant across physical education curriculums. This model is defined as "skill-based" instruction.

The study was undertaken in the naturalistic setting of a New Zealand secondary school with year 10 students. The game adopted for instruction was short tennis. Two classes of students were assigned treatment under one of the instructional models in an eight-lesson unit with a third class assigned as a control. Twenty-two students were tested on declarative knowledge of short tennis rules and scoring, shots/strokes, and strategies in the form of a pre and post written test. Students' pre and post game performance was measured using the Game Performance Assessment Instrument (GPAI). Player performance was coded from video footage to assess tactical court movement and decision-making as well as skill execution.

Declarative knowledge domain results revealed a statistically significant improvement in both treatment groups for overall knowledge. In specific knowledge categories, the TGFU treatment group also improved significantly in skill and strategy related knowledge over instruction time whilst the skill-based group improved significantly in skill-related knowledge only. The TGFU group's skill-related knowledge improvement was also significantly higher than the skill-based group. Game performance results indicated that some improvement was evident in both treatment groups following instruction with a trend for a greater degree of improvement in tactical performance by the TGFU group. However this improvement was not found to be statistically significant for either treatment group or between groups for any GPAI component.

Findings are analysed and discussed in light of previous studies and recommendations are provided for future research into game and sport pedagogy.

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CHAPTER ONE:

INTRODUCTION

International research suggests that education in games and sport continues to occupy a major percentage of the secondary school physical education curriculum. Griffin, Mitchell and Oslin (1997) state that in the United States about two thirds of physical education time is allocated to game teaching and learning. A survey conducted in England revealed that 65% or more of the time allotted to physical education was spent in the games curriculum (Thorpe, Bunker & Almond, 1984). In Australia, competitive games have also formed a large part of physical education programmes since the 1950's (Brooker, Kirk, Braiuka & Bransgrove, 2000). In New Zealand the situation is little different, games and game skills have become established as a dominant component of physical education instruction.

Considering the impact of game and sport education in physical education curriculums, it is surprising to note that limited research has been undertaken to investigate the best and most effective ways of teaching games and sports to students in schools. One reason for this may lie in the dominance of one particular approach; an approach which this thesis calls into question.

Instruction within games and sports has traditionally centred on the learning of specific skills with the goal of developing player technique for skilled performance (Bailey & Almond, 1983; Turner & Martinek, 1995a). An example of this traditional instruction in an early basketball lesson would be the teaching of the chest pass technique. The technical focus would encompass criteria such as correct weight transfer, arm and wrist position and follow through to complete the action. The approach is based around the pedagogical assumption that before one can play the game, they must practice and demonstrate the motor skills involved. This traditional approach (commonly referred to as skill-based teaching) continues to remain a prominent feature of physical education game and sport instruction.

The widespread use and support for skill-based teaching has been largely influenced by an emphasis on motor skill learning for human performance. In the late 1960's and the early 1970's, the work and published findings of motor behaviour

researchers was prevalent. This included the experimental studies of Franklin M Henry, known as the father of motor behaviour (Schmidt, 1991). As a consequence, further attention and awareness was instigated toward the value of motor skill instruction. Research and studies into the best ways to teach and foster motor skill development in students and athletes continued to maintain prominence in physical education and coaching research throughout the 1970's and 1980's. Substantial quantities of literature containing coaching theories and drills for teaching sports skills were commonplace in physical education publications.

While motor skills are an integral component of successful sport and game performance, a further look into the complex nature of game play indicates that skilful movements are not the sole contributors to performance. Decisions need to be consistently made during performance regarding the selection of skills and the application of strategies to gain advantage over opponents. Turner and Martinek contend that "game play is interwoven with various decision-making opportunities for the participant, some of these decisions need to be made instantaneously, whereas others are more anticipatory. It is critical therefore that the successful game player possess the knowledge to make these decisions in a timely and effective way" (1995a; p. 45).

More recently, the prominent skills-based approach has been questioned and criticised for disempowering players and producing teacher or coach-dependant players that can perform skills in an isolated context but not in the context of the game environment. Due to these perceived limitations, alternative approaches to teaching games and sports are receiving more attention and recognition in the recent literature. One such approach that developed out of Loughborough University, Britain in the early 1980's is known as "Teaching Games for Understanding" (TGFU). The TGFU instructional model places an emphasis on cognitive processing, including game appreciation and tactical understanding by students. The model recognises the importance of motor skill development but in a context where tactics and strategies of games have first been promoted and discovered.

Since the introduction of TGFU, the model has gradually gained recognition as an approach worthy of consideration. In the Britain and the United States, the model (and adaptations developed from it) have gained increased attention and implementation in recent years. Whilst supported from a theoretical standpoint, investigation into the effectiveness of TGFU as a valid instructional model is still lacking in terms of a research base. The results of the limited overseas studies (in a narrow range of sports) have been largely equivocal when comparing the model to more traditional practices.

Accordingly, this quasi-experimental research study is assigned to investigate the value of the TGFU instructional model at the junior secondary school level. It aims to compare its effectiveness to the widely used and advocated skill-based model within the naturalistic setting of a New Zealand secondary school. This study is believed to be the first of its kind in New Zealand physical education to research the effectiveness and viability of this alternative and innovative game education model.

CHAPTER TWO:

"A TALE OF TWO MODELS"

At the heart of this study are two different instructional models, one which currently shapes the majority of game teaching in physical education and a recent and alternative approach to instruction. This chapter will outline these models individually, presenting their pedagogical approaches to content and characteristic methods of instruction. It will acknowledge the theoretical backgrounds and philosophies that influence their structure and highlight the differences between them. The reasoning behind the perceived need for the alternative TGFU model is also presented and discussed.

Within any research, there are specific terms that take on particular meanings in relation to the context of a study. This chapter firstly defines important terms and their use in the context of this research. It is important to define and distinguish between sports and games for the purpose of discussion as well as skills and techniques as they relate to physical performance.

Definition of Terms

Traditional definitions of sport indicate that it is a physical activity that is competitive, requires skill and exertion and is governed by institutionalised rules (Coakley, 1998). Within this context, more specific definitions are largely dependant on the sociological influence within organised sport. Whose rules are adopted and become standardised is an important question. When distinguishing between sport and games, it is these institutionalised (or official) rules that separate the two. Games whilst still competitive and containing rules, are subject to rule changes and flexible variations in equipment and playing space. The play of children often reflects game play when rules, playing dimensions and team numbers are changed whilst still maintaining a competitive nature. Rink, French and Tjeerdsma (1996) point out that the British sense of the word "game" does not always indicate sport and generally means a simpler form with modifications in place. This study distinguishes the two terms in accordance with the above difference.

When defining a skill, Schmidt (1991) cites the definition of psychologist E.R Guthrie as capturing the most critical components of skills: "Skill consists in the ability to bring about some end result with maximum certainty and minimum outlay of energy or of time and energy" (1952; p. 136). A motor skill emphasises the quality of physical movement as a determinant of a successful end result, therefore relating to efficiency and accuracy of movement.

The key distinguishing factor between a skill and a technique is the emphasis on the end result in a skill. A technique involves learning and performing the mechanical components that make up a motor skill without necessarily focusing on the end result. Thus performance in a sports drill situation can encompass either technique of skill performance, but game and sport performance involves skills. The two terms are interdependent however in that correct and efficient technique should ultimately provide the means to achieving the desired result consistently (Schmidt, 1991). For the purposes of this study, when discussing instructional models and

analysing game movements this is how skill and technique performance are differentiated.

Instructional Models

Models have been defined as "miniature representations that summarize data and or phenomena and thus act as an aid to comprehension" (Zais, 1976; p. 91). A model aids in structuring theory and information into a process that can be more easily followed. Joyce and Weil (1980) define an education instructional.model as "a plan or pattern that that can be used to shape curriculums, to design instructional materials and to guide instruction in the classroom and other settings" (p. 1). Instructional models provide an overall direction for instruction and take into consideration a number of individual educational components. Consequently a model may incorporate a number of specific methods, strategies and styles of teaching to achieve the broader educational goals. Instructional models have strong theoretical foundations and learning outcomes for students that represent these wider visions. They are philosophically based around views on the ways that students best learn and the content that should be provided for them to learn. Metzler (2000) notes that the best instructional models in education link theories of learning and teaching to processes that educators can promote in the practical setting.

In physical education, the notion of model-based instruction for achieving educational outcomes is relatively new, teaching has traditionally been content-driven and based around the specific activity being taught (Metzler, 2000). Because physical education encompasses a range of movement education including exercise, sport and games, dance, cultural movement, outdoor education and aquatics; teachers often base their instructional methods and content according to how and what they have always taught within a specified movement area. In this sense, games and sports are frequently taught in ways that teachers become accustomed to or they have been educated in at training colleges and universities. This "way" becomes their adopted model of instruction. In sport and game education, research suggests a skill-based instructional model has been the most prevalent in

gymnasiums and on sports fields in the last three decades (Cheffers & Mancini, 1978; Almond, 1986b; Revegno, 1993).

The Skill-Based Model

The widely implemented skill-based model for teaching games is characterised by highly structured lessons that are involved with teaching technique or skills as a prerequisite for game play. It is acknowledged that this very broad description encompasses a wide variety of drills, and activities for teaching techniques and skills. There does however exist a unifying and underpinning belief that techniques and skills must be taught to at least some level of proficiency before a student can experience the game or sport (Rink, French & Tjeersdma, 1996).

Thorpe, Bunker and Almond (1986) and Christina and Corcos (1988) provide a typical structure of lessons within the scope of the skill-based model. The lessons generally involve an introductory activity/warm up followed by a technique or skill phase consisting of demonstration, drills and practice. This skill phase is followed right through the lesson or the lesson is rounded off with some sort of competitive game (usually the official sport). Subsequent lessons introduce a new skill focus as well as revising skills from previous lessons. Joyce and Weil (1986) discuss this orientation to teaching games under what they refer to as the theory-practice model. Here, a technique is presented, taught, demonstrated and practiced until it is learned by students. Under this skill-based model of instruction, new techniques or skills can be added in each lesson so students continually learn a range of skills that are part of the game. An example of a basic skill-based structure for a softball unit is outlined below:

Lesson One -	Throwing and catching with glove (high ball and throw)
Lesson Two -	Revision, fielding a ground ball with glove
Lesson Three -	Revision, swinging and striking
Lesson Four -	Revision, pitching
Lesson Five -	Revision, game play
Lesson Six -	Game play

With games often being played at the end of individual lessons or the final lessons of units, students get the chance to use the game to apply the techniques and skills they have been taught during a lesson or unit.

Rink (1985; 1993) proposed an approach to game instruction, that whilst making changes to the typical format of structuring game lessons and units, it continued to provide evidence of the common belief that skills need to be introduced and refined first before students should enter game situations. Rink's approach advocated a four stage sequential process where students in the first two stages are introduced to object control and individual game skills that are practiced in the form of drills. The skills are then combined to become more complex and they are extended and refined further with additional activities. An example in basketball includes combining separate skills of dribbling and passing together within drills. At stage three, modified games are introduced allowing the students to perform skills in a game context, these are often mini games where team members and space is reduced such as three versus three soccer. Offensive and defensive strategies are gradually introduced and taught under direct instruction from the teacher. In stage four, the official sport is utilised. Students experience this environment, whilst accommodating the introduction of new rules and procedures that make up the sport. This approach acknowledges the need for development of other components of game play in teaching such as tactics and strategy, and it works on the premise that this knowledge should be taught after technique and skill development has been fostered.

The structure of various coaching education programmes reflects this approach, where game concepts and strategies are included following sufficient periods of skill coaching and practice. The current New Zealand Soccer format is:

Level One Coaching –	Individual technique and skill
Level Two Coaching –	Team skills, principles of play
Level Three Coaching –	Coaching in the full game, principles of play – defence, midfield and attack.

Under a skill-based model of instruction, the official sport is always the ultimate focus of the teaching units. The techniques and skills are seen as the key content of lessons in order to progress to playing the sport (Thorpe, Bunker & Almond, 1986). As a result, particularly in secondary school programmes, units of teaching are commonly structured around individual sports such as volleyball, basketball, badminton and so on.

With skill teaching forming the core of physical education game lessons, the skill-based model has been largely characterised by direct styles of teaching. Direct teaching has traditionally been the most widely used style of teaching in physical education and continues to be used by the vast majority of physical education teachers today (Metzler, 2000).

Since the influential work of Mosston (1966) and the acceptance of a spectrum of teaching styles for physical education, styles or strategies are best represented on a continuum. At one end lies direct, teacher-centered styles known as command or task teaching and at the other exists indirect and more interactive styles known as problem solving and guided discovery (Mosston & Ashworth, 1994). The main distinguishing factor amongst the styles is the role of the teacher and the input of the students into the learning process. Direct styles of teaching indicate explicit teaching that is broken down step by step and highly monitored by the teacher (Rosenshine, 1987). Direct teaching advocates the teacher as the leader and instructor, providing the knowledge to the learner. This direct style of instruction involving specific direction and the teacher/coach in command has been termed "prescriptive" (Kidman, 2001). In direct teaching, skills are commonly taught by providing students and athletes with specific directions and feedback on what to fix. The formal structure of direct teaching styles appears to align with the structured nature of motor skill instruction where a skill becomes the focus for education. Turner and Martinek (1995a) suggest a direct command or task teaching style more readily fits with skill acquisition than other aspects of games such as decision-making.

The emphasis placed on the psychomotor domain (physical techniques and skills) in physical education games, has lead too much of the previous pedagogical research focusing on the best ways to teach motor skills to students. Literature on skill teaching has pointed to a strong need for direct teaching strategies when fostering motor skill acquisition and the development of motor programmes in individuals. One of the worlds leading experts in motor behaviour research is Dr Richard Schmidt. Schmidt (1991) identifies the importance of providing direct instruction and modeling clear demonstrations to motor skill learners. This is considered of paramount importance in the early and middle stages of skill learning, known as the verbal-cognitive and associative stages. It is in these stages of development which the vast majority of school students are situated, particularly across a range of sports. In these stages, performers are firstly picking up the basic requirements of a skill and secondly beginning to organise and develop effective movement patterns for the skill (Schmidt, 1991). Mosston (1992) also indicates that when teaching skills, a task or command style is the most appropriate. He promotes practice and replication of the correct form of the skills, accompanied by frequent prescriptive feedback for improved performance. Other pedagogical research studies have also strongly supported the use of direct teaching when teaching motor skills (Gusthart & Springings, 1989; Metzler, 1989; Werner & Rink, 1989; French, Rink, Rikard, Lynn, & Werner, 1991; Silverman, 1991; Rink, French, Werner, Lynn & Mays, 1992).

Direct styles of teaching, as with any other style or methodology, are grounded in educational theory regarding beliefs about the way in which humans learn. In general, direct instructional strategies find their basis in behavioural and information processing theories of learning. These direct strategies of instruction were derived from the theory that behaviour is a learned response. The operant conditioning theories of B. F. Skinner the behavioural psychologist were influential on this theory. Findings indicated that reinforced responses or behaviours were likely to be repeated again when stimulus was presented. Similarly, behaviours that were not reinforced or followed by punishers would decrease or disappear. Behaviourist theory advocates shaping, modeling and practice of behaviour, followed by reinforcement (Metzler, 2000). Corrective feedback is provided to the

learner to correct mistakes and consequently shape behaviour. This is followed by positive feedback to extrinsically reinforce correct performance and provide learner motivation. Whilst all learning theories acknowledge a high level of learner engagement for learning, behaviourists are not as concerned with the level of cognitive processing as they are with the response of the learner (Rink, 2001). In terms of skill instruction, more emphasis is placed on the resulting skill execution than how the learner arrived at that performance. Essentially, direct methods of technique and motor skill instruction aim to get the learner performing a required movement pattern, which can then be reinforced as correct and through practice acquired as a motor programme.

Although many educators use direct styles of instruction, they may not be inherently aware that specific learning theory and extensive research underpin the way they are teaching. Educators adopt instructional models and styles of teaching within them for a number of reasons and this is often dependant on which area of a subject they are educating in. The fact that game and sport education has been characterised by educating for technique and skill replication with direct instructional styles cannot be attributed to any sole explanation. A variety of sociological influences have and continue to impact on the common use of the skill-based instructional model.

Why The Technical Focus?

The drive for motor skill learning in physical education programmes has directly influenced the priority given to techniques and skill teaching in game lessons. The emphasis on the psychomotor domain in which students aquire physical skills related to movement and sport has heavily characterised programme outcomes. In the past, many educators have viewed the acquisition of motor skills as physical education's number one objective (Bucher & Wuest, 1987; Graham, 1987). Whilst in more recent times, the cognitive and affective learning domains have received further recognition and attention, skill development maintains an important position. In the US, the National Association for Sport and Physical Education

(1992; 1995) acknowledges the development of motor skills as a major outcome of physical education programmes. In New Zealand, the recent Health and Physical Education Curriculum Document defines "Movement Concepts and Motor Skills" as one of its four key strands of learning (Ministry of Education, 1999).

Whilst the acquisition of more general and fundamental motor skills such as running, jumping and throwing are of particular concern to the elementary physical educator, (Sweeting & Rink, 1999). A goal of primary and secondary physical education programmes is to revise and build on these skills with more specific skills for performance in games and sports. Placing skills at the forefront of games teaching appears a natural response to meeting the curriculum demands for motor skill development.

An inherent focus on skills and technique by physical education teachers may also be attributed to their professional tertiary training. As physical education progressed to degree status in Britain and the United States in the 1960's, a number of specialised courses emerged within the subject as it sought to gain recognition amongst what were considered the more academically orientated subjects. Bunker and Thorpe (1986a) identify skill acquisition as one of the chief areas of growth where the rapidly growing literature on motor learning was influential as was experimental procedures with skill learning. Trainee teachers at universities and education colleges were immersed in the continual streams of literature coming forth related to skill instruction.

A direct approach to skill instruction may also be attributed to the clearly documented lesson plans required at tertiary institutions for assessment means. These plans guide teachers to identify key teaching points for skill lessons, consequently resulting in more formal teaching styles (Bunker & Thorpe, 1986a). Teacher training and performance assessment has traditionally focused on the teacher performance instead of the holistic nature of the learning environment. Areas such as voice projection, presence, demonstrations and feedback are all highly monitored and have provided a means of assessing teachers (Thorpe, cited in Kidman, 2001). With a focus on teacher performance in terms of content and

delivery, there becomes an inherent responsibility for educators to be passing down information explicitly to fulfil their role as teachers.

Outside of teacher training institutions, society also expects teachers and coaches to be delivering instruction. Parents, players and other teachers/coaches often evaluate instructional effectiveness in terms of the sport knowledge directly passed on to players. If the person at the head of the class or team is not observed explicitly passing down knowledge, their own knowledge base and credentials are frequently brought into question.

Direct skill teaching in the form of instruction, demonstrations and drills has allowed physical educators to provide evidence of specialised content teaching in their games and sport lessons. In the United States particularly, criticism has been directed toward teachers that let children play games for lessons without any educational teacher intervention. These lazy teachers have been termed "ball rollers". In the United States, the use of alternative approaches to teaching which have not focused on specific skill teaching have often been misread and misinterpreted as "ball rolling" (Chandler & Mitchell, 1990). Through direct skill instruction, physical educators can justify their teaching and escape this negative labeling. They can be observed actively educating content within lessons.

Perceived Limitations of the Skill-Based Model

After years of experience and extensive lesson observation as both teachers and lecturers David Bunker and Rod Thorpe (1982) concluded that the skill-based model often led to:

* A large percentage of children achieving little success due to the emphasis on performance, i.e. "doing"

* The majority of school leavers "knowing" very little about games

* The production of supposedly "skilful" players who in fact possess inflexible techniques and poor decision making capacity

* The development of teacher/coach dependant performers

* The failure to develop "thinking" spectators and "knowing" administrators at a time when games and sport are an important form of entertainment in the leisure industry.

Thorpe and Bunker became concerned when observing students that teachers genuinely classed as skilful players. They encountered rugby players who made poor decisions regarding when to kick, pass or hold the ball and tennis players who failed to capitalise on their good technical strokes due to poor positioning on court or a lack of attention to opposition movements when selecting shots. Whilst the learning of technique and skills in drills isolated from a game is commonly classed as skill practice, Thorpe (2000a) sees skills as highly contextual in that their application in a game (their correct environment) is quite different to isolated performance and necessary for effective skill transfer. Thorpe, Bunker and Almond (1986) contend that skilfulness in a game context involves much more, particularly from a cognitive processing perspective. They believe the ability to make appropriate decisions for skill selection based on the cues presented within a game is as important as the performance of the skill itself. Turner and Martinek (1995a) acknowledge that excellent technical performers are only skilful when they understand when and where to utilise this talent. Bunker and Thorpe (1986a) attribute a lack of focus on the cognitive domain in which players must sort relevant information and make decisions in relation to the goals of the game. A player may possess a magnificent and accurate soccer pass in drills but in a game context may fail to recognise open players to pass to, or may use their pass when a dribble or strike is more appropriate for the defensive pattern encountered. Is this player skilful?

The development of coach dependant players (performers who consistently rely on the coach or teacher to make decisions for them) noted by Bunker and Thorpe

(1982) revealed a common lack of ability to read games and process appropriate responses for the use of skills. This reliance on instructors has been characteristic of prescriptive/direct styles of teaching and coaching that have been traditionally advocated (Kidman, 2001). The nature of direct instruction for learners is to listen and perform exactly the way the coach instructs. It is of interest, that while direct instruction has characterised skill teaching, the fostering of cognitive strategies and tactics for applying skills is often provided through a similar transmission of knowledge. From a coaching perspective, Kidman (2001) notes that team plays and tactical moves are often provided to players for use in specific situations in practice. When this guidance is removed (the majority of games require long periods without coach intervention or communication) players often appear indecisive and lost in the environment. It is proposed that these players have not been encouraged and empowered to make decisions for themselves (Thorpe, 2000b).

Thorpe and Bunker became perplexed by the structure of technique and skill focussed lessons, which often concluded with a brief spell of game play. Often students are left to play with the presumption that the skills taught can be transferred and applied in the game setting because they have been covered earlier. An assumption occurs that all the pieces of the puzzle will fit together when the game is played and make all the previous skill instruction meaningful (Werner, 1989). Metzler (1990) notes that teachers commonly remark that they teach skills early on in units and then students just "go out and play for the remaining classes" (p. 57). The games are often seen as a treat for students for behaving and participating during skill teaching (Thorpe, cited in Kidman, 2001). This mindset indicates a lack of attention to using the appropriate game context to actually teach, but rather as a reward or activity to round off a lesson or unit.

Teaching Games For Understanding – Structure and Philosophy

It is well known and documented that there is far more to successful game and sport performance than technical proficiency alone (Den Duyn, 1996). Mental attitudes such as determination and self-belief, combined with strategic planning and tactical decision-making are integral components contributing to successful performance

(whether this success is measured by victory or playing the game well is another issue). Whilst skill-based instruction may contribute to performance, many of the lessons under this approach neglect other contributing factors. What has emerged is a belief that these areas do not hold the same importance or priority as the mechanical efficiency of performers.

The alternative TGFU model (developed by Bunker & Thorpe, 1982) challenges the philosophy and questions the educational value of the traditionally orientated skill-based approach to game and sport teaching. It provides a different way of exploring game and sport education that aims to empower students with greater understanding and appreciation of the games and sports they play.

Thorpe and Bunker developed TGFU to place the understanding of games at the heart of teaching. They believe the understanding of games, encompassing the strategies and tactics involved, should be recognised first. TGFU works on a belief that game appreciation and tactical awareness should precede the development of motor skills - teaching "why" and "what" before "how". Fundamental game concepts, strategies and tactics can be discovered and appreciated even if players are not technically proficient. Thus an emphasis is placed on the cognitive domain where students are encouraged to make their own decisions in light of game challenges. TGFU aims to develop thinking players who have an appreciation of games and can see the purpose of the skills required (Werner, Thorpe & Bunker, 1996).

It is significant at this point in discussion to distinguish between strategies and tactics. Often the terms are used interchangeably, and whilst the development of both is advocated through TGFU, they can be viewed differently within game and sport application. The most prominent usage of both terms is grounded in war application and the need for strategies and tactics arises from challenge and competition where one side aims to outdo the other (the notion of sports described as battles is not uncommon). From a war perspective, Von Clausewitz (1989) outlines the role of the strategist as determining the collective goal and being responsible for the ideas and structure behind achieving the goal. The tactician

focuses on the more concrete objectives and conducts the battle (with the goal in sight) but adapts the actions and combines the manoeuvers.

In application to games and organized sports, little changes in the context of these terms. Literature suggests strategy is concerned with principles of play and action guidelines discussed in advance to organise a team or individual for play (Bouthier, 1988; Gre`haigne & Godbout, 1995). Here the notion of the game plan is central, applying a vision for the way that the game should be played or a blueprint for victory. Tactics are the game actions undertaken voluntarily and they involve adaptation to the pre-determined strategy and also the requirements of the ever-changing game environment (Bouthier, 1988; Gre`haigne & Godbout, 1995). Tactics are game responsive actions that involve quick decisions as they are always applied under time constraints. Identifying opponent weaknesses and responding to opponent strategies during the game involves tactical application. Whilst strategies guide and organise game play, tactics encompass the performance decisions during the game. These two components are interrelated and reliant upon each other. It is of little use having a game plan and structure if it can not be effectively carried out within the game conditions. However, there is little value in continuing a specific plan or pattern of play if it is being shutdown or beaten and proving ineffective – there requires flexibility and adaptation by players to the ever-changing nature of game environments.

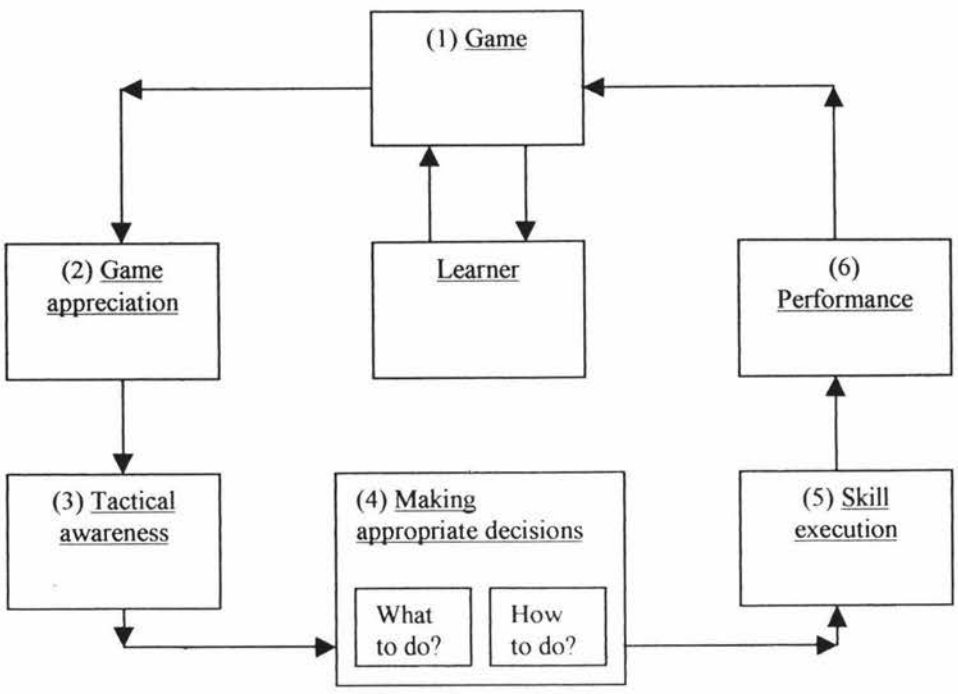
The TGFU model was originally established as a focus for secondary school (year 7-13) game education (Bunker & Thorpe, 1982). The TGFU structure is characterised by progressive modified games, which aim to challenge students and require them to solve tactical problems. Bunker and Thorpe (1986a) acknowledge that by their very nature games present problems to be solved by players. Each game is fully explored before progression to a subsequent game that may focus on a different fundamental concept and/or contain further tactical complexity. A typical lesson format sees a game in action from the outset of the lesson (see Figure 1).

Figure 1 - A Typical "Teaching Games for Understanding" Lesson Structure

Warm up
Modified game
(Progress through developmental stages for understanding and performance)
Progression to next modified game
Warm down

There is no time stipulation for each game, as educators progress through at the pace determined by student understanding and when they feel the necessity to provide and promote further challenge. More basic games that foster less skill, tactical consideration or challenge are presented earlier in units to be gradually built upon (Werner, Thorpe & Bunker, 1996). Within each game, a number of developmental stages are worked through to encourage and develop student understanding. A model of these stages was presented by Bunker and Thorpe (1982) and guides the TGFU teaching structure.

Figure 2 - The Game Evolution Model (Bunker & Thorpe, 1982)



The model places learner development at the centre of all teaching, rather than the content. The game reflects a modified game (appropriate to the level of the learner) which students play from the outset. Game appreciation fosters understanding of the basic rules of the game and why the rules are in place. Almond (1986a) signifies the importance of rules in giving a game structure. In this phase students are introduced to the basic rules regarding how the game is played and how points and winning can be achieved (primary rules), this is not a place for highly technical or advanced complex rules. Bunker and Thorpe (1982) note that all students must understand the rules regardless of how simple, as this is a prerequisite for the development of appropriate strategies and tactics to play the game. In this phase students gradually learn to appreciate the ways in which rules dictate the game and subsequently the tactical considerations. Examples include: a high net allows more time for movement and longer rallies, a larger playing space allows more space for players to attack and defend and a three-second ball holding rule requires faster decision-making.

Tactical awareness is fostered in students as they encounter and solve problems that arise within games (Werner, Thorpe & Bunker, 1996). Tactics relate to the aims and strategies of the game and the means to helping achieve these during performance. In volleyball, the basic aim is to land the ball in an open court space or force an error by an opponent to gain points, in rugby the aim is to get one of your team across the try line within the constraints of the rules. In order for these aims to be realised certain strategies (principles of play) and tactical decisions become paramount. By starting games off with more simple structures, students can be introduced to more basic tactical ideas and concepts that can be extended and specialised through further games (Werner, Thorpe & Bunker, 1996). Basic games allow students to explore tactics such as ways of creating space and spreading defences on attack and cutting down opponent options and denying space on defence. Simple tactical questions often present a number of solutions; these can be explored and trailed by students in the changing context of games. This phase allows students to think deeply about why specific actions are employed and are more suitable than others as they construct an understanding of the game.

The decision-making phase of the model is directly linked to tactical application and encompasses the cognitive nature of learning in TGFU. Bunker and Thorpe (1986a; p. 28) indicate "the uniqueness of games is the decision-making process which precedes the technique employed". They contend that it is this ability that is fundamental to successful game play. Other literature, including Hughes (1980) and Oslin, Mitchell and Griffin (1998) also acknowledge appropriate decision-making during game play as a key component of performance.

Decision-making is highly situational due to the continual change of circumstances in games and it is dependent on the player to identify and respond to the cues presented. Thorpe (2000a) indicates a key phrase with regard to making decisions in games – "it all depends", decisions depend on situations, on opponents movements, the defensive structure, where you are positioned, the time in the game, the score and so on. By gaining knowledge and perception within the game, students can learn to recognise cues and formulate appropriate responses. This may be to an opponent moving forward to attack in a net game or a loaded base situation in a fielding game. Specific environmental cues naturally favour certain tactical options over others.

The "how to do" component relates to the best way to execute the decision and is particularly relevant to speed of performance. Players need to determine whether they have time and can focus on accuracy or whether a quick movement is required in the situation with less emphasis on object control (Bunker & Thorpe, 1982).

Skill execution refers to the actual production of the required movement when a decision has been processed. Although skill teaching is not initially undertaken in TGFU lessons, it is recognized as an integral component of total performance. "If you don't have the skills to exploit the situations you are faced with, your performance has to be limited" (Thorpe, cited in Kidman, 2001; p. 33). By introducing skill teaching at this point, it is believed skills have a clearer relevance to students than teaching them from the outset. Thorpe, Bunker and Almond (1986) propose that when students come to comprehend cognitively what they can do in game situations to be more effective, they will look to ways of improving their

performance. In this sense, skills become more relevant and necessary and there exists a greater intrinsic motivation for skill acquisition. For example, if a student understands the need for depth and angles to the back of the court in tennis (to set up a net attack or to give them time to recover between shots) they will be more likely to want to learn the best means of achieving this result. Thorpe (2000a) advocates skill instruction only when the need is identified; this is primarily due to a lack of technique causing breakdown in games (i.e. if players cannot get sets high enough in volleyball or cannot trap a ball to control it effectively in hockey). This skill practice is generally in the form of drills with direct instruction to aid technique. The aim however is to get students back into a competitive game environment for skill application as quickly as possible. In TGFU instruction, if students are achieving the desired result in games (their performance is not affected) there is no need to intervene or change technique in that game. Den Duyn (1996) acknowledges that many athletes (even at the elite level) possess unorthodox techniques that still consistently achieve the optimum result.

Performance is attributed to a combination of the previous processes and is measured against independent criteria (Bunker & Thorpe, 1982). This is based on a variety of formative and summative assessment measures and is how players are catergorised as good and bad players. It is acknowledged that game performance involves multiple factors and overall performance should not be generalised from assessing one area. Traditionally (with the emphasis on skill learning) isolated skill tests have provided the dominant means of assessment in physical education (Oslin, Mitchell & Griffin, 1998). Bunker and Thorpe (1982) note performance evaluation should encompass measures of appropriateness of response as well as efficiency of technique.

The approach to education, fundamental to TGFU, sees the teacher moving away from the centre stage during instruction to a position more closely associated with a knowledge guide or facilitator. The teaching style advocated is one of questioning and discussion where students are encouraged to think for themselves and formulate various solutions to tactical problems. Teachers are responsible for setting up learning experiences (games), and promoting self-learning rather than constantly

transmitting content to students in a direct explicit fashion. "Our approach requires the teacher to highlight the problems raised by the game and for pupils using their experience of playing the game to find solutions to them" (Bunker & Thorpe, 1986b; p 13). Questions can be wide and varied and progress to more specific ideas within game situations; the following provide examples within different games: How do we gain a point? How do we open up an attacking space? Where could you place the ball to set up a net attack and why? What are your options as the ball carrier in a full court defensive press?

At every developmental stage of game evolution, placing decisions onto the students is viewed as fundamental to their understanding of strategies and tactics. A shared approach to learning is fostered with the teacher setting up experiences and providing ideas and the students cognitively and socially constructing their own sense of the games and exploring concepts practically. Discussion sessions in between game play also allow for ideas from other students to be trailed and contribute to the learning process (Doolittle & Girard, 1991).

This indirect style of teaching is by no means new to physical education instruction with the advent of the TGFU philosophy. Indirect approaches to teaching came to prominence in the sixties when more cognitive styles of teaching in movement education challenged the exclusive use of direct methods (Bilbrough & Jones, 1963; Mauldon & Redfern, 1969). However, within the game and sport curriculum, their generally remained a conservative view and an unwillingness to implement a new outlook and fresh approach to education. The increasing focus toward motor skill and technique acquisition in game education at this time saw direct methods maintain prominence. While literature was alerting educators to a range of teaching styles including more indirect methods, teaching for reproduction of movement (skill teaching) was firmly grounded in direct styles involving practice and replication of correct form (Mosston, 1966). Indirect styles were presented for inviting production through promoting discovery and creativity by students (Mosston, 1966). The contention remains that a focus on movement replication and not cognitively based strategies and tactics prevented educators from adopting the more widespread use of indirect approaches in game and sport lessons.

The increased prominence of indirect styles of teaching in physical education in more recent times can be linked to attempts to further capture the holistic nature of physical education as a valid subject area that deals with the mind and the body as one. Physical education has historically had to endure criticism from what are considered the more academic and intellectual subjects (Culpan, 1996). There has frequently been a lack of acceptance and acknowledgement that learning in and through movement is both an intellectual and physical activity (Tinning, Kirk & Evans, 1993). There has often existed a "long standing assumption that the students mind goes into the classroom and his or her body to the gym" (Miller, 1987). The need to justify learning in the cognitive domain within physical education in addition to physical movement skills has promoted suggestion of more discovery learning through questioning and problem solving approaches by educators. Miller (1987) called for the use of open-ended questioning and incorporation of thinking exercises into classes to promote critical thinking. More recently Schwager and Labate (1993) and Blitzer (1995) have called for thinking skills to be further addressed in physical education classes as opposed to providing students with spoon-fed information. Schwager and Labate (1993) identify TGFU as a useful and effective approach for encouraging critical thinking processes through games.

Mosston's indirect styles of teaching influence the process for game understanding promoted within TGFU. It is recognised however, that the teacher still has influence guiding the learner toward solutions so the teaching style is not independent problem solving in its strictest sense. Mosston's guided discovery style involves leading and guiding students to a pre-determined concept through the use of questioning and activity (1992). The learner is cognitively engaged in formulating answers to questions and contributing to discussion, which lead to the understanding of a certain learning outcome. In badminton for example, as opposed to directly telling students they need to be balanced, facing the net and on the balls of their feet when ready to receive a shot, the guided discovery approach would advocate asking the students to experiment standing in a variety of positions with differing weight distribution. Through activity and questioning they could decide which was the easiest position to move from to receive a range of shots. In TGFU,

whilst a modified game form would be used, parallels in the teaching process can be drawn.

In fostering tactical understanding and application, Mosston's problem solving approach most closely aligns with the style advocated in TGFU. In this style, learners are guided to recognise a variety of solutions to a particular problem. If the problem relates to scoring points in a game, fundamental principles and strategical solutions can be explored. Once solutions have been realised, (i.e. the need to maintain possession to run an offense in basketball) the tactics employed can be discussed and applied. Students can focus on how to keep the ball off the opposition. Examples include: positioning themselves between the ball and the defence, recognising open passing lanes, faking to put defensive players off balance, players moving away from defence to create space and setting offensive screens to free up players.

The process that aims to improve learners game understanding and performance in TGFU is based on philosophical assumptions about how humans best learn. TGFU instruction is rooted in constructivist and social constructivist theory, in the belief that learners construct their own ways of knowing. Knowledge development is based around existing perceptions and experiences and is built upon through social interactions with the teacher and peers. This cognitive knowledge construction is thought to contribute to a higher level of learning (Cobb, 1994). The use of indirect teaching methods is grounded in a developmentalist constructivist orientation to learning theory. This theory advocates experiential learning and discovery learning by students (Darling-Hammond & Snyder, 1992). Constructivists advocate a high cognitive level of engagement by learners through questioning, analysing and problem solving (Brooks & Brooks, 1993; Anderson, Reder & Simon, 1996). There exists a belief that learners construct their own ideas in comparison to absorbing or copying from others. Developmental educators such as Piaget (1952), Dewey (1958) and Bruner (1977) have been promoters and advocates of this theory. The focus is as much on the cognitive processing in learning (the construction of knowledge and understanding) as the resulting outcome or response.

In constructivist teaching, the teachers role emerges as a facilitator of learning rather than a transmitter of knowledge, providing students with rich learning experiences (Muke, 1999). Students are encouraged to take ownership for what they learn through accommodating relevant knowledge to their existing perceptions. Indirect styles of teaching are thought to be more learner-centered and holistic contributing to the overall development of the individual (Peterson, 1979).

Why Play Games?

With games (as opposed to activities and drills) providing the educational medium in TGFU, it is critical to outline their justification. Students often want games early in lessons (Siedentop, 1991). "When can we play a game?" is a common question asked of teachers. The use of games as the teaching medium in TGFU is underpinned by two key factors - motivation and relevance. Thorpe (2000a) notes that games provide enjoyment and motivation to students due to the nature of competition, social interaction and challenge. Why not use games to teach if there is such enthusiasm for them? Introducing games from the outset allows teachers to harness the motivation many students bring to physical education lessons. As sport psychologists, Thorpe and Bunker were concerned that students were arriving to physical education classes energetic and ready to play and were instead being placed into technical drills that were contributing to a loss of motivation. Thorpe (2000a) stresses that (contrary to popular belief) it is not paramount that one possesses great skills in order to play and enjoy games and the last thing teachers want to do is drain many students intrinsic love for game play. The example of a squash centre illustrates Thorpe's sentiment regarding skills: On court 1, two A-grade players can play a skilful game of squash with disguised drop shots, boasts and powerful rallies. On court 13, two novice players can also play squash and have a great game, maybe with little exhibition of technical skill but still enjoying the sheer nature and challenge of game play. Games are for everyone and rules and tactics still apply at all levels of skill.

A loss of motivation in some game lessons has been attributed to a lack of relevance seen in technique drills, as they are decontextualised from the actual game

environment. It is contended that pupils that enter skill drills practice skills in isolation without knowing where the skill actually fits, without this reference point for what they are doing practice lacks meaning and relevance to them. Students also may fail to find drills particularly challenging (they often involve repetition of movements) in comparison to competing in a game context requiring constant change and response to situations. "Playing the game provides motivation for students to participate, motivation which learning skills in isolation so often erodes" (Chandler, 1996; p. 49).

Game Modification in TGFU

Children often modify neighbourhood and playground games to level up the playing field and enhance competitive challenge. Examples include limiting bowling run-ups in cricket for the older physically larger players to reduce speed or making a goal wider at one end in soccer to help one team if the teams contain uneven numbers. In this situation children are empowered to make decisions about their games. Thorpe (2000a) believes there is much to be learnt from observing how children restructure games to establish more equitable challenges and increase motivation. Simple changes can also make games more appropriate for the developmental levels of students.

Bunker & Thorpe (1982) believe the teacher's task is to present a game which students can enter comfortably with the skills they currently possess. In contrast to focusing on skills students have not developed. TGFU focuses on what students can do and allows them to play. This is achieved through game modification. Modification allows for representation of official sports whereby game forms encompass the same tactical structure but contain adaptations to suit students' size, age and current skill level. Siedentop (1991) notes that teachers are often reluctant to modify equipment in physical education and they rely on established rules and regulations (official sports). Modification of equipment to suit students has been previously identified as crucial to improve performance and allow more success for students (Grineski, 1992; Williams, 1996). In addition to equipment, modification in TGFU includes the rules of games, the number of players and the playing space.

This is reported to allow the opportunity for essential game play to be taught and provides more opportunity for student success and achievement recognition (Ellis, 1986). Modifications in TGFU make games simpler to play but are also used for exaggeration of tactics (Werner, Thorpe & Bunker, 1996). As part of a badminton unit, a tennis ball throwing game with a high net (volleyball height) played on a long thin court provides an example. The long thin playing space emphasises the need for front and back spacial awareness and promotes the use of exploiting this space as a tactic to gain advantage and points. This tactic is fundamental to success in badminton. The act of throwing and catching the ball slows down the game so students can catch the ball and think about where to place it rather than having to contact it immediately. The high net also gives students more time to react to throws and make decisions.

Skill performance is often minimised for students in early TGFU games through modification. This is to promote attention to the tactical aspects of game performance. Kicking and striking can be substituted for throwing or larger softer balls that are easier to strike and slower moving can be introduced. In the above game example, throwing a tennis ball provides a simplified skill rather than striking with a racquet. This allows students to focus more attention on cognitive decisions regarding placement of the ball rather than on simply making contact as is frequently evident in skills of higher complexity. Schmidt (1991) states that when skills of a more simple nature are performed, secondary attention capacity is elevated for more recognition of external factors. In this case, reducing skill encourages tactical thinking. If you asked a novice basketball player to dribble the ball down court and make a pass to an open team mate, the skill of dribbling and keeping the ball under control will demand significant attention allowing less for the identification of open passing lanes to team mates. If you ask the same player to run down court holding the ball and make the pass, the attention required for movement is now significantly reduced and the player can divert further attention to finding a free player.

Thorpe (2000b) stresses it is better to have students understanding a modified game well than being out of depth and playing poorly in official sports (as they can be

built toward this level in subsequent units). In TGFU, the final game reached in a unit may not be the official sport and teachers have the flexibility to take the progression of games as far as they see appropriate for the level of learners' understanding and performance (Thorpe, 2000b).

TGFU Game Classification

In addition to modifying games, TGFU works off the premise that all games can be classified according to their basic tactical structures. Werner, Thorpe and Bunker (1996) note that just as fundamental skills can transfer across games (striking, kicking, throwing) so can tactics and strategies. A classification system was presented by Thorpe, Bunker and Almond (1986) and is utilised to group tactically similar games within TGFU (see Figure 3).

Figure 3 - Game Classification (Thorpe, Bunker & Almond, 1986)

Invasion	Net/Wall	Fielding/Run Scoring	Target
	Net		
Handball (FT)	Badminton (I)	Baseball	Golf
Basketball (FT)	Tennis (I)	Softball	Croquet
Netball (FT)	Table Tennis (I)	Rounders	Bowls
Team Handball (FT)	Paddle Tennis (I)	Cricket	Curling
Ultimate Frisbee (OET)	Platform Tennis (I)	Kickball	Ten (5 or 9) Pin
Waterpolo (FT)	Volleyball (H)		Pub Skittles
Football (OET)			Billiards
Soccer (FT)	Wall		Snooker
Rugby (OET)	Squash (I)		Pool
Speedball (OET)	Handball (court) (H)		
Hockey (FT)	Paddleball (I)		
Lacrosse (FT)	Racquetball (I)		
Ice Hockey (FT)	Jai Alai (I)		
FT – Focused Target	I - Implement		
OET – Open End Target	H - Hand		

Invasion games involve invading opposition territory with the purpose of scoring points in a wide end or focussed target. Net/wall games involve a net (divided court space) or a wall (shared court space) where the aim is to score points with

unretrievable shots or to force opponent error. Fielding/run-scoring games involve striking to beat a field of players and gaining runs to score points. Target games involve aiming at a stationary target with a projectile with an emphasis on accuracy for points.

This grouping of games and sports (although taking influence from earlier classifications) allows for games to be viewed in a conceptually different way to previous examples. Previous classifications (Mauldon & Redfern, 1981; Ellis, 1983) have generally distinguished games in relation to their technical or skill base (Werner & Almond, 1990). This classification system attempts to further distinguish games based on tactical similarity due to the object or goal of the game. As an example, attacking in invasion games involves such tactics as spreading defences, creating space for passes and maintaining possession. Defence involves cutting down passes, bisecting attacking angles, identifying weaknesses or strengths in opposition and responding to changing attacking patterns. These fundamental tactics are applicable to basketball, ultimate Frisbee, hockey, rugby league and other sports of this nature although the motor skills and rules may differ.

Under this classification, games that contain similar skills may be found under opposing catergories. Softball, hockey and tennis all involve fundamental striking skills with a small ball but conceptually their game structures differ. Werner, Thorpe and Bunker (1996) note that similarities between games can come to be recognised and understood by students and games that may have appeared dissimilar at first can be linked through their fundamental strategies. In secondary school games and sport units, the separation of sports into distinct blocks of content with a lack of integration between units is common practice. The proposed advantage in TGFU is that students who understand the structure and tactical requirements of one game can transfer ideas and knowledge over to other games that they encounter (Doolittle & Girard, 1991; Butler, 1996). When students move from a basketball unit to soccer they can learn to acknowledge common principles of attack and defence relating to both games. Students can learn to recognise the fundamental structure of a new game and relate it to prior learning in games within the same category. The constructivist learning philosophy is embedded in this

notion of grouping games in the belief that students can assimilate the conceptual links between games into their current understanding of game play.

The TGFU game classification has also been proposed as a macro-level solution to selecting games to teach within physical education curriculums. Werner and Almond (1990) believe this grouping of games allows for teachers to select fewer games (for longer instructional time) but across all categories, ensuring students gain education across types of games and learn to identify and understand structural similarities. "When conscious decisions are made to teach students the similarities and differences between games, students will benefit from games education (Werner & Almond, 1990; p. 27).

CHAPTER THREE:

THE PROBLEM

With TGFU now gaining widespread recognition as a curriculum alternative, its practical effectiveness as an instructional model warrants investigation. This chapter firstly highlights the key beliefs inherent within the TGFU model regarding game and sport instruction. There is a need for further study to support or question these instructional beliefs. If TGFU is to become established as a legitimate teaching methodology in secondary schools it must also be compared against more widely adopted practices in game and sport education. This chapter acknowledges this key issue facing researchers and provides justification for the comparative study undertaken. Lastly, to maintain a clear focus, the purpose of this study is clearly outlined with the formulation of eight key research questions.

TGFU presents physical educators with a philosophy-based pedagogical guide for instruction. Whilst the value and order of content and the predominant instructional style may differ from a skill-based orientation, the ultimate outcome remains consistent, to have student performance in games or sports reaching a level of competency that allows for further positive outcomes to emerge. Achieving competency in game performance ensures students are more likely to experience success within games and sport and this has been directly linked to enjoyment and raised self-efficacy (Feltz, 1994). An enjoyable and successful experience can also contribute to continued participation in sport and physical activity where additional benefits of competition, social interaction and exercise can be gained. Sport and game instructions ultimate goal is enjoyment and for students to be able play the game proficiently enough that they are motivated to return to the game (Rink, 1996; Harrison, Preece, Blakemore, Richards, Wilkinson & Fellingham, 1999). It is clear that the development of elite level athletes through school physical education programmes is unrealistic, the time available for instruction and the variety of areas covered does not lend itself to students specialising in a single sport. Furthermore, the concept of ability and mental attitude plays a crucial role, all the quality teaching and coaching available cannot turn everyone into an elite athlete – this is what makes them elite. Game curriculums aim to bring students to a level of competency in a range of games and sports and foster a continued interest and participation in physical activity, whether they continue to aspire to the top level or simply play for recreation.

With the development of game competency established as a major objective, the question becomes – how can teachers help students achieve competency? Physical education teachers want to know what are the best ways to teach sport (Rink, French & Graham, 1996). TGFU provides a new outlook and direction for games instruction that challenges much of the previous assumption about the best way to improve student performance.

TGFU - Pedagogical Assumptions

A key issue with supporting a particular orientation to teaching and learning is that assumptions are made about the way in which learners best learn (Rink, 2001). Advocates of the TGFU approach believe it presents a means of making games more meaningful and promoting higher order decision-making for improved performance (Doolittle & Girard, 1991; Thorpe, Bunker & Almond, 1986). Supporting and implementing the TGFU model involves taking for granted inherent ideas about what and how one should teach. When researching TGFU, these assumptions need to be addressed with an attempt to provide data to validate their position. The following are key pedagogical assumptions on which TGFU instruction was developed (Rink, French & Tjeerdsma, 1996; Gre`hainge, Godbout & Bouthier, 1999; Rink, 2001).

* Strategy in game play is a cognitive process and needs to be taught to learners.

TGFU instruction advocates the need for learners to comprehend at a cognitive level the aims, strategies and tactics of games. This knowledge needs to be brought to a conscious level of processing by the teacher. Whilst skill-based instruction sometimes includes direct tactical facilitation, this has not remained an area of priority. There has commonly been a lack of attention to tactical teaching or an expectancy that students will pick up strategies and the application of tactics at an unconscious level through moving from skill practice into game play (Turner & Martinek, 1995a). In some recent research, the application of general tactics has been identified in game play analysis when these tactics have not been deliberately brought to a conscious level by the teacher (McPherson & French, 1991; French, Werner, Rink, Taylor & Hussey, 1996; French, Werner, Taylor, Hussey & Jones, 1996). This acquisition of general tactics has been identified thus far in studies utilising net games (tennis and badminton) where tactics are generally more simple than invasion and striking/fielding games involving larger numbers of players. The tactics acquired through game play have not related to more complex sport specific tactics but to those which Thorpe, Bunker and Almond (1986) refer to as generic and applicable across games within the same classified category.

Support for strategy and tactical instruction in game lessons may be strongest in the area of student misconception identified within game play. Mistakes and poor performance in games have been attributed to a lack of knowledge or incorrect ideas about the aims and what to do in sport situations. "Many mistakes commonly observed in young children in sports situations may stem from a lack of knowledge about what to do in the context of a given sport situation" (French & Thomas, 1987; p. 17). Placek, Griffin, Dodds and Briand (1998) found students who followed the ball (instead of spreading out) in team games, held incorrect ideas about the game purpose and the strategical options created by their actions. These ideas negatively influenced their performance but the students felt this was how they were supposed to play. Hare and Graber (2000) suggest the problem of student misconception lies not within the psychomotor domain but within a misunderstanding of the aims and strategies of games. Is teacher intervention therefore required to shape and develop game-related knowledge? Leaving strategical and tactical knowledge to hopefully be absorbed through game play alone with no conscious intervention or guidance, could result in the ideas acquired by students failing to align with appropriate game strategies, actions may instead be based on how individuals themselves perceive the game goals.

* Game appreciation and tactical knowledge are as important to successful performance in games as motor skill acquisition.

The development of knowledge for decision-making is prioritised in TGFU and taught before skill instruction. Whether this approach to content results in improved development of tactical decision-making in game performance poses a fundamental question for researchers. Certainly support is evident from a theoretical perspective and research related to the link between knowledge development and sport performance. Anderson (1976) founded two classifications for knowledge known as declarative and procedural. Declarative knowledge represents factual information, in sport and games, knowledge of the game rules, positions, goals and general strategies and tactics indicates declarative knowledge. This type of knowledge aligns with the aims in the game appreciation and tactical awareness phases of the TGFU game evolution model. Procedural knowledge refers to procedures for

completing sequences of actions, which refers to knowledge of appropriate actions for more specific game situations (Thomas, French & Humphries, 1986). The tactical awareness and decision-making phase of game evolution in TGFU can therefore be seen as promoting this type of knowledge once the rules, goals and strategies have been discovered.

It has been reported that a basis of declarative knowledge is required for procedural knowledge to develop (Anderson, 1976; Chi & Rees 1983). Players base their game decisions on their background knowledge of the game structure and goals. Procedural knowledge is considered a more sophisticated form of knowledge and Chi, Glasier and Farr (1988) found a link between sport expertise and an increased amount of procedural knowledge in individuals. The link between this perceptual/cognitive knowledge domain and expert performance has also been documented in studies on game expertise. Obviously motor skill factors (such as performance at the autonomous stage and greater consistency and adaptability in movement patterns) play a role in performer expertise, but superior declarative and procedural knowledge is identified as a key cognitive factor (Rink, French & Tjeersdma, 1996). McPherson and Thomas (1989) in their study of 9-12 year old tennis players also found that players classed as expert performers had a sound procedural knowledge base from which to make decisions on court.

TGFU instruction demonstrates a deep appreciation of the cognitive influence on game performance in the response selection phase of player decision-making. The importance of this phase is supported by information processing theories for motor skill performance (Sanders, 1980; Pew, 1984; Schmidt, 1991). The selection of what to do in reaction to a stimuli in motor performance (decisions based on knowledge) are activated before motor programme retrieval and output (response programming). Thus the more knowledge held for game situations, the more information is available on which to base one's decisions. "The knowledge underlying response selection has been found to be as critical a component as the ability to execute a response" (McPherson, 1993; p. 304).

* Strategies and tactics should be taught indirectly

The teacher should guide students toward recognising appropriate game strategies and tactics using questioning and promoting challenges arising from games. This belief regarding the teaching style undertaken encompasses developmental and social constructivist views as to how learners best acquire knowledge (discussed in chapter two). Streams of literature have been documented advocating indirect learner-centered approaches based on learning theory (Piaget, 1952; Dewey, 1958; Bilbrough & Jones 1963; Stanley, 1969; Bruner, 1977; Logsdon, Barrett, Broer, Ammons & Roberton, 1977). The drive behind more discovery-based learning is the belief that it provides more authentic and meaningful learning and is based around the needs of the individual learner.

While constructivist learning theory provides a clear direction for teaching and is valued for fostering strategical and tactical knowledge in TGFU. Pedagogical research has been equivocal and has failed to provide any definitive advantage to learning from indirect problem solving approaches as opposed to more explicit direct teaching. (Rink, French & Tjeersdma, 1996). The use of indirect teaching appears best viewed as a theoretical based solution to fostering increased learner knowledge. Continued study examining the use of indirect methods for sport and games education can help provide further answers as to the suitability in a practical context.

Justification for Study

Whilst considerable literature exists outlining and detailing the TGFU model, research examining its viability and effectiveness has been limited (Rink, French & Tjeerdsma, 1996). Much of the support for TGFU is found in the writing of the developers as well as in subjective articles and anecdotal reports with a lack of empirical data (Dolittle & Girard, 1991; Berkowitz, 1996; Chandler, 1996; Butler, 1997.) The remaining research has been recent studies in the UK and US comparing tactical approaches to traditional skill-orientated approaches. There is a requirement for the TGFU research base to be extensively built upon, to provide further

objective data concerning viability and instructional effectiveness in relation to more widely established physical education pedagogy. The developers initiated an attention toward further study when the TGFU model was originally presented by acknowledging they were left with one vital question - "does it work?" (Thorpe & Bunker, 1986; p. 78). It is the author's contention that this broad question is one that has only just begun to be answered, within a limited range of games and sports.

The TGFU model and philosophy was introduced to New Zealand coaches by Rod Thorpe at the National Coaching Conference, 1998 and more recently to physical educators in his keynote address to at the National Physical Education Conference, July, 2000 in Wellington. New Zealand tertiary institutions are now beginning to include study and practical application of TGFU into their physical education teacher education programmes and in-service courses. New Zealand physical educators, new to the model, are currently reliant on the information in the limited overseas research when considering departmental implementation. The TGFU model warrants trial and study across a further range of contexts, including the New Zealand educational environment.

It is vital that professional educators keep up to date with latest developments and current research in their fields. Physical educators have often shown a reluctance to move forward and trial new approaches (Ward & Doutis, 1999). This is arguably why skill-based instruction has maintained prominence for such a long period. New directions and innovations within physical education demand study and analysis to determine their strengths and weaknesses and what contribution they can make to physical education classes today. The purpose of comparative research into an alternative instructional model (such as TGFU) is not to say that a particular method of game and sport instruction is the only way to teach, this limits the impact of selecting from a range of teaching models to apply in different learning contexts. However, the aim must be to provide findings to support claims for the use of certain approaches. Reporting advantages or drawbacks of a particular model in a particular setting can add to the existing research base and help physical educators make more informed decisions regarding their own teaching.

Study Purpose

The purpose of this comparative study is to measure the effectiveness of a TGFU approach and to compare its effectiveness with a skill-based approach to instruction when teaching the game of short tennis to year ten students in the naturalistic setting of a New Zealand secondary school. The selected instructional period is eight lessons over a four-week unit in order to provide relevant and realistic data to practicing teachers aligned with the common timeframe allocated for individual game and sport units in schools. This study seeks to determine whether students improve significantly from instruction in TGFU and whether this improvement is significantly better than a skills-based treatment group in written knowledge and tactical and skill components of game performance. Eight research questions are presented to provide a direction and focus for the study. This direction allows for clear discussion in relation to the study results and for comparisons to be made between the findings of other related studies contained in the review of literature.

This study specifically aims to:

* Measure and determine any changes in students' written declarative knowledge of short tennis rules and scoring, strokes and strategies.

Research Questions 1 and 2

Is there a statistically significant improvement in the declarative knowledge of the TGFU and skill-based treatment groups following instruction?

Is there a statistically significant difference between the two instructional models on the improvement of students' declarative knowledge?

* Determine and compare changes regarding tactical court movement during short tennis game play.

Research Questions 3 and 4

Is there a statistically significant improvement in the tactical court movement of the TGFU and skill-based groups following instruction?

Is there a statistically significant difference between the two instructional models on students' tactical court movement improvement?

* Determine and compare changes regarding tactical decision-making during short tennis game play.

Research Questions 5 and 6

Is there a statistically significant improvement in the tactical decision-making of the TGFU and skill-based groups following instruction?

Is there a statistically significant difference between the two instructional models on students' tactical decision-making improvement?

* Identify and compare changes in short tennis skill performance (contact and execution/outcome) during game play.

Research Questions 7 and 8

Is there a statistically significant improvement in the skill performance of the TGFU and skill-based groups following instruction?

Is there a statistically significant difference between the two instructional models on student skill performance improvement?

CHAPTER FOUR:

REVIEW OF LITERATURE

This chapter discusses the key studies specifically related to comparing the effectiveness of skill-based versus tactical approaches to teaching games. Firstly, adaptations of the TGFU model are reported, a variation on the model has been adopted as the "tactical approach" in much of the literature outside the UK. Although the changes do not alter the pedagogical philosophy put forward through TGFU, it is necessary to acknowledge the key differences. A critique of the relevant studies, presenting their major findings and highlighting their perceived limitations is also presented throughout the text. The validation of the GPAI (Game Performance Assessment Instrument) adopted for video coding of tactical movement, tactical decision-making and skill execution in the study is included, with discussion on the need for more authentic games-based assessment when comparing skill and tactical approaches. The chapter concludes by outlining the contribution this study intends to provide to the current research base.

Adaptations of TGFU

American studies make up the highest percentage of the contributing research comparing the instructional approaches. Within these studies, the term "tactical approach" is frequently adopted to describe the game-centered approach undertaken. In the US, an adaptation of TGFU has characterised tactical teaching in games. In Australia the TGFU philosophy has extended beyond physical education to provide a sport coaching approach termed Game Sense. Whilst the tactical approaches are born of the same philosophy, there are subtle differences apparent that are necessary to acknowledge when critically examining studies from the differing countries. While this study examines the original TGFU model as outlined by Bunker and Thorpe (1982) it draws on previous studies that may incorporate a slightly altered tactical approach.

The Tactical Games Approach

Since the introduction of TGFU in Britain, variations of the model have been trailed. This experimentation has looked primarily at means of making the model into a more structured guide for implementation in schools. Two key philosophies of the original model have guided new developments: the promotion of game understanding through tactical knowledge in the cognitive domain and the use of indirect questioning styles to engage students. In the US, the more recent trend toward model-based instruction has resulted in the development of TGFU into what Metzler (2000) terms a more formal instructional model. This model is known as the Tactical Games model. This model, like TGFU, uses the medium of representational and exaggerated games to facilitate tactical understanding that can be applied in other game situations (Griffin, Mitchell & Oslin, 1997).

The Tactical Games model requires teachers to list the tactical problems to be solved in units and then devise a series of learning activities (including games) to teach each area in progression. Here, tactical challenges are documented in a checklist format. Metzler (2000) provides an example for a typical basketball unit:

1 Moving the ball on offense
2 Shot selection
3 Off-the-ball movements
4 Defensive guarding
5 Positioning for rebounding
6 Fast breaks
7 Out-of-bounds plays and defence

In contrast, Thorpe and Bunker's TGFU model commences with a simple game (in this case from the invasion category) it allows tactical problems to emerge from involvement, which are frequently initiated through student input. Although teachers have the game challenges in the back of their minds, they are encouraged to be more flexible with timing of instruction, as opposed to teaching to a pre-determined order. The same tactical area of instruction may also resurface in subsequent TGFU games containing additional complexity where previous principles are discussed in a new context. For example, students may recognise and practice getting in the passing lane on defence in a two on one invasion game. In a subsequent game with additional team numbers, the selection of which lane to fill is dependant on the player they are guarding and is subject to change according to the defensive pattern (zone or person to person) undertaken.

In Tactical Games, game-like activities are used which are not always competitive games in their own right. Often scenarios or simulated situations are played out like a segment of the official game. Griffin, Mitchell and Oslin (1997) provide an example when teaching offensive and defensive strategies in baseball through selection of a "run down" play. The learning environment is staged to replicate a run down and is repeated several times exploring solutions to the attacking and defensive challenges. Students alternate between positions of attack and defence. To foster a similar concept, TGFU would look to a more general generic game. As an example, to promote the above tactics a variation on the game "piggy in the middle" could be used where two players have to try and tag another with a ball inside a marked boundary. The game could run in two-minute stages recording the number of times the player was tagged. When a base-running game is integrated

later in a unit, students are encouraged to build on previous understanding in a new environment when attempting to make or avoid tags.

The application of skill teaching in the Tactical Games model is also pre-determined with practice tasks or skill drills dispersed between games before progression to a new game. The skills taught are based on their perceived relevance to learners and like TGFU are incorporated into tasks requiring tactical decisions (game-like conditions) as quickly as possible (Metzler, 2000). It is acknowledged in the Tactical Games lesson structure that a practice task will follow a game when students have understood the need and relevance of a particular skill (Griffin, Mitchell & Oslin, 1997). Taking a tennis unit example, a modified court game is initiated which encourages students to move their opponents and look for open court space, it poses the question of what to do if the ball is hit to the opposite side of a players racquet hand. The game is then followed by a practice task involving the backhand groundstroke once it has been identified. Similarly, the TGFU model advocates skill instruction when it has a relevance to students, but only when a lack of skill is breaking down the game structure. In tactical games, skill instruction is incorporated periodically prior to progression.

Whilst altering and shaping the TGFU model, the basic philosophy remains. The Tactical Games model has consequently allowed US physical educators to be provided with a more formalised plan for game and sport education. Strategies and tactics for teaching are explicitly stated and games and activities with example questions are provided as guides for lesson plans. One of the chief criticisms of TGFU is that the model has been presented as a theoretical philosophy but doesn't progress further in terms of establishing clear guidelines for implementation. This lack of guidance may help explain why the model has only reached countries outside the UK in the last decade. Clear guidelines appear a natural requirement considering the adjustment that teachers who have always taught from a skill-based perspective are required to make. Chandler (1996) notes that the TGFU model requires teachers to be truly knowledgeable about the deep structure of games and to develop appropriate games for fostering tactics. Butler (1996) found it is not

possible to simply add a model to the existing curriculum that requires some teachers to undergo such a "radical philosophical adjustment" (p. 19).

In Britain the development of TOP sport resource cards by Thorpe has provided modified progressive games that teachers and coaches can present to students. Thorpe (cited in Kidman, 2001) notes that while teachers may not initially have a clear understanding of how to structure games for tactical teaching - TOP sport does it for them. The games themselves ensure the students are still challenged - simply through playing. The aim with TOP sport games is for teachers and coaches to gradually pick up on the challenges the games are setting and begin to ask the sort of questions that promote further tactical thinking in players. In a similar sense, this is what the Tactical Games model has done for US educators by provided a more concrete guide for implementation.

Game Sense

Rod Thorpe's visit to Australia in 1996 challenged sport coaches to look at the structure of their training sessions and question their use of isolated skill drills that often showed little resemblance to an actual game. The concept of "technique + pressure = skill" influenced thinking as coaches began thinking of ways to make practice of technique and skill more authentic to the game environment (Den Duyn, 1996). The TGFU philosophy of learners understanding games in a tactical sense and recognising fundamental similarities across games was also promoted. A video and instructional booklet was developed in 1997 by Thorpe and Australian coaches and became packaged as Game Sense. Although Game Sense was developed as a coaching programme, the terms TGFU and Game Sense are frequently used interchangeably as both focus on learners making sense of games by promoting conceptual understanding. Game Sense, like TGFU and Tactical Games before it, is as much about empowering athletes to make their own decisions as promoting tactical awareness. The indirect style of questioning leading to self-discovery for learners is promoted.

A key difference noted in use of the Game Sense approach relates to its application as a coaching aid. It is utilised for coaching in specific sports and players right through to elite skill levels (TGFU was developed initially as a school physical education-based model). In this sense, less equipment modification for skill minimisation is evident at the elite level due to frequent autonomous level motor skill performance. It is predominantly rule and playing dimension changes that govern game modification for tactical exaggeration. New rules are often integrated into the official game context, an example in field hockey could include the requirement of four or more passes in the attacking half for a goal to count (to emphasise spreading defence using width and depth on attack). In tennis, a game where three points are awarded from a point gained at the net as opposed to one gained from the baseline promotes the encouragement of attacking tactics and shot selection.

Game Sense and Tactical Games can be viewed as different interpretations of the TGFU model based on the context in which they are applied. In any context, variations and new ideas will be employed just as different methods of teaching motor skills have emerged within the broad context of skill-based instruction. It is easier to define what links these approaches in their philosophical underpinning than what separates them. The concepts of fostering game appreciation, tactical understanding and empowering learners form the core basis for all instruction under these tactical approaches.

Review of Relevant Studies

With the comparatively recent development of the TGFU model of instruction (1982) the majority of research into the model traces back little further than last decade. After the initial presentation of the model, research remained stagnant for a long period (Chandler & Mitchell, 1990). Research studies that have sought to investigate the effectiveness of skill-based versus tactical approaches have commonly adopted a quasi-experimental design (which this study also adopts). In this design, students of a specific year level are assigned to pre-determined treatment groups. The groups are pre tested on knowledge, skill or game

performance components (usually a combination) and instruction is provided for a specified period. Treatment is followed up by posttest procedures to determine improvement levels of individuals and treatment groups collectively. Improvement levels are then analysed in order to determine whether differences in performance in a group and between groups are statistically significant. This level of significance is commonly set at "$p < .05$". Accordingly, any mention of "significant" improvement in the following review indicates a statistically significant difference was determined. The following studies represent the key research conducted thus far.

Turner and Martinek (1992) compared a skill-based approach with a tactical approach in the sport of field hockey. It is unknown whether skill modification (rolling or throwing for striking) was incorporated within the tactical approach. However, smaller sided games provided the instructional medium with frequent question-related intervention from the teachers to promote strategies and tactics. Novice sixth and seventh grade students randomly selected from two schools were involved in a six-week (six lesson) period of instruction learning hockey under one of the approaches. The study involved four groups of eleven students with two teachers, each teacher taught in both approaches to eliminate any possibility of individual teacher effects. Performance variables measured included declarative and procedural knowledge, skill speed and accuracy and game control, decision-making and skill execution. Declarative knowledge (knowledge of rules and game structure) and procedural knowledge (game play situational actions) was tested through the administration of a twenty-item multiple choice test which students sat prior to and following treatment. Ten questions related to each categorisation of knowledge. No significant differences were recorded in students' knowledge levels over treatment time or between the treatment groups.

General field hockey skill in dribbling dodging and shooting was measured using the Henry-Friedel Field Hockey Test (HFFHT) (Henry, 1970). This test has a construct validity coefficient of .70 - .89 placing it between very good and excellent on the validity scale (Barrow & McGee, 1979). In the HFFHT, scores are recorded for accuracy and speed with the students receiving ten trials each. The total time of all trials is added for a speed score and the accuracy score is calculated by adding

points awarded for striking the ball into marked areas in a goal box. Results indicated that both treatment groups improved significantly in time performance for dribbling and dodging skills. In terms of shooting accuracy, neither group showed significant improvement from the pretest trials. Turner and Martinek (1992) suggest the emphasis on speed for reduced time scores may have resulted in students rushing shots, which adversely affected accuracy results. Skill tests of this nature that require students to perform with speed and accuracy can frequently result in a trade off with students prioritising one factor over another. In the HFFHT, students who rush shots are likely to gain better time scores even if their shots are inaccurate. This is a key consideration for researchers implementing tests of this nature and indicates the need for both speed and accuracy to be evaluated collectively when determining overall performance. Individually, analysis of these components can be misleading.

Game play analysis was undertaken with an instrument based on the adaptation of an observational tool designed by French and Thomas (1987) for basketball performance analysis. This instrument is based around three defined stages that make up cognitive and physical components of skill performance – control of the ball, decision-making and skill execution. Students were coded with a 1 or a 0 dependant on the fulfilment of criteria for controlling the ball, making appropriate decisions about when to shoot, pass, dribble and tackle and skill execution (shooting, passing, dribbling and tackling). Results indicated that overall no significant differences between the two treatments for game playing ability were determined. The ball control variable did however increase significantly in both groups. Turner and Martinek (1992) suggest this had an influence on the lack of significant improvement in tactical decision-making seen in either group. Because students controlled the ball more frequently in the post testing, they had more decision opportunities in which to be coded. This subsequently resulted in more errors recorded (any lack of control resulted in the decision or execution components unable to be coded).

Ball control improvement was also influential on the significant improvement recorded in dribbling skill execution in both groups. Students improved in

advancing the ball with less loss of control. This study indicated that no significant improvement was gained in decision-making of game execution components from a tactical approach compared to a skills-based orientation. All performance improvement founded was consistent across both treatments.

The two teachers involved in the study had one and four years teaching experience respectively, their expertise in implementing a tactical approach is questionable considering the amount of training they received. The teachers received in-service training and were provided outlines of the two instructional approaches and an article by Bunker and Thorpe describing the TGFU model prior to instruction. It is hoped that training went well beyond an outline of the theoretical and instructional framework for a tactical approach and allowed for a considerable duration of practical experience and quality guidance. Although a treatment validation was carried out on alternate lessons, a lack of extensive knowledge and experience with game-centered teaching may have impacted on the quality of education provided under the tactical approach.

It is suspected this limitation may also be identified in other previous research. A lack of training is a key consideration for researchers and many teachers may not have acquired enough practice and experience to successfully implement the model to its full potential. Educating in TGFU is a difficult process, requiring teachers to have the ability to construct and adapt challenging games and facilitate independent learning (Werner, 1989). With the traditional and widespread use of skill-based instruction, teachers are likely to have trained and developed more practical experience within this paradigm (Butler, 1997). Any physical educators involved in studies of this nature require extensive training and practice to be able to confidently facilitate this alternative approach to instruction.

Lawton (1989) compared the TGFU approach with skill-based instruction involving badminton instruction to twelve and thirteen year olds. The treatment period was six lessons over a six week period (as in Turner & Martinek, 1992). The performance assessment included declarative and procedural knowledge of badminton tactics (in the form of a written test) as well as validated badminton skills tests. The results

indicated no significant differences in development of knowledge or skills between the two treatment groups. Again the differences between skill development in both groups were minimal, supporting the view of Thorpe, Bunker and Almond (1986) that skill performance is not marginalised or adversely affected by promoting tactical knowledge at the commencement of lessons. This continues to be a principle concern for a number of educators and coaches considering implementation of a TGFU approach (Butler, 1996; Kidman, 2001).

Turner and Martinek (1995b) repeated the field hockey study testing the same performance variables as their previous study (1992). On this occasion, the duration of instruction provided was extended to a full semester (sixteen lessons). All performance variables were tested using the same means as previously with the declarative and procedural knowledge test extended to thirty questions. Results indicated declarative knowledge of the tactical group improved significantly more than the skills-based group, this finding provides support to the notion that game appreciation and tactical awareness developed in TGFU may effectively promote the development of learner knowledge. In contrast, the development of procedural knowledge for hockey situations was minimal and not statistically different between the groups. This finding lends support to the idea that declarative knowledge links occurs first and are necessary for development of more advanced procedural knowledge, which may take significant time (French & Thomas, 1987; McPherson & Thomas, 1989).

In ball control and the passing and tackling components of decision-making the tactical group also improved significantly compared to the skills–based group. This included decisions regarding who to pass to (open players) and when to make a tackle (one on one defensive situations). These findings are supported by French and Thomas (1987) and McPherson and Thomas (1989) who both found that a significant improvement in declarative knowledge (in this case basketball and tennis respectively) related to better decisions during game play.

Whilst improvement in cognitive decisions was noted, execution of the decision (performance of key skills in the competitive game context) did not improve

significantly in either group or one group over another. The use of a game context for motor skill learning in the tactical approach (as opposed to drill-structured practice) did not lead to superior improvement in game skill but again there was no less skill improvement for students in the tactical group.

Allison and Thorpe (1997) also utilised the game of hockey in one of their two studies comparing TGFU and skills-based instructional models for invasion game instruction. These studies were conducted in response to criticism citing a lack of research by developers into the effectiveness of their own model (Chandler & Mitchell, 1990). The hockey study involved fifty-six year eight girls and this group was split into two groups (one for each approach). The same teacher taught each group for the duration of six weeks (six lessons). Testing was conducted over a three-week period both prior to and following treatment. Performance variables included tactical knowledge and understanding and skill performance. Although not indicated, it is assumed the knowledge and understanding test was similar to that administered by Turner and Martinek (1992; 1995b). It is unknown whether "knowledge and understanding" was used to indicate both declarative and procedural knowledge or whether the test was of more general nature. The skills test utilised was again the Henry Friedel Field Hockey Test measuring dribbling and dodging speed and goal shooting accuracy.

The skills test results indicated a 14% overall improvement for the TGFU treatment group in shooting accuracy as opposed to a 4% decrease by the skills-based group. In speed scores, an 18% increase was found for the TGFU group compared with a 13% increase for the skills-based group. Tactical knowledge and understanding test results indicated a 47% improvement for the TGFU group and 35% for the skill-based group.

Whilst these findings indicate substantial support for the use of a TGFU approach in both the cognitive and psychomotor domains, limitations within this study must be examined in light of the findings. Hockey skill performance was only measured in an isolated test environment, not in the context of the game of hockey itself. No attempt was made to code player skill execution while actually playing (as in the

two hockey studies previous). This lack of contextual measurement appears to contradict the key reasoning for teaching skills in a game context in TGFU – for transfer to the game environment. Because the TGFU students collectively improved to a greater extent in the skill test - does this indicate their game execution would have been any more superior? This study fails to address this question. The HFFHT has a high construct validity rating based on judges' ratings, but questions remain about the authenticity of skill tests of this nature. The HFFHT test requires players to dribble around a stationary opponent as quickly as possible, while this incorporates control and dribbling ability, a game situation would rarely see a defensive player remain stationary and wait for the attacker to come to them. Thorpe (2000b) acknowledges that technique and pressure determines skill, in this assessment situation the pressure is solely time dependant. Additional pressures such as defensive patterns and other players' movements are not factors. The performers are also required to shoot at an open goal to complete each trial. Whilst skill accuracy is measured the pressure of a goalkeeper as encountered when shooting in a game context is eliminated. Subsequent limitations of this study also include a lack of information regarding the knowledge and understanding test and its administration, the vague description makes it difficult to interpret the findings reported for this variable. In addition, no tactical coding instrument was included for game decision-making, thus no parallels could be drawn concerning transfer of stated or written knowledge into a physical performance context.

Allison and Thorpe's other study (1997) involved forty-six year nine boys and the use of basketball instruction. The research design was identical to the previous hockey study with the assessment of knowledge and understanding and basketball skills from standardised skills test providing the data for comparison in improvement levels. The skill tests adopted were the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) basketball tests measuring speed spot shooting and passing skills (1994). Validity coefficients of .37 - .91 are reported for all ages on these individual tests (Strand & Wilson, 1993). The speed-shooting test involves players shooting from five marked spots around the basket; the distance to the basket from each shot is 9ft, 12ft or 15 ft (dependant on age). The passing test involves the students aiming to hit six 2ft x 2ft targets marked

along a wall; the targets are 2ft apart and at alternate levels of 5ft and 3ft from the ground (AAPHERD, 1984).

Results indicated that TGFU treatment group collectively improved better than the skill-based group for the shooting skill test (23% improvement compared with 13%). The results for the tactical knowledge and understanding variable indicated a 35% improvement for the TGFU group as opposed to 17% for the skill-based group. Again these results indicate support for a TGFU approach in both the cognitive and psychomotor components tested. The same limitations are also identified in that the skill measurement and decision-making assessment were not undertaken in an authentic game context.

In the above studies, the nature of tactical intervention for the skill-based instruction remains unclear. Turner and Martinek, (1992; 1995b) and Allison and Thorpe (1997) all validated treatment according to the following questioning instrument devised by Turner and Martinek (1992).

Table 1

Description of Treatment Validation Instrument (Turner & Martinek, 1992)

1. The students spent most of the lesson in games or game related situations.	(yes/no)
2. The students spent the lesson learning specific skills taught by the teacher before playing a game.	(yes/no)
3. The teacher started the lesson with skill instruction.	(yes/no)
4. The teacher intervened in game play or play related practices to explain strategies to students.	(yes/no)
5. The teacher based his/her teaching on observations of an initial game or game related situation (e.g. 3 : 1, 3 : 3).	(yes/no)
6. The major emphasis of the lesson was skill teaching.	(yes/no)
7. The major emphasise of the lesson was tactical instruction in games or game-like practices.	(yes/no)

From the instrument, questions 2, 3 and 6 require the answer "yes" to validate the skill-based instructional approach. These questions allow for no specification

regarding whether strategies and tactics were actually taught at all. There was also no explanation of the style of teaching predominantly used. It is acknowledged that the tactical groups in these studies were taught strategy and tactics with incorporation of an indirect questioning style and that skill instruction was included when required, but no further description for the skill-based treatment is included. It becomes difficult to determine whether any of the documented improvement for the tactical groups resulted from these groups learning tactics that the other group were not consciously taught at all or from learning tactics under a particular style (direct versus indirect instruction).

Gabriele and Maxwell (1995) conducted a comparative study with first year college students and the game of squash. The skill-based intervention incorporated direct strategy instruction following skill practice in lessons (allowing for comparison between direct and indirect styles to teaching strategies and their effect on tactical performance). Video footage was analysed to determine skill execution and decision-making performance based on player court position, shot selection and shot outcomes. After six weeks of instruction skill execution results again showed no distinction between individual treatment classes whom both improved at a similar rate. In relation to tactical decision-making the tactical group showed a significantly higher proficiency for making appropriate decisions based on the shots they selected. This study provides some supportive data for discovery/problem solving teaching for strategy and tactical facilitation. Students taught strategy directly showed less improvement when it came to making their own game decisions. The results of this study are currently presented in abstract form and it is unclear on the number of lessons provided for each group within the six-week allocation. Limitations include possible individual teacher effects as two different teachers educated each treatment group.

More recent studies in the United States have compared the effectiveness of skill-based instruction with a Tactical Games model of instruction. Early results in the tactical domain of both knowledge and game context decisions indicate support for the tactical approach. Mitchell, Griffin and Oslin (1995) (developers of the Tactical Games model) investigated soccer instruction adopting eight lesson units of

instruction. Sixth grade students were involved and tested on knowledge, skill (passing and shooting) and game decision-making using a recently validated coding instrument known as the GPAI (Game Performance Assessment Instrument). Results indicated no skill differences between treatments and that no group improved significantly in soccer skills throughout the unit. Both groups improved significantly in skill related knowledge but again there was no significant support for one treatment over another. In relation to tactical knowledge however, the Tactical Games group improved significantly compared to pretest results, this level of improvement was not evident in the skills-based group. This finding supports that of Turner and Martinek (1995b). In game decision-making, initial results indicate that the tactical group also improved significantly in off-the-ball movement and decision-making regarding when and who to pass to and when to shoot at goal. This research is currently presented in the form of a presentation abstract.

A similar study involving volleyball (Griffin, Oslin & Mitchell, 1995) was undertaken with sixth grade students in nine lesson units. As in the soccer study, preliminary results indicate no significant differences between treatments in skill knowledge or performance, although both groups' skill-related knowledge did improve significantly. This supports the majority of studies in finding little difference between skill acquisition improvement levels between treatments. In contrast to other studies, tactical knowledge of both groups significantly improved over the unit but the tactical group's scores were significantly higher when adjusted for the pretest scores. In game performance (GPAI assessment), early analysis indicates improvement in the court position and decision-making components coded for the tactical group.

Other studies have altered the specific nature of intervention for each treatment group without directly investigating a TGFU or Tactical Games approach. Two studies involving badminton and ninth grade students were reported in 1996 which separated treatment under three approaches – a tactical, skills and a combination approach (French, Werner, Rink, Taylor & Hussey, 1996; French, Werner, Taylor, Hussey & Jones, 1996). The tactical approach incorporated tactical instruction consistent with a TGFU approach (modified games and indirect teaching) with the

exception that no explicit skill instruction was included from the teacher. The skills approach focussed on motor skill instruction through drills with no tactical instruction from the teacher and the combination approach involved the teacher integrating instruction in both skill and tactical domains at various stages throughout lessons. These studies did not attempt to compare contrasting styles of teaching tactics but rather the impact of consciously teaching one domain over another on student game performance. None of the approaches followed a true TGFU model of instruction where skill teaching is integrated following prior recognition of strategies and tactical knowledge.

The first study, French, Werner, Rink et al. (1996) involved thirteen lessons of instruction for each treatment in a three week unit. In contrast to the majority of previous studies, different teachers (Rink, French and Werner) were utilised to teach each group. Whilst this poses the question of individual teacher effects, this decision was qualified in that each teacher was a specialist in their area and had extensive experience. Pre and post testing measured specific skills (serve, clear, smash and drop) using validated skills tests including the Poole Long Serve and Forehand Clear Tests (Johnson & Nelson, 1986). Written knowledge was measured with a forty five-question test covering aspects of both declarative and procedural knowledge (rules, techniques and strategy). Game play assessment was coded using a similar observational instrument to that in other studies (French & Thomas, 1987; McPherson & French, 1991; Turner & Martinek, 1992; 1995b) whereby performance is coded under control, decisions and skill execution during game play. Under these instruments, control of the projectile (in this case clean contact on the shuttle) is acknowledged as crucial to allow an appropriate decision to be carried out, therefore any lack of control observed results in no coding for decision-making or execution.

Results indicated no significant empirical data to support one approach over another for badminton instruction. There were no statistically significant differences between treatment groups in any variables measured other than lower scores on the serve and drop shot skill tests by the combination group. This study also included a control group in the research design to allow further comparison of the treatments in

relation to a group receiving no instruction. All treatment groups improved significantly better than the control on decision-making components and some measures of skill execution including the clear skill test and forceful shots and serves during games. This finding that all groups were generally better than the control as a result of all treatments supports the impact of quality teaching on student performance. The fact that all groups (including the skills only group) improved in decision-making may support the notion that some generic net game tactics may be acquired without being specifically taught. This level of improvement in decision-making has not been found for any skill-based groups in studies involving invasion game instruction (Turner & Martinek, 1992; 1995b; Mitchell, Griffin & Oslin, 1995).

The subsequent study, French, Werner, Taylor et al. (1996) involved a six-week duration of instruction (thirty lessons). It was acknowledged that a lack of findings in the three-week (thirteen lesson) study might have resulted from a lack of time allowed for students to progress from a novice level of performance (French, Werner, Rink et al. 1996). Different teachers were used from the first study and again each taught a specific group, again they were all specialists with substantial experience and all had additionally played badminton at a national level of competition. All the same procedures were repeated for assessment as the initial study with the testing included at the three-week stage of instruction in addition to pre and post procedures. Results indicated that again all groups achieved significantly higher levels of cognitive and skill performance than the control. All groups' skill performance also continued to improve from the three to six week period, supporting the case for longer time intervention to facilitate improved skill acquisition. The skill and tactical groups demonstrated better performance than the other groups on the following measures of game play; forceful and co-operative shots, game decisions and serve decisions. However no significant differences were recorded between the three treatment groups across performance measures.

McPherson and French (1991) sought to investigate the influence the timing of strategy and skill instruction had on the performance of novice college tennis players. This study involved an extended period of instruction with two separate

groups receiving thirty-eight lessons of instruction over a semester. In experiment one, seventeen students received initial instruction (the first block of nineteen lessons) in fundamental tennis skills (forehand, backhand, serve and volley) as well as declarative tennis knowledge (rules, stroke techniques, scoring and player positions) the last two lessons involved full game play. The subsequent block of instruction involved development of singles strategies and response selection/decision-making in game situations. In experiment two, seventeen students initially received minimal skill instruction followed by declarative and procedural tennis knowledge instruction using problem-solving approaches and game situations. In the second block, extensive motor skill teaching was introduced followed by both game play for application of tactics and skills. To simplify – one group was taught skills followed by strategy and tactics and the other strategy and tactics followed by skills. Assessment included a declarative knowledge test and skills tests including the Reid (1962) tennis battery for groundstrokes and serving (validity co-efficient of .80 - .92) and a volley test designed by the authors. Game performance was again coded according to control of the ball, decision-making and skill execution from videotaped footage. These tests were carried out pre and post and also in the middle of instruction following the first block of instruction.

From experiment one, results showed that skill improved significantly after the first block, however it did not continue to improve significantly in the second block when strategy and tactical instruction was included. It has been suggested that this could be due to the interference at the mid-term phase by introducing an additional focus (strategy). French, Werner, Taylor et al. (1996) also identified this as a possible reason for less improvement in the combination group compared to groups focussing on a single area of badminton instruction. This notion of dual attention requirements has support in motor skill theory in that performance of novice players can suffer because of a limited capacity to direct attention to both skill and environmental aspects at once (Schmidt, 1991; Magill, 1993). The minimisation of skill complexity promoted in earlier TGFU games is based on reducing this interference for learners and allowing a focus on environmental cues for decision-making.

Decision-making ability during tennis games improved throughout the semester (including the first block), thus indicating that beginners may be able to develop some basic strategies and decision-making ability without any specific teaching of strategy and tactical patterns. This finding was supported by French, Werner, Taylor et al. (1996) whose skill-only group also improved significantly in tactical decision-making by the conclusion of the unit.

Experiment two supported the view that conscious teacher intervention is influential on motor skill performance (Rink, 1985; Werner & Rink, 1989). Students in this experiment improved significantly in decision-making after the initial block of teaching but their skill execution did not indicate significant improvement until motor skill instruction was introduced in the second block (this skill improvement was less than the experiment one group). In contrast, French, Werner, Taylor et al. (1996) found skill performance in the tactics only group significantly improved without teacher intervention in this area. The difference in motor skills required between tennis and badminton may influence this result, the force production requirements in tennis strokes make it difficult for novice players (Rink, French & Graham, 1996). The differing complexity of motor skills required may be the distinguishing factor in determining whether they should be taught at a conscious level. The advantage of the TGFU model in this respect is that if some basic skills in some games are gained simply through play, the teacher does not need to step in and teach them. This allows further focus on skills that students have not acquired and are problematic to their performance and/or the game structure. Therefore educators are not teaching skills for their own sake; they are based on the contextual needs of each student's level of development.

Authentic Game Performance Measurement

The drawbacks of not including a game-based performance instrument for measuring tactic and skill variables (Lawton, 1989; Allison & Thorpe, 1997) relates to a lack of data concerning actual game performance. With improved game performance a fundamental goal of instruction, assessment must seek to encompass this context. Historically in physical education, research study measures and school

formative and summative assessment has primarily consisted of multiple choice tests and standardised sport skill tests (Hensley, 1997). These skill tests commonly include assessment of speed, accuracy and power components of skill performance (AAHPERD, 1989; NASPE, 1992; Strand & Wilson, 1993).

Reasons for the prevalent use of skill tests firstly point to the widespread priority awarded to motor skill acquisition in lessons (skill-based instruction). With the majority of lessons leaning heavily on skill instruction, researchers and teachers have sought to assess isolated skills as a measure of student achievement (Oslin, Mitchell & Griffin, 1998). In this sense, the structure of the tests commonly mirrors the instructional activities students have been engaged in (repeated skill drill performance). Siedentop (1996; p. 250) summarises this common pattern of teaching and assessment: "Students are taught specific skills, frequently practice these skills in regimented drills and then are tested on their ability to perform these isolated skills using standardised tests". Standardised tests also contain clear guidelines and consequently are easier to set up and implement. Skill test manuals are abundant, outlining equipment required and procedures. Performance is also easily measurable against set performance criteria, technique checklists and established norms. Many tests (such as those published by AAPHERD) use national norms as a comparative measure (Strand &Wilson, 1993).

Within testing of this nature, a frequent assumption is that skill test scores are representative of a student's ability to perform those skills in a game. What these measures fail to acknowledge is what advocates of TGFU claim physical education game pedagogy has neglected in lessons – the cognitive domain of motor skill performance. If a player performs ten volleyball forearm passes into a marked area or dribbles a soccer ball around cones in a specified time, their physical performance of the skill based on accuracy and/or speed can be assessed. What they do however is pre-determined by the design of the test; the decision-making component of skill performance that is unique to games is eliminated for the performer.

In addition, it is assumed that performing motor skills in the test context equates to similar performance when facing opponents in a competitive game. How much influence do the pressure and situational circumstances of a game have on motor skill performance? Accurately and quickly dribbling a hockey ball around cones is different to adjusting for a moving opponent; similarly, shooting a basketball on your own is contextually different to shooting in a game situation with defensive pressure.

There is some support for the belief that skill performance in a test environment has relevant transfer to game play. Many standardised skill tests contain high concurrent validity ratings when compared to expert ratings of student skill ability and some tests have also been correlated using ratings of individual performance during game play as the criterion (Johnson & Nelson, 1986). The latter validity procedure seems necessary to provide any substantial support for appropriate transfer from a test to a game environment. Whilst skill tests provide important data regarding specific skill performance, debate continues regarding their continued use for evaluation over actual game performance measures.

The recent attention toward appreciating cognitive decisions as an integral component of performance (through TGFU and resultant tactical approaches) has caused educators and researchers to question assessment measures and look toward the game environment as the context to assess. For the most part, this context has not traditionally been included as a means of formative or summative evaluation in physical education (Veal, 1993). The game context allows for more holistic assessment as opposed to assessing isolated skills and using this as grounds to comment on students overall ability. "Holistic assessment is more efficient and more powerful, requiring the students to integrate knowledge of the game, strategy and a variety of skills into a single authentic performance" (Hensley, 1997; p. 22).

The notion of authenticity is central to criticism directed at skill tests in that the context in which the assessment is undertaken is artificial and bears little resemblance to a real-life application. Hensley (1997) notes that while sport skill tests are performance based, "relatively few are high in authenticity" (p. 20).

Making a test performance-based rather than requiring written knowledge does not ensure its authenticity. While authenticity will occur at varying degrees across assessment, the current trend toward game-based analysis (Gre'haigne & Godbout, 1998; Oslin, Mitchell & Griffin, 1998; Blomqvist, Luhtanen, Laakso & Keskinen, 2000) places more contextual significance at the heart of assessment.

The shift to games-based measurement is a difficult process and requires the establishment of clear guidelines and observational instruments for coding player performance. Subjective assessment through individual teacher observation is by no means sufficient, it is one thing to observe games but another to validly and reliably assess game performance. Recent research studies comparing instructional models have implemented game-based assessment through the development of coding instruments to include control, skill execution and tactical decision-making components (French & Thomas, 1987 - basketball; McPherson & French, 1991 - tennis; Turner & Martinek, 1992, 1995b - field hockey). These observational instruments, whilst innovative, comprehensive and detailed have been complex and entirely sport-specific, they have shown no attempt to provide an instrument that can be suitably adapted across all categories of games by researchers and teachers.

A subsequent limitation of these coding instruments has been a lack of coding for off-the-ball movements by players (Oslin, Mitchell & Griffin, 1998). In the basketball and hockey studies, the focus was always directed at the player in possession of the ball and the decisions and skills they exhibited. However, the players situated off the ball are crucial to invasion game success. The ability to support the ball carrier and place oneself in an open space or lane is critical to exploit space. These concepts are fundamental to TGFU instruction. Similarly in the net game studies (tennis and badminton) the player striking the ball has been coded, but not their movements in between shots, which involve tactical movement and preparation for subsequent shots. Examples include returning to a home/recovery position (badminton) or in tennis, moving to an attacking net position and bisecting shot angles (Werner, 1989).

Whilst not undermining the contribution and innovation these coding instruments have provided, potential disadvantages can be learnt from and built upon to expand the range of options available for assessing game performance. Other measurement instruments have been more recently introduced which warrant comprehensive trial and analysis (Gre`haigne, Godbout & Bouthier 1997; Hensley, 1997; Gre`hainge & Godbout, 1998).

Validation of The Game Performance Assessment Instrument (GPAI).

The GPAI was first proposed by Mitchell, Griffin and Oslin in 1994. It has attempted to address limitations of previous instruments. The validity and reliability of the GPAI has been examined and documented (Oslin, Mitchell & Griffin, 1998) across studies using volleyball, basketball and soccer performance (Griffin, Oslin & Mitchell, 1995; Mitchell, Griffin & Oslin, 1995).

Construct validity indicated that the GPAI was able to differentiate between students expertly rated as high and low ability performers in all variables coded across all three sports. Effect sizes (ESs) using pooled standard deviations were calculated, results indicated all ESs ranged from .23 – 1.93. Thomas and Nelson (1996) state that any ES greater than zero reflects a meaningful difference between groups. Reliability was calculated by obtaining a stability-reliability coefficient. Using test-retest procedures a minimum of 30% of students were retested. All reliability coefficients ranged between .84 - .99 across all three studies, placing reliability in the acceptable, very good and excellent standards (Barrow & McGee, 1979).

The GPAI is based on seven game performance components, which are applicable across all four game categories identified in the game classification model (Thorpe, Bunker & Almond, 1986). The content validity of these components was determined through development and discussion by six expert teachers and coaches (with ten - thirty years experience) until a consensus was attained for all components. These components form the basis for all coding in the GPAI and are as follows:

1 Base: Appropriate return of performer to a "home" or "recovery" position between skill attempts.

2 Adjust: Movement of performer, either offensively or defensively as required by the flow of the game.

3 Decisions Made: Making appropriate choices about what to do with the ball (or projectile) during the game.

4 Skill Execution: Efficient performance of selected skills.

5 Support: Off-the-ball movement to a position to receive a pass or throw.

6 Cover: Defensive support for player making a play on the ball, or moving to the ball (or projectile).

7 Guard/Mark: Defending an opponent who may or may not have the ball or projectile.

Though all components relate to performance, not all are applicable to all games and sports and not all have to be assessed. For example, individual games (tennis, badminton and squash) do not involve support or guard components and invasion games do not have the base component as a requirement. Flexibility is provided for researchers and teachers to assess the aspects of performance at their discretion. However, the more applicable components that are coded the more comprehensive the analysis will be and the closer researchers can be to building a complete picture of overall game performance.

For all components except skill execution, coding is based on appropriate or inappropriate movements or decisions. Skill execution is coded according to efficient or inefficient skill execution. This allows each component to be analysed

individually through comparison of the number of appropriate and efficient codings in relation to the total number of coded attempts.

The GPAI, although still in the relatively early stages of development and trial, has shown to be a valid and reliable method for assessing game performance in four components across three sports. The base, cover and guard components have not yet been validated in any study.

Whilst the seven GPAI components provide a common unified base from which aspects of performance can be selected and coded, a problematic area remains concerning the development of clear criteria for each component in a range of sports. This guidance for implementation is not established at this stage. In the validation studies, the authors devised the criteria for the specific sports, teachers and researchers are currently left with the task of deciding what constitutes appropriate and efficient performance for each selected component in the games they wish to assess. In this sense, a degree of subjectivity remains. With further study and development, the establishment and publication of such criteria would help ease implementation across the spectrum of games.

Whilst requiring continued development, the GPAI has made significant progress in a short time. It provides a concrete guide for authentic game assessment, which this study adopts for tactical and skill analysis of short tennis performance.

Contribution of This Study to the Literature

In contrast to a number of recent studies investigating tactical and skill-based instruction, this study investigates and compares the effectiveness of the original TGFU model of instruction as proposed by Bunker and Thorpe (1982). Skill minimisation is adopted within the earlier stages of the TGFU unit to focus on generic net game tactics. Progression to more tennis specific concepts occurs gradually combined with the introduction of striking skills. Strategies and tactics are taught adopting an indirect style involving frequent questioning and constant input from students into their own learning. Progressive modified games provide

the medium for instruction and each is worked through the structure of the game evolution model (Bunker & Thorpe 1982). This study seeks to provide further empirical data regarding the viability of the original model as a means of game and sports instruction.

This study examines the model in a naturalistic New Zealand educational setting. To the authors knowledge no previous study of this nature has been documented in New Zealand. The time frame selected for the instructional treatment aligns with a typical physical education unit in New Zealand junior secondary schools (approximately eight lessons over a three to four week period) in order to provide data relevant to the current teaching structure. The instructional environment maintained is as natural as possible in order to provide environmentally authentic data. All testing and instructional classes will occur in school allocated physical education time under normal conditions with instruction provided to students from their current physical education teacher. This natural environment has commonly been disrupted in previous studies where students are bused to a separate location placed in different groups and educated by new and unfamiliar teachers.

This study compares the TGFU approach utilising tennis. The game is modified to short tennis containing the same rules, goals, strategies, tactics and technical performance as official tennis. Recent tennis studies have looked at motor learning in relation to practice schedule effects and skill acquisition (Hebert, Landin & Solmon, 1996; Benguigui & Ripoll, 1998). Whilst others (McPherson & Thomas, 1989; McPherson & French, 1991; McPherson, 1999) have compared expert and novice performance and the timing of skill and tactical intervention on tennis performance. No study found by the author in the literature thus far has investigated the effects of TGFU compared to traditional skill-based teaching using tennis or short tennis instruction. With the necessity to examine TGFU instruction in a greater variety of sport and games, this study makes an important contribution to the research base.

Whilst two previous studies discussed have adapted coding instruments for tennis performance analysis, off-the-ball movement between strokes has not been coded as

a dependant variable. The application of the GPAI assessment instrument in this study ensures this integral component of performance is also measured to provide more complete data on overall performance.

CHAPTER FIVE:

METHODOLOGY

The Selected Game

The game adopted for instruction in this study, short tennis, is a modified version of standard tennis. It is played on a badminton court space (13.4m x 6.1m) with a slightly lower net (.80 - .85m as opposed to .91m). A larger foam ball is also adopted for play (an 8cm diameter as opposed to 6.67cm). Short plastic racquets which allow for greater control by younger smaller participants are frequently incorporated, but in this study the use of standard (27 inch) strung racquets was maintained due to the age of the participants. Whilst containing modifications, short tennis contains the same rules, scoring system, strategies and tactical elements of the official sport. Generic net game strategies apply as well as further sport specific tennis strategies, required for success in the outdoor game. The modifications do contribute to some reduced skill complexity with the larger, slower moving ball easier to control and the reduced court space ensuring less force production is required to get the ball over the net or to play shots of depth. In New Zealand, short tennis was originally introduced as a game for primary school age children through to early teens with the introduction of the "Kiwi Sport" tennis programme (Hillary Commission, 1991). Since its introduction, the game has become increasingly popular at junior secondary school level, particularly as a winter alternative to outdoor tennis instruction.

Participants

Students

Three classes of year 10 (14 and 15 year old) students were selected from a New Zealand co-educational secondary school for the study. All classes were randomly assigned to one of the treatments. Two classes received instruction in each of the allocated treatments (TGFU and skill-based instruction), whilst the remaining class was established as the control class. From the three classes, thirty students (10 from each treatment class and 10 from the control class) were randomly selected to

participate in the knowledge and game performance testing procedures. All students involved had limited previous tennis and short tennis experience with no students having played tennis previously at a competitive level (all students were therefore classed as beginner to intermediate level performers).

The Teacher

The teacher included in the study was a secondary school physical educator of nine years experience. The teacher was experienced and confident in delivering skill-based instruction, which had served as his dominant form of instruction throughout teaching. He had previously taught both short tennis and tennis on numerous occasions utilising a skill-based approach. The teacher was involved in extensive training with the TGFU model prior to instruction in the study. This training included a comprehensive in-service course and three months of regular one on one professional development with a TGFU specialist in both theory and practical application of the model. The teacher also had prior experience teaching volleyball, badminton and basketball with the TGFU model at the junior secondary school level. The short tennis TGFU instructional unit was developed by a postgraduate TGFU specialist in close consultation with the teacher. Prior to instruction in the study, the teacher taught the same unit to another class, with observation and feedback provided by the specialist.

Treatments

All students received instruction as part of their physical education programme in their normal allocated class time. The teacher utilised was the regular physical education teacher for all three classes. All classes received a total of eight lessons in the form of two lessons per week (50 minutes duration) over a four-week period.

Control

The control class received no short tennis instruction and continued their normal physical education programme for the treatment period. This consisted of a touch football module.

TGFU

The TGFU class received short tennis instruction aligned with the original structure of the TGFU model discussed in previous chapters (see Appendix A for the TGFU unit outline). Progressive modified games were presented (earlier games involved skill minimisation) and followed through the game evolution model. Skill teaching was included when the need became apparent, and always followed strategy and tactical development. An indirect questioning style based on problem solving and discovery was adopted as the dominant style for education in short tennis strategies and tactics.

Skill-based

The skill-based class received short tennis instruction according to a unit structure based around the learning and practice of specific tennis strokes (see Appendix B for the unit outline). Instruction was centered around direct skill instruction incorporating teacher demonstrations and various skill drills. Games of short tennis were included at the end of some lessons. Short tennis rules and scoring were taught within the unit. No explicit strategy or tactical instruction was provided to students at any stage throughout the unit.

Treatment Verification

All lessons were observed by a TGFU specialist to ensure correct treatment was carried out in relation to the lesson structure and teacher instruction. The following validation instruments were adopted (see Tables 2 and 3). These were based on the instrument devised by Turner and Martinek (1992) but further developed to

include a more comprehensive verification, particularly in relation to the skill-based instruction.

Table 2 – Description of the TGFU Treatment Validation Instrument

TGFU instruction
* Following the warm up, the lesson begins with a modified game or the game of short tennis yes / no
* The teacher intervenes within games to provide strategy and tactical instruction yes / no
* The game evolution model is followed through before progression to a subsequent game yes / no
* Skill instruction only occurs following game play and strategy and tactical instruction yes / no
* The teacher uses frequent questioning and discussion to encourage strategies and tactical solutions/ideas from the students. yes / no

Table 3 – Description of the Skill-based Treatment Validation Instrument

Skill-based Instruction
* Following the warm up, the lesson begins with skill instruction (a new skill or skill revision) yes / no
* The teacher provides direct skill instruction and skill demonstrations for each introduced skill yes / no
* Skill drills are utilised for skill practice activities yes / no
* Equipment used is reflective of the unit focus (short tennis) yes / no
* No direct or indirect strategy or tactical instruction is provided by the teacher yes / no

Items were answered "yes" to validate instruction under each treatment. For all 16 lessons taught, all applicable items were coded 100% "yes" by the observer.

Instruments

General Testing Procedures

Testing was conducted for all selected students from each class during two regular lesson time allocations in the week immediately preceding instruction (pre testing) and a further two in the week immediately following instruction (post testing). In the first testing session students were required to sit a written knowledge test and in the second, students were videotaped playing games of short tennis for game analysis procedures. The posttest retention period was therefore a maximum of four days for the knowledge test and one week for the game play analysis from the completion of treatment. All testing measures were identical for both pre and post procedures. Due to unforeseen circumstances (student absence due to illness and/or school extra-curricular activity involvement) a total of eight students were unable to be retested following treatment. This consequently reduced the number of tested students to nine for the TGFU and skill-based treatments and four for the control.

Knowledge Testing

A ten question written test was developed to measure students' declarative knowledge of short tennis rules, scoring, strokes and strategies that reflect an understanding and appreciation of the game. Students were required to acknowledge key rules, identify scoring methods for tennis games and sets and to list the shots and attacking and defensive strategies applicable to the game. The original test was piloted with a sample of five year ten students prior to the study and two minor alterations were made to aid clarity and understanding. The term "shots" was added with the term "strokes" in question nine and the term "strategies" was altered to read "tactics you can use in tennis to help you win". When the test was administered students were given time to read the script and ask any questions to clarify items. Students were provided as much time as they required to sit the test and were asked to write as much as they knew for each question, all students were isolated from each another with no discussion permitted during testing (see Appendix C for a copy of the test paper).

Game Performance Measurement

In order to measure and code game performance for tactical movement, decision-making and skill execution, video footage was required. The video recording involved the use of two video cameras (one per court) which were set up on tripods at one end of each of the courts and monitored by a supervisor. The cameras were set at a wide angle and situated approximately 5 metres back from each baseline in order to capture a view of both players simultaneously and the court space being utilised. All students were recorded playing a competitive game of short tennis for the duration of 10 minutes in each of the pre and post testing sessions.

All students were placed in pairs and assigned to play an opponent of similar ability. The allocation of pairs was determined by the teacher according to his rating of each student's motor ability in striking and also any past observations of net game performance. Students played their allocated opponent in both pre and post testing in order to achieve consistency. The only exceptions occurred for one pairing in each of the TGFU and skill-based treatment groups due to student absence. In both these cases another student from the testing group of similar ability was selected to replace the absent opponent (these substitute students were not coded in the respective games). Rink, French and Graham (1996) highlight the importance of pairing students of similar ability in the notion that game play is highly contextual. They found that tactics adopted by players are to some degree dependent upon the tactics used by an opponent. Skill level of opponents was also one of the strongest variables identified in their badminton studies. If players are mismatched, higher ability players will only do what they need to do to gain points and this may incorporate the inclusion of a limited number of tactics. By ability grouping students and maintaining the allocated pairs for pre and post testing, the opponent ability variable can be controlled to a greater degree.

Prior to pre testing recording, all students were shown the court boundaries and the basic rules of short tennis were covered to allow students to commence a competitive game. An emphasis was placed on keeping score to maintain competition, although the official scoring system was not a requirement for

students who were not familiar with it. All students were warmed up and played short tennis for at least 10 minutes against their allocated opponent prior to all recording. The 10-minute recording time was therefore reflective of the early to middle portion of a match. Due to recording at this early stage and the reduced court size in short tennis. Individual student fitness levels were not identified as a limiting factor on performance.

Videotape analysis was undertaken through application of the Game Performance Assessment Instrument (GPAI) to short tennis performance. Three of the seven game components identified and validated by Oslin, Mitchell and Griffin (1998) are applicable to the game of singles tennis and short tennis and consequently were measured in the video analysis. These components are:

Adjust – Movement of performer either offensively or defensively as required by the flow of the game.

Decisions Made – Making appropriate choices about what to do with the ball during the game.

Skill Execution – Efficient performance of selected skills.

For each of the above components, game specific criteria were established which provided the framework for coding player performance. Tactical movement (Adjust) and game decisions (Decisions Made) were coded as either appropriate or inappropriate and skills (Skill Execution) were coded as either efficient or inefficient (see Appendix D for a copy of the coding sheet utilised).

Each performance component was coded individually, thus each players video footage was viewed three times (utilising freeze frame and slow motion when necessary) for completion of the coding.

The following are the game specific criteria developed for coding under each component. The criteria established are based on key attacking and defensive

tactics and skill requirements outlined in the latest publications by the United States Tennis Association (1996) and The Lawn Tennis Association (2001).

GPAI Component - Adjust

Coded - Appropriate

The player deliberately moves to or toward an appropriate defensive or attacking mid-point position on court after the completion of a shot. These positions are either the mid-point (centre) of the baseline (defensive) or the mid-point (centre) of the front court on or in front of the short service line (attacking) (see Figure 4 for the positions). The positions are established allowing .75 of a metre horizontally either side of the mid-point.

Movement to the attacking net position is only coded appropriate from either an approach shot or a serve of depth or where a short shot is retrieved and allows insufficient time for a return to the defensive baseline position.

Coded - Inappropriate

The player fails to move at all (does not move until their opponent has played their next shot) or the player moves toward or to an inappropriate position.

Commencement of Coding

A player serving is coded from their first movement following a successful serve and every subsequent shot in the point. A player receiving is coded from their first movement following their return of serve and every subsequent shot in the point.

If the net halts a player's shot (including the serve and return of serve) and there is insufficient time to determine movement to or toward a position, no code will be allocated.

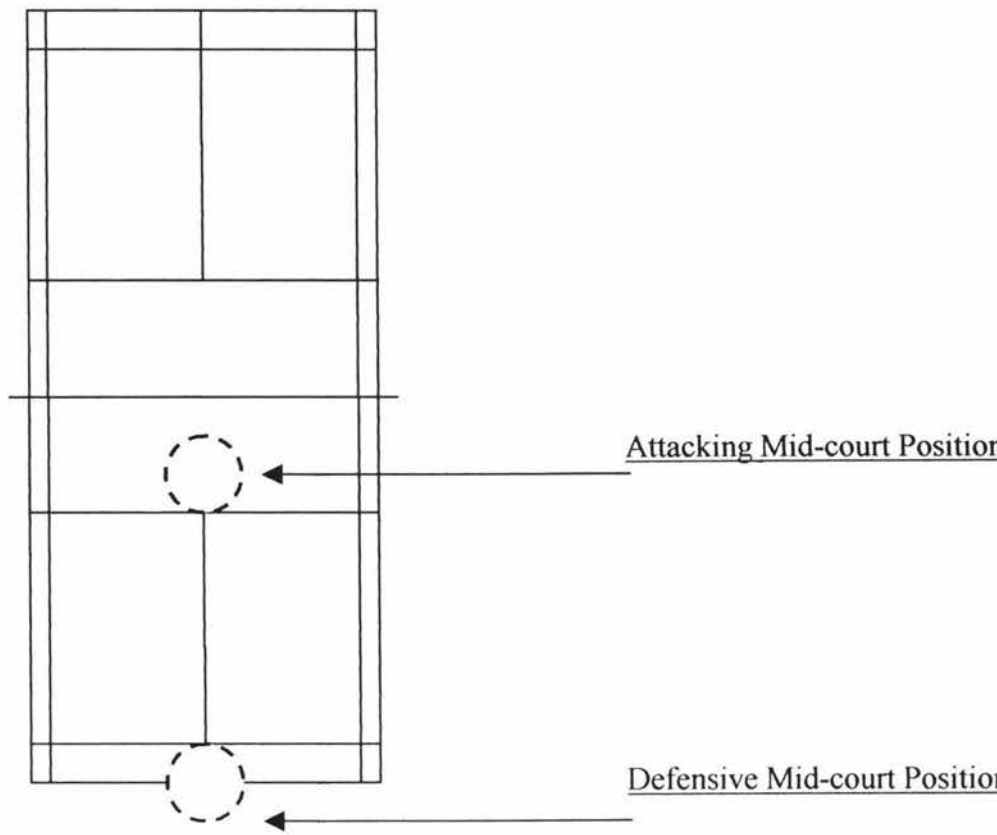
Exceptions

If a player plays a shot from one of the appropriate positions and remains where they are because there is no need to alter position an appropriate code is given.

If a player plays an approach shot that moves a player wide and they move into the attacking position, movement toward the side the opponent has moved is also appropriate to bisect the angle of an opponent return. This movement is coded appropriate.

The defensive mid-court position is subject to variation in the distance in front or behind the baseline. The exact position returned to is frequently dependent on the player's opponent and the depth of groundstrokes played. Deep groundstrokes will necessitate a player adopting a position further back (behind the baseline) while shorter strokes allow for a player to return to a position slightly forward of the baseline. For this reason, if a player makes a deliberate movement toward this general area without stopping directly on the baseline, the movement is still coded appropriate.

Figure 4 - Attacking and Defensive Court Positions
(Adapted from The Lawn Tennis Association, 2001)



GPAI Component – Decisions Made

Coded - Appropriate

The player's stroke forces their opponent to move two or more steps to play the ball (from where the opponent is standing when the ball is struck). A shuffle for repositioning the body without actually moving any distance is not classed as a step. The opponent is also forced to move into one of the three identified court zones (see Figure 5) to play their next shot or the ball lands in one of these areas.

Coded - Inappropriate

The opponent does not have to move at least two steps to play the ball or the shot does not move the opponent into or land in one of the three court zones.

Commencement of Coding

The first shot coded is the return of service if the player is receiving. The first shot coded for the server is their second shot (immediately following their serve). If a stroke is halted by the net, no code is allocated for that shot as there is substantial margin for error in accurately predicting where a ball would land and where an opponent would move to in order to play the ball in this situation.

Exceptions

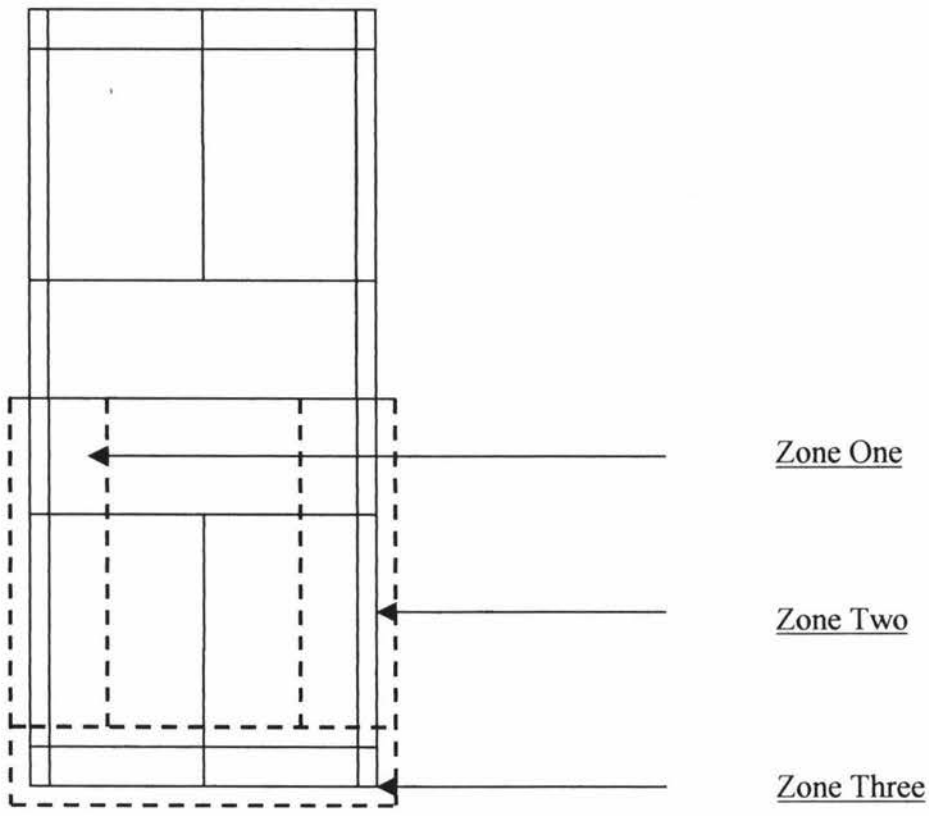
If the opponent is not moved at least two steps but is kept back at the baseline to play their next shot from a shot of depth (court zone 3) an appropriate code is also allocated.

If the shot does not move the opponent to or land in one of the three areas but is a clean winner (the opponent does not get to it with a valid attempt) an appropriate code is also allocated.

If a stroke meets the appropriate criteria but lands outside of the court boundaries within .5 of a metre of a sideline or the baseline it is still coded appropriate as the movement of the opponent was still evident, although the skill execution was inefficient.

If a stroke fails to meet the efficient contact criteria for skill execution (i.e. the ball is not contacted cleanly off the racquet strings) but still goes over the net, no code will be allocated for the shot. Clean ball contact is defined as a minimum prerequisite for carrying out a conscious decision.

Figure 5 – The Three Court Zones for Tactical Movement of Opponents



GPAI Component – Skill Execution

Contact

Contact refers to the ability to make clean contact with the ball to play a shot. This division of skill execution is similar to that undertaken by French, Werner, Rink, et al. (1996) for badminton and the control component acknowledged in McPherson and Thomas (1989) and Turner and Martinek (1992; 1995b).

Coded - Efficient

Clean contact from the racquet strings, enabling selection of an action (shot). The shot may strike the net or land out of court on the opponent's side.

Coded - Inefficient

The player misses the ball, illegal contact (body), carried ball, the ball strikes the racquet frame or grip. The ball is mishit and drops directly down in front of the player, strikes the lower portion of the net with minimal force or goes out of court on the player's side of the court before reaching the line of the net.

Shot Execution and Outcome

Coded - Efficient

The shot receives an efficient code for contact and meets one of the following shot criteria. The criteria are similar to those utilised by French, Werner and Rink et al (1996) but are appropriately adapted for short tennis performance.

Execution

Groundstroke-	Firmly hit, flat or slightly upward trajectory on ball (less than 4.5ft (1.37m) above net)
Drop-	A non-forceful shot (reduced force), the ball must land in the front of the court (in front of short service line). A flat or slightly upward trajectory on ball (less than 3ft (0.91m) above the net)
Smash-	A forceful shot, played with a downward trajectory from above head height
Volley-	Firmly hit, downward trajectory on ball if played from above net level. A slightly upward trajectory (less than 4.5ft (1.37m) above net) if played from below the net level.
Lob-	A non-forceful shot (reduced force) with a high trajectory on the ball. Only played when a player is forced to move to the side of the court and requires time to get back to the defensive mid-court position (defensive lob) or an attacking lob to clear an

opponent who is attacking at the net (otherwise classed as a "loop" shot).

Outcome

The shot clears the net and lands in court or is struck by an opponent on the full in the court space.

Coded - Inefficient

The shot fails to meet one of the individual shot criteria, or is classed as a "loop" shot. A "loop" shot is a shot played with little force on the ball and a high trajectory.

The shot strikes the net or lands out of court or is struck by a player outside the court space on the full.

Contact and Execution/Outcome Relationship

If the shot is coded inefficient for contact, the execution/outcome component also receives an inefficient code. It is however possible for a shot to receive a code for efficient contact but an inefficient execution/outcome.

Commencement of Coding

The first shot coded is the return of service if the player is receiving. The first shot coded for the server is their second shot (the shot immediately following their serve).

Exceptions

If a groundstroke is hit from above the level of the net in such a way that the ball travels immediately downward but clears the net and lands in court, an efficient code will be allocated.

Exclusion of Serve Analysis

The serve stroke was not selected for analysis in this study. Whilst the act of serving contains substantial tactical decision-making, the serve decisions and

execution have been acknowledged in previous badminton and tennis studies as a separate component from the rest of game play (McPherson & Thomas, 1989; French, Werner, Rink, Taylor & Hussey, 1996). The nature of tennis play following the service, involves the need for instantaneous decision-making and responses by players. It is these situational decisions and quick responses within the game that this study sought to analyse in light of the treatments provided. The serve, whilst acknowledged as a fundamental component of the game, is the sole skill where performers decisions are made with significantly more time available to plan the movement prior to execution. The performer also maintains control of the ball speed and placement for striking. The game play analysis undertaken specifically concentrated on tactical application and skill execution within all remaining components of tennis game play.

Construct Validity of the GPAI Component Criteria

Construct validity of the GPAI coding for short tennis performance was measured as by Oslin, Griffin and Mitchell (1998) in soccer, basketball and volleyball. Success was measured in distinguishing between individuals previously rated as high and low ability in game performance. From the selected students in the study, a professional tennis coach of ten years was asked to view all pretest data and categorise each student's game performance as either high, medium or low. From his interpretation, 4 students were placed in the high category and 9 in the low. Eight students (four from the high and low groups respectively) were coded from their 10 minutes of game play footage for all components: Adjust, Decisions Made and Skill Execution - contact and execution/outcome (see Appendix E for player scores). Each component was analysed separately using independent *t*-tests (unequal variances, $p < .05$). Results showed that in three of the four components (with the exception of Adjust) the GPAI was able to significantly differentiate between students classed as high and low ability performers (see Table 5). A non-parametric Kruskal-Wallis test was subsequently conducted to establish any significant differences between the two groups. Results indicated significant differences ($p < .05$) between the high and low groups for all four GPAI components (see Table 5).

Table 5 – Comparison of GPAI Components Using Independent *t*-Tests and the Kruskal - Wallis Test With Students Classed as High or Low Ability in Short Tennis Game Performance: A Test of Construct Validity.

	High (n = 4) m	Low (n = 4) m	*t*	Kruskal –W p
Adjust	1.685	0.255	1.65	0.020*
	(1.722)	(0.163)		
Decisions Made	2.120	0.368	6.15**	0.021*
	(0.533)	(0.202)		
Skill Execution				
(Contact)	21.5	2.1	3.42*	0.021*
	(11.269)	(1.290)		
(Execution/Outcome)	2.005	0.110	12.8***	0.021*
	(0.277)	(0.106)		

Standard deviations are given in parentheses.
p <.05 *. p <.01 **. P <.001***

Data Analysis

The data from the written tests and the videotapes was analysed to assess any statistically significant improvement in the TGFU and skill-based treatment groups as a result of instruction and any statistically significant differences between all three groups' performance in the following short tennis components:

* Written declarative knowledge of short tennis (in rules and scoring, shots/strokes, strategy and overall knowledge categories).
* Tactical movement and tactical decision-making in a game context
* Skill Execution (contact and execution/outcome in a game context)

The level of significance for all statistical analysis tests was set at p <.05, the conventional value assigned in research of this nature (Salkind, 1997).

Declarative Knowledge Tests

The written tests were marked according to an established marking criterion (see Appendix F for the criteria). This provided raw scores for each of the knowledge categories: rules and scoring, strokes/shots, strategies and overall scores (see Appendix G for individual player scores).

Individual Treatment Group Improvement

Paired sample *t*-tests (based on group pretest and posttest means) were undertaken to determine any significant improvement in the TGFU and skill-based groups individually as a result of instruction.

Differences Between the Groups

Each player's score differences (posttest – pretest) were calculated for the following statistical analysis:

A parametric Analysis of Variance (ANOVA) was conducted between the three groups for each knowledge category including pair-wise comparisons between individual groups. A non-parametric Kruskal-Wallis test was also carried out to support findings.

Game Performance

For each player's pre and post video footage of game performance, the initial results were established as outlined by Oslin, Griffin and Mitchell (1998):

The Adjust component was recorded by using an Adjust Movement Index (AMI) = (number of appropriate movements) divided by (number of inappropriate movements).

The Decisions Made component was recorded by using a Decisions Made Index (DMI) = (number of appropriate decisions) divided by (number of inappropriate decisions made).

The Skill Execution component was recorded by using a Skill Execution Index (SEI) for both contact and execution/outcome components individually = (number of efficient codings) divided by (number of inefficient codings).

Any score greater than one for each component indicated a greater number of appropriate or efficient responses than inappropriate or inefficient (see Appendix H for individual player scores under each component).

Individual Treatment Group Improvement

For each GPAI component, paired sample t-tests (based on group pretest and posttest means) were undertaken to determine any statistically significant improvement in the TGFU and skill-based groups individually as a result of instruction.

Differences Between the Groups

For each GPAI component, each player's score differences (posttest – pretest) were calculated for the following statistical analysis:

A parametric Analysis of Variance (ANOVA) was conducted between the three groups for each component including pair-wise comparisons. A non-parametric Kruskal-Wallis test was also undertaken to support findings.

CHAPTER SIX:

RESULTS

The findings of this study are presented under two sections – Declarative Knowledge and Game Performance. Within these sections the results of the individual components measured are presented in the form of relevant tables and graphs with the findings of the statistical tests of significance.

Declarative Knowledge

Rules and Scoring

Table 5 – Means of Pretest and Posttest Raw Scores by Group.

Group	Pretest	Posttest
Skills-based	5.167 (2.646)	5.945 (2.530)
TGFU	5.444 (3.486)	7 (2.958)
Control	1.750 (0.646)	2 (0.707)

Scores out of 12 marks total. Standard deviations are given in parentheses.

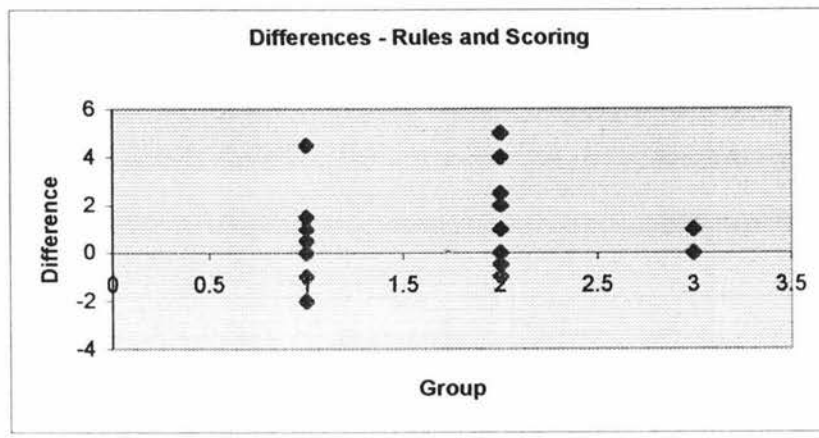
Paired sample *t*-tests on each treatment group's pretest and posttest rules and scoring scores indicated that neither group improved significantly as a result of instruction over treatment time (see Table 6). The TGFU group's improvement was marginally outside the accepted level of significance ($p = 0.05$).

Table 6 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-1.28	0.236
TGFU	-2.31	0.05

$p < .05$ *. $p < .01$ **.

Figure 6 – Plot of Differences in Pretest and Posttest Scores by Group.



Group 1 – Skill-based, Group 2 – TGFU, Group 3 - Control

Table 7 – Means of Score Differences By Group.

Group	Mean	Standard Error
Skills-based	0.778 (1.822)	0.592
TGFU	1.556 (2.022)	0.592
Control	0.250 (0.500)	0.889

Standard deviations are given in parentheses.

The ANOVA revealed no significant main effect for changes in rules and scoring knowledge over time $F(2, 19) = 0.866$, $p > .05$. The Kruskal – Wallis test gave a similar indication (Chi-Square = 1.506, DF 2, $p = 0.480$). ANOVA pair-wise comparisons showed no significant differences between the performance of any two groups in this knowledge category.

Shots/Strokes

Table 8 – Means of Pretest and Posttest Raw Scores by Group.

Group	Pretest	Posttest
Skill-based	0.667 (1.658)	1.334 (1.5)
TGFU	1.111 (1.167)	2.778 (1.716)
Control	0.5 (1)	0.5 (1)

Scores out of 7 marks total. Standard deviations are given in parentheses.

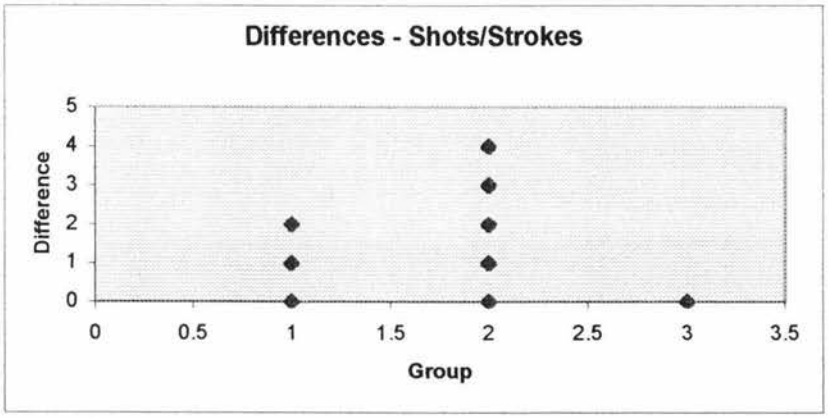
Paired sample *t*-tests on each treatment group's pretest and posttest shots/strokes scores indicated that both groups improved significantly as a result of instruction over treatment time (see Table 9).

Table 9 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-2.83	0.022*
TGFU	-4.08	0.04*

$p < .05$ *. $p < .01$ **.

Figure 7 – Plot of Differences in Pre and Posttest Scores by Group.



Group 1 – Skill-based, Group 2 – TGFU, Group 3 – Control

Table 10 - Means of Score Differences by Group.

Group	Mean	Standard Error
Skill-based	0.667 (0.707)	0.306
TGFU	1.667 (1.225)	0.306
Control	0 (0)	0.459

Standard deviations are given in parentheses.

ANOVA results indicated a significant main effect for differences between the groups in the shots/strokes scores over time $F(2, 19) = 5.317$, $p < .05$. This was supported by the Kruskal - Wallis test result which also revealed a significant difference for this variable (Chi-Square = 8.848, DF 2, $p = 0.012$). The ANOVA pair-wise comparisons indicated that the TGFU treatment group improved significantly over the control group ($p = 0.007$) and the skill-based group ($p = 0.032$) The difference between the skill-based group and the control was not statistically significant ($p = 0.242$).

Strategies

Table 11 - Means of the Pretest and Posttest Scores by Group.

Group	Pretest	Posttest
Skill-based	0.778 (0.712)	1.056 (0.917)
TGFU	1.223 (0.618)	1.611 (0.697)
Control	0.875 (1.109)	0.625 (0.947)

Marks out of 5 total. Standard deviations are given in parentheses.

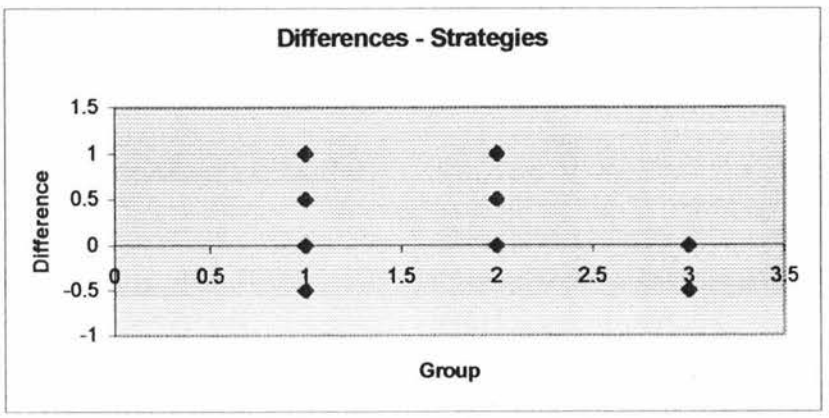
Paired sample *t*-tests on each treatment group's pretest and posttest strategy scores indicated that the TGFU group improved significantly as a result of instruction over treatment time (see Table 12).

Table 12 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-1.64	0.139
TGFU	-3.50	0.008**

$p < .05$ *. $p < .01$ **.

Figure 8 – Plot of Differences in Pretest and Posttest Scores by Group.



Group 1 – Skill-based, Group 2 – TGFU, Group 3 - Control

Table 13 – Means of Score Differences by Group

Group	Mean	Standard Error
Skill-based	0.278 (0.507)	0.137
TGFU	0.389 (0.334)	0.137
Control	-0.250	0.205

Standard deviations are given in parentheses.

The ANOVA indicated no significant main effect between groups for difference in declarative strategy knowledge over time $F(2, 19) = 3.477$, $p > .05$. This result was marginally above the accepted level of significance ($p = 0.052$). The Kruskal - Wallis test revealed a similar result (Chi-Square = 5.891, DF 2, $p = 0.053$). Whilst no significant main effect was found, ANOVA pair-wise comparisons showed that the TGFU group did improve significantly ($p = 0.018$) in relation to the control group.

Overall Declarative Knowledge

Table 14 – Means of Pretest and Posttest Raw Scores by Group.

Group	Pretest	Posttest
Skill-based	6.611 (4.540)	8.334 (4.366)
TGFU	7.834 (4.650)	11.389 (4.682)
Control	3.125 (2.658)	3.250 (2.398)

Marks out of 24 total. Standard deviations are given in parentheses.

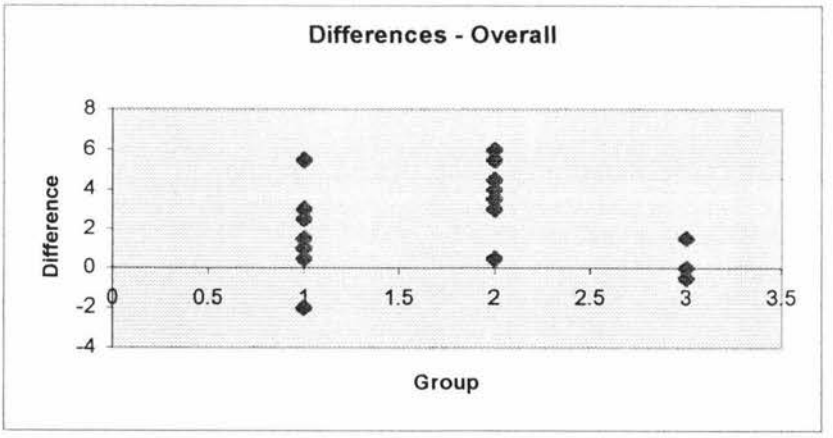
Paired sample *t*-tests on each treatment group's pretest and posttest overall knowledge test scores indicated that the TGFU and skill-based groups improved significantly as a result of instruction over treatment time (see Table 15).

Table 15 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-2.52	0.036*
TGFU	-5.44	0.001**

$p < .05$ *, $p < .01$ **.

Figure 9 – Plot of Differences in Pretest and Posttest Scores by Group



Group 1 – Skill-based, Group 2 – TGFU, Group 3 - Control

Table 16 – Means of Score Differences by Group.

Group	Mean	Standard Error
Skill-based	1.722 (2.048)	0.626
TGFU	3.556 (1.960)	0.626
Control	0.125 (0.947)	0.939

Standard deviations are given in parentheses.

The ANOVA result indicated a statistically significant main effect for differences between groups in overall declarative knowledge over instruction time $F(2, 19) = 5.080$, $p < .05$. The Kruskal – Wallis test revealed a similar significant difference between group scores (Chi-Square = 7.746, DF 2, $p = 0.021$). ANOVA pair-wise comparisons showed a significant difference for the TGFU group over the control group ($p = 0.007$). The differences between the skill-based group and the control and the TGFU and skill-based groups were not statistically significant.

Game Performance

Tactical Court Movement (GPAI Component - Adjust).

Table 17 - Means of Pretest and Posttest GPAI Scores by Group.

Group	Pretest	Posttest
Skill-based	0.861 (1.303)	0.910 (1.197)
TGFU	1.478 (1.210)	1.720 (0.931)
Control	0.275 (0.177)	0.220 (0.118)

Standard deviations are given in parentheses.

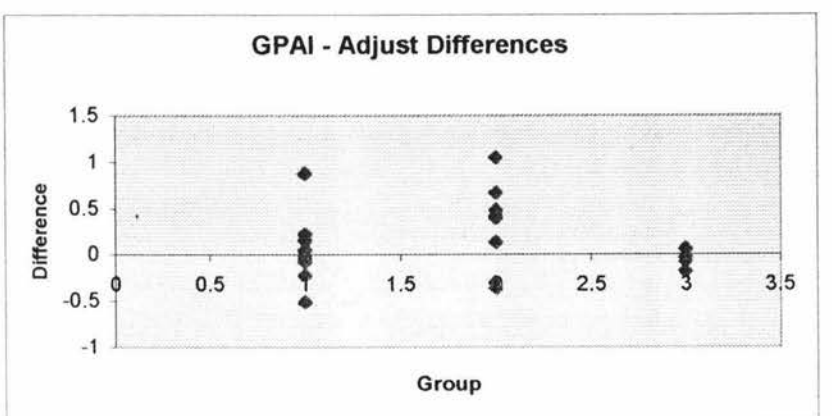
Paired sample *t*-tests on each treatment group's pretest and posttest "Adjust" scores indicated that neither group improved significantly as a result of instruction over treatment time (see Table 18).

Table 18 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-0.39	0.708
TGFU	-1.48	0.177

$p < .05$ *. $p < .01$ **.

Figure 10 – Plot of Differences in Pretest and Posttest GPAI Scores by Group.



Group 1 – Skill-based, Group 2 – TGFU, Group 3 – Control

Table 19 – Means of GPAI Score Differences by Group.

Group	Mean	Standard Error
Skill-based	0.049 (0.378)	0.135
TGFU	0.242 (0.490)	0.135
Control	-0.055 (0.010)	0.202

Standard deviations are given in parentheses.

The ANOVA result revealed no significant main effect between groups for differences in adjust performance during game play $F(2, 19) = 0.920$, $p > .05$. The Kruskal – Wallis test also indicated no significant difference (Chi-Square = 1.264, 2 DF, $p = 0.532$). ANOVA pair-wise comparisons also indicated no significant differences between any two groups.

Tactical Decision-Making (GPAI Component – Decisions Made)

Table 20 - Means of Pretest and Posttest GPAI Scores by Group.

Group	Pretest	Posttest
Skill-based	1.203 (1.177)	1.375 (1.177)
TGFU	1.037 (0.533)	1.291 (0.359)
Control	0.463 (0.292)	0.398 (0.136)

Standard deviations are given in parentheses.

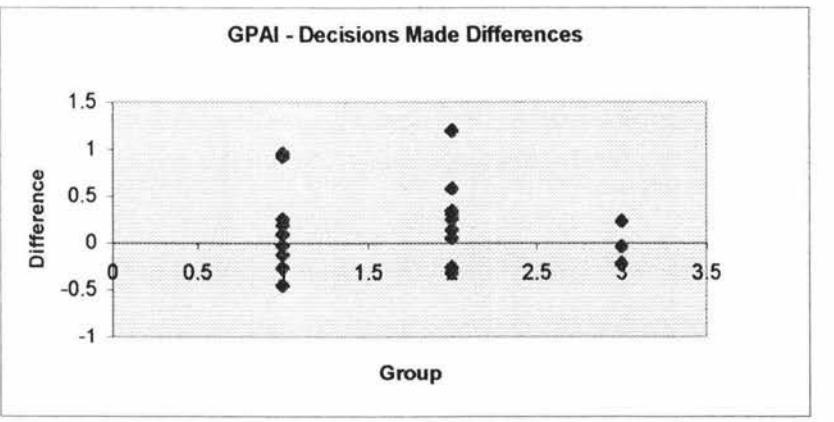
Paired sample *t*-tests on each treatment group's pretest and posttest "Decisions Made" scores indicated that neither group improved significantly as a result of instruction (see Table 21).

Table 21 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-1.05	0.326
TGFU	-1.68	0.132

$p < .05$ *. $p < .01$ **.

Figure 11 – Plot of Differences in Pretest and Posttest GPAI Scores by Group.



Group 1 – Skill-based, Group 2 – TGFU, Group 3 – Control

Table 22 – Means of GPAI Score Differences by Group

Group	Mean	Standard Error
Skill-based	0.171 (0.490)	0.148
TGFU	0.254 (0.456)	0.148
Control	-0.065 (0.215)	0.221

Standard deviations are given in parentheses .

The ANOVA revealed no significant main effect between groups for tactical decision making during game performance F (2, 19) = 0.724, p > 0.5. ANOVA pair-wise comparisons also revealed no significant differences as did the Kruskal – Wallis test (Chi-Square = 1.701, DF 2, p =0.427).

Skill Performance (GPAI Component – Skill Execution)

Contact

Table 23 - Means of Pretest and Posttest GPAI Scores by Group.

Group	Pretest	Posttest
Skill-based	6.372 (10.540)	12.252 (9.5514)
TGFU	16.901 (10.815)	25 .772 (18.128)
Control	2.920 (1.555)	4.725 (3.697)

Standard deviations are given in parentheses.

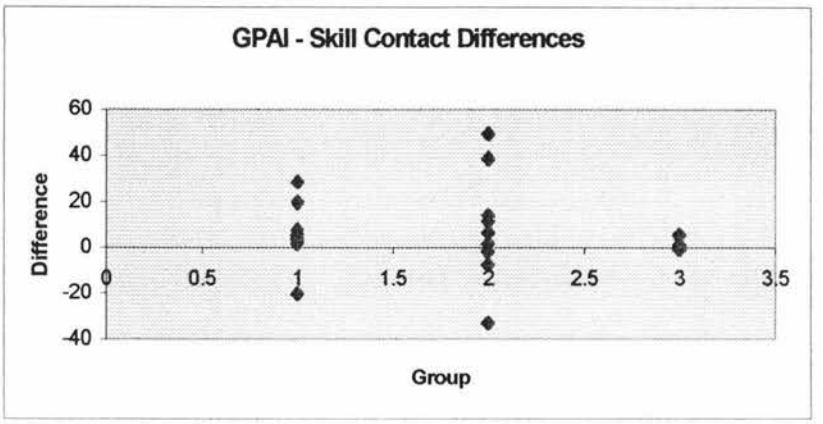
Paired sample *t* tests on each treatment group's pretest and posttest "Contact" scores indicated that neither group improved significantly as a result of instruction (see Table 24).

Table 24 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-1.32	0.225
TGFU	-1.09	0.306

p <.05 *. p <.01 **.

Figure 12 – Plot of Differences in Pretest and Posttest GPAI Scores by Group.



Group 1 – Skill-based, Group 2 – TGFU, Group 3 – Control

Table 25 – Means of GPAI Score Differences by Group.

Group	Mean	Standard Error
Skill-based	5.880 (13.410)	6.018
TGFU	8.871 (24.325)	6.018
Control	1.805 (2.674)	9.027

Standard deviations are given in parentheses.

The ANOVA indicated no significant main effect between groups for differences in skill contact performance F (2, 19) = 2.18, p > .05. The Kruskal – Wallis test also showed no significant difference (Chi-Square = 1.652, 2 DF, p = 0.438). ANOVA pair-wise comparisons also revealed no significant differences between any two groups.

Execution/Outcome

Table 26 - Means of Pretest and Posttest GPAI Scores by Group.

Group	Pretest	Posttest
Skill-based	0.679 (0.670)	0.857 (0.919)
TGFU	1.051 (0.774)	1.111 (0.675)
Control	0.205 (0.191)	0.215 (0.187)

Standard deviations are given in parentheses.

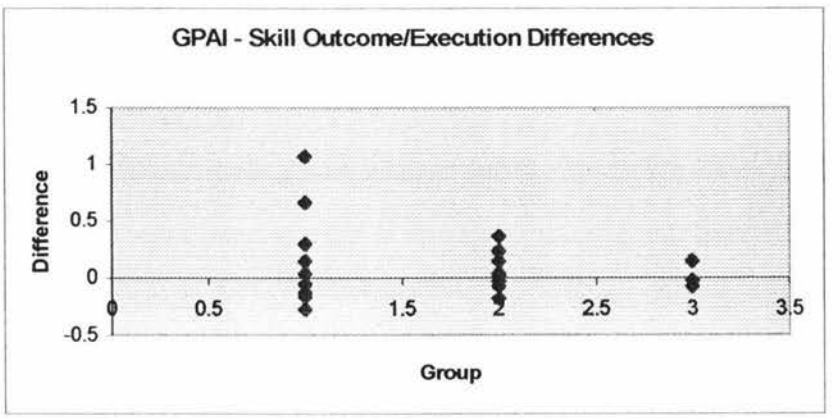
Paired sample *t*-tests on each treatment group's pretest and posttest "Execution/Outcome" scores indicated that no group improved significantly as a result of instruction (see Table 27).

Table 27 – Paired Sample *t*-Test Results of Group Pretest and Posttest Scores.

Group	t	p
Skill-based	-1.22	0.256
TGFU	-1.10	0.302

p <.05 *. p <.01 **.

Figure 13 – Plot of Differences in Pretest and Posttest GPAI Scores by Group.



Group 1 – Skill-based, Group 2 – TGFU, Group 3 – Control

Table 28 – Means of GPAI Score Differences by Group.

Group	Mean	Standard Error
Skill-based	0.178 (0.436)	0.102
TGFU	0.060 (0.163)	0.102
Control	0.01 (0.963)	0.152

Standard deviations are given in parentheses.

The ANOVA result again indicated no significant main effect between groups for differences in skill execution/outcome $F(2, 19) = 0.545$, $p > .05$. The Kruskal – Wallis test revealed a similar result (Chi-Square = .2205, 2 DF, $p = 0.090$). ANOVA pair-wise comparisons also indicated no significant differences between any two groups.

CHAPTER SEVEN:

DISCUSSION OF RESULTS

It is important when discussing and interpreting the findings of this study, that the results are acknowledged within the specific context in which it was undertaken. The age of students, the game adopted for instruction, the teaching environment and the duration of instruction have frequently varied across previous comparative studies ensuring care must be taken when discussing the results on a general basis. The findings of this study allow for interpretation based on previous research to contribute to existing literature and shape the scope and direction of future research. Accordingly, this chapter is separated into three sections for discussion. The first discusses the findings and issues related to declarative knowledge development, the second focuses on the GPAI game performance results and the third involves general discussion of issues and implications related to the findings of this study. This chapter also concludes by briefly discussing the limitations of this research.

As with the literature review, any use of the term "significant" in this chapter and the subsequent chapter indicates a statistically significant finding.

Declarative Knowledge (Research Questions 1 and 2)

A strength of the knowledge data analysis in this study was the separation of knowledge categories to provide a more comprehensive picture of group performance. The majority of previous studies have presented knowledge results based solely on overall student scores. Distinguishing between categories of knowledge allows for deeper investigation into the effects on specific knowledge domains from instruction within a particular model. As the findings of this study indicate, variations in improvement can occur depending on the knowledge category in question.

Whilst both treatment groups posttest scores were higher for the rules and scoring knowledge category, neither groups improvement was found as statistically significant for this category. This finding mirror replicates that of Lawton (1989) and Turner and Martinek (1992) who both found no significant difference for knowledge development in badminton and field hockey respectively. Possible explanations for this lack of improvement include the relatively short duration of instructional time (8 lessons). Both Lawton's and Turner and Martinek's studies consisted of a six-week period of instruction (6 lessons) and it was contended that this duration may have been a limiting factor on declarative and procedural knowledge development. "In this study the treatment period of six lessons may have placed limitations on the amount of knowledge that students could realistically gain during such a short time" (Turner & Martinek, 1992; p. 28). The subsequent hockey study by Turner and Martinek (1995b) supported longer instruction for knowledge development with both groups improving significantly over the control group after a semester of instruction (16 lessons). Up until recently, comparative studies that had shown a trend for significant improvement in student knowledge development have involved more lengthy instructional periods. French and Thomas's (1987) study of expert and novice basketball players was carried out over a full season whilst McPherson and French's (1991) study on the timing of tactical and skill instruction in tennis continued throughout two semesters. Recently however, two comparative studies have shown significant improvement in students', declarative knowledge base following shorter instructional periods of 8-9

lessons (Griffin, Oslin & Mitchell, 1995 - volleyball; Mitchell, Griffin & Oslin, 1995 - soccer). This improvement was noted in general declarative knowledge (tested in this study) as opposed to more situational procedural knowledge. To date, no studies of shorter instructional duration (under 10 lessons) have shown significant improvement in procedural knowledge development, supporting the notion that this type of knowledge takes substantially more time to develop.

This findings in this category are of interest considering both treatment groups were involved in short tennis game play, and rules and scoring instruction was provided to students. In TGFU instruction this took the form of an introduction to rules and discussion on how they shape the game structure (game appreciation), whilst in the skill-based unit the instruction was more explicit and direct. Whilst both groups knowledge showed some improvement (with greater improvement evident in the TGFU group) neither of these instructional styles significantly impacted on students' knowledge base.

A possible reason for the TGFU group's lack of significant improvement in this knowledge area may be that the progression through games with slightly varied rules caused some confusion to students regarding which rules applied in the final game. The early volleyball games involved rules where the ball could only be caught on the full and some games incorporated altered court space dimensions to promote tactics. It is possible that this may have interfered with students' cognitive recollection as opposed to having standard rules for game play throughout the entire unit. However, the fact that the basic structure of short tennis rules were maintained throughout and the lack of significant improvement also evident in the skill-based group indicates that this was not likely to be a highly influential factor on group knowledge recollection.

In contrast to the rules and scoring knowledge, the skill-based and TGFU groups both exhibited significant improvement from pretest to posttest in the shots/strokes knowledge category. This finding supports those of Griffin, Oslin and Mitchell (1995) and Mitchell, Griffin and Oslin (1995) who found both treatment groups improved significantly in skill-related knowledge over time. French, Werner, Rink

et al. (1996) and French, Werner, Taylor et al. (1996) in their 3-week (13 lesson) and 6-week (30 lesson) badminton studies also found that all treatment groups improved significantly in all categories of knowledge (rules, technique and strategy).

The improvement difference between the two treatment groups was also statistically significant in this knowledge category in favour of the TGFU group. This contrasts with the findings from the studies above, all of which failed to find any significant group performance differences. In skill-related knowledge, no study to date has indicated more significant improvement for one treatment group over another. This study supports Thorpe's sentiment that TGFU does not hinder the learning of skill-related knowledge. Skill-related knowledge was not adversely affected (in fact it was significantly improved) by the introduction of strategy discussion and tactical knowledge prior to skill instruction.

The use of indirect teaching and questioning for improved student knowledge recollection is supported through the results in this knowledge category. In TGFU instruction, the discussion of specific shots and their relationship to strategies and tactics when they were introduced may have contributed to greater shot/stroke recollection by the TGFU group. The frequent posing of tactical questions related to shot selection required students to think about and name suitable shots for application in game situations, this may have influenced knowledge retention to a greater degree. By contrast the skill-based group were given the names of strokes directly as they were introduced for skill instruction which did not lead to the same level of improvement.

A valid question regarding the findings in this particular knowledge category concerns the depth of knowledge required. This may have contributed to the significant improvement observed in both groups as compared to the rules and scoring section. Students were simply required to recall and list shots/strokes involved in the game of short tennis; there was no requirement to break the skill down to its components or for any further knowledge. At this purely declarative level, significant improvement was evident; the question remains whether requiring

additional skill-related knowledge would also have resulted in significant improvement.

The complexity of knowledge-related questions remains largely unclear in previous studies; the only distinguishing factor has been the separation of declarative and procedural sections for analysis. Differences in knowledge requirements between studies could be an influential factor as to why results have been varied regarding the knowledge improvement of students, particularly across studies when the duration of instruction has been similar.

The TGFU treatment group improved significantly in strategy-related knowledge between pretest and posttest scores. This improvement was also significantly greater than the control group. Whilst the skill-based group showed some improvement it was not statistically significant between scores or over the control. These findings support the use of strategy and tactical intervention in lessons (game appreciation and tactical awareness) which contributed to a higher level of improvement than students taught without tactical intervention. The use of indirect problem-solving teaching in this intervention may also have contributed to the improvement noted in the TGFU group although this is not substantiated due to the skill-based group received no tactical instruction. Studies by Griffin, Oslin and Mitchell (1995), Mitchell, Griffin and Oslin (1995) and Turner and Martinek (1995b) support these findings, all Tactical Games or TGFU groups in these studies significantly outperformed skill-based groups in tactical knowledge improvement.

In this knowledge category, the 8-lesson TGFU instruction period was sufficient to detect some significant improvement in declarative knowledge of tennis strategies; a level of improvement that did not occur for the skills-based group. An important issue arising from this finding concerns the TGFU pedagogical assumption regarding the conscious teaching of strategies and tactics. If some general concept of net game strategy and tactics is assimilated through game play without any tactical intervention, as revealed in the studies of McPherson and French (1991), French, Werner, Rink et al. (1996) and French, Werner, Taylor et al. (1996) this may take a greater period of time to develop than if the information is consciously

taught. With physical educators frequently challenged in trying to achieve as much as possible with a limited time frame for instruction (generally 6-8 lessons) this study would indicate that tactical knowledge may best be fostered through conscious teaching rather than leaving it to chance. Additionally, with net games generally containing less complex tactics, it is likely that other categories of games with higher tactical complexity (invasion, striking/fielding) will necessitate conscious tactical intervention for greater student knowledge improvement.

Upon examination of overall knowledge scores, both instructional units were shown to benefit student performance over the eight lessons. Both treatment groups improved significantly from pretest to posttest. The TGFU group improved significantly over the control while the skill-based group and control groups pairwise comparison was marginally outside the accepted level of significance, due to a marginal increase in the overall marks attained by the control group. This result is positive for teaching effects, indicating that both forms of instruction with a quality teacher contributed to significant overall knowledge improvement. Between the two treatment groups, the TGFU group was shown to improve to a greater degree but this improvement was not revealed as statistically significant with all knowledge categories combined.

Whilst statistically significant improvement was identified in two individual knowledge categories for the TGFU group and one for the skill-based group, the knowledge marks obtained were still relatively low, Table 14 reveals the overall knowledge posttest means for each group were still below 50%. This trend is consistent throughout all knowledge categories with the exception of rules and scoring where the TGFU group established a mean of 7 out of 12 marks (see Tables 5, 8 and 11). Whilst it appears the majority of students in both treatment groups were able to add to their existing overall knowledge, they were still at a limited stage of declarative knowledge development by the completion of instruction. The findings of research into expert and novice performers including French and Thomas (1987) and McPherson and Thomas (1989) support this conclusion. They found that a foundation of declarative knowledge is required in order to develop more sophisticated procedural knowledge and that novice performers often lack

both these types of knowledge. Students in this study still appeared to demonstrate a knowledge base aligned with that of novice performers following their respective instruction.

Game Performance (Research Questions 3-8)

Tactical Court Movement

A perceived strength of this study was the coding of players' off-the-ball movement between strokes. The GPAI adjust component revealed that in general, students had some concept of moving back to a mid-point following a stroke at the pretest phase. The means of 0.861 and 1.478 for the skill-based and TGFU groups respectively, indicate some degree of tactical movement was taking place. Whether this was picked up from previous game play is undetermined but this observation does lend support to the idea that some general net game tactics may arise from simply experiencing game play or games with similar tactical requirements.

Although some improvement was seen in both treatment groups with a greater improvement evident by the TGFU group (see Table 17), no significant improvement was found for either treatment group or between groups for this component. Although the TGFU group received instructional intervention regarding tactical court movement, it provided no definitive advantages for game performance.

Observations of player movements when coding this component revealed some points worthy of discussion. Some players in all three groups were observed frequently moving back to the middle of the court on the horizontal axis but not to the back or front court positions. This movement to the middle of the mid-court indicated that there was some concept of tactical movement held but the return to this position is tactically applicable to badminton or squash rather than the sport-specific movement for tennis play. As a result of this movement, these students were playing a number of groundstrokes with the ball bouncing close to their feet or were forced to play low volleys from the mid-court area. This observation may be

attributed to knowledge of a very general generic strategy that these players have applied in other net and wall games (move to the middle to make it easier to reach all shots) rather than a recognition of the more specific tennis strategies of moving to defensive and attacking positions.

General observation of both pretest and posttest video footage also indicated that students appeared to be largely playing and moving from the back of the court rather than placing pressure on opponents using net attacks. In order to further differentiate between appropriate adjust movements exhibited by players; an additional analysis was conducted for the two treatment groups. From the number of appropriate movements, the number of movements to the attacking position were calculated and divided by the number of movements to the defensive baseline position. This provided scores, which were analysed for each group by calculation of means and the application of paired sample t-tests of significance (see Table 29).

Table 29– Analysis of Attacking Movement from Appropriate Adjust Movements.

Group	Pretest Mean	Posttest Mean	t	p
Skill-based	0.109 (0.158)	0. 107 (0.203)	0.02	0.982
TGFU	0.017 (0.025)	0.031 (0.049)	-0.88	0.405

Standard deviations are given in parentheses

Analysis indicates that the player percentage of movement to attacking positions was extremely low in both groups and was not significantly different following either form of instruction. Although TGFU instruction involved net attacking tactics, these actions were not applied any more frequently by students in posttest game play.

Three key reasons are postulated for this finding and they are likely to be applicable to different students depending on individual skill levels and knowledge development. Firstly, some students may not have felt confident about moving to the net, due to a lack of technical ability in volleying. Net movement does carry greater risk and the skill level that students had attained by the end of instruction

may not have been sufficient for them to warrant adopting this style of play. Secondly, for some students, attacking from the baseline could have been their adopted style of play based on their perceived strengths. Even at an elite level the risk involved with coming to the net ensures that some players rely on baseline groundstrokes to wear down opponents and win points for them (United States Tennis Association, 1996). Staying back may indicate a conscious tactical decision to play in this style. Lastly, in relation to knowledge development, students may not have developed adequate procedural knowledge for net attacks in game situations. Recognising when you have placed an opponent under pressure and when is an appropriate time to attack is a difficult process for novice players, particularly if procedural (if-then) sport-specific relationships have not been developed. Although the concepts behind net attacks were taught and discussed in TGFU instruction, these may have been comprehended at a very basic level, without sufficient allowance for net attack patterns to emerge in response to game "cues". As stipulated, most players maintained a novice level of knowledge at the posttest phase, the ability to recognise opportunities to attack the net may have been limited.

Tactical Decision-making

The decision-making component of game performance as measured by shot placement did indicate some improvement for both groups with the TGFU group again showing slightly greater improvement than the skill-based group (see Table 20). This trend was common to both components of tactical play. However results again revealed this level of improvement was not statistically significant for either treatment group or between groups. Although the TGFU group received instructional intervention relating to movement of opponents and finding open court space and they significantly improved in strategy-based declarative knowledge, no significant improvement in their physical performance was identified.

The lack of significant findings in this component of game performance draws attention to the complex interaction between cognitive and physical performance in game play. The shift from recognising strategies and being able to execute them is a huge challenge to competitors and a unique part of games and sport. This

requirement is not evident in other school curriculum areas where verbal or written cognitive understanding is adequate to perform tasks. This result suggests the size of the step from "what to do" and actually doing it may be underestimated within physical education where short duration instructional units are commonplace. Many students in this study (in both treatment groups) identified hitting away from an opponent as a key attacking strategy, however GPAI assessment still indicated a lack of significant physical improvement in this performance area.

As Rink, French and Graham (1996) acknowledge, skill and strategy are inextricably linked. In this study the lack of improvement in skill execution/outcome seen over time in both groups may have impacted on the students ability to successfully implement the tactics that they could identify at a cognitive level. Likewise students may also have chosen not to attempt specific tactics and play safe, due to a belief that their skill level was insufficient to carry them out.

In the TGFU unit, the use of modified games with skill substitution (throwing for striking) did not transfer to significantly improved tactical performance in short tennis. This finding indicates that the use of skill minimisation in TGFU game progressions may be more problematic in practice. One postulated reason concerns the change in skill requirements that still must be overcome upon transfer to more complex games. The complexity involved in striking as opposed to throwing may have meant that students still had to make a considerable skill adjustment in order to carry out the same strategies in short tennis games. Chandler (1996) cites progression from game forms to games in TGFU as a key concern within the model structure, in that a lack of congruence between games and the skill in various game forms may impact on appropriate transfer. In this study, although modified skill games may have allowed students to become familiar with net game strategies, the result on performance in short tennis was not significant. At some point the striking skill had to be introduced in the game progression, thus requiring a further challenge for students to enable them to apply the same strategies that come substantially easier when throwing a ball.

The means of both groups at the posttest phase (see Table 20) indicate only slightly more appropriate decisions were made over inappropriate ones. A large number of shots were still being hit short and straight back to the opponent. This high proportion of inappropriate decision-making indicates one of two things. Firstly as discussed, students may not have possessed the skill to move opponents around or keep them back although cognitively the intent was held. Rink, French and Graham (1996) acknowledge that "not only do players who have more skill execute skills better in the tactics they choose, but they also have more strategies to choose from" (p. 491). Players who were still struggling with skill performance after eight lessons (the results suggest a high proportion in both groups) may not have had strategies available to them because of the skill requirements. If a player cannot hit a deep backhand or a firm passing shot, they lose these shots as strategies, the importance of skill development for improved tactical performance may have been a key limitation on the decision-making results.

Secondly, many students may still have been playing at a co-operative level of game play following instruction. This is highlighted by a focus on keeping the ball going and in the court rather than applying strategies to gain ascendancy over an opponent. The term co-operative does indicate intent and whilst some players may have been deliberately hitting the ball to each other to keep play going, others as noted above may have been trying to keep the ball in and even hit to open space, but a lack of skilled control made their play appear co-operative. French, Werner, Rink et al. (1996) and French, Werner, Taylor et al. (1996) both observed high degrees of co-operative play amongst students playing badminton even after substantial periods of instruction. They found students in the 6-week (30-lesson) study needed this period of instruction to successfully develop into competitive players. After only eight lessons it is highly likely that many students in this study had not made the step to competitive short tennis play.

Skill Contact

Results indicated a lack of significant improvement for this component from either treatment group in relation to the control and also between treatment group performance. The opportunity to demonstrate improvement in this category was affected by the selection of criteria. The coding of efficient and inefficient contact did not offer the degree of sensitivity that was anticipated resulting in minimal requirements to achieve an efficient code. Although the coding was based on control variables utilised in other comparative studies, the nature of short tennis with a slower larger ball meant that contacting the ball cleanly off the racquet was relatively easy for most students. This was not such a skilful requirement as in other studies (i.e. trapping and controlling a hockey ball or striking a badminton shuttle). Many players therefore scored high scores in the pretest phase and posttest phases (see Appendix H) and it only took a marginal difference in the number of inefficient contacts in the posttest performance to alter scores quite substantially either way.

This limitation of the GPAI scoring index when scores are largely efficient (which was not picked up in validity testing) is one that has not been identified in previous studies. This perhaps explains why previous research using the GPAI system has sought to code skills based on the outcome of skill execution only without a contact or control measure. This provides a key implication for researchers to consider when adapting the GPAI to a further range of games.

The fact that most students scored highly and experienced repeated success in contacting the ball is a positive feature of short tennis and indicates a positive benefit of modification in allowing greater student success, however in relation to analysis of contact performance, the results were affected substantially. The GPAI skill execution/outcome variable in this study provides a more comprehensive and true indication of student skill performance and therefore is adopted for relevant discussion in this performance domain.

Skill Execution/Outcome

Although skill performance is considered less complex in short tennis, this variable revealed the difference in complexity between cleanly contacting the ball and executing efficient strokes in the game. GPAI scores (see Appendix H) indicated the ability to consistently perform shots of sufficient force and direction remained difficult for most students after receiving eight lessons of instruction.

While both treatment groups encountered direct short tennis skill instruction, Skill execution/outcome scores revealed only a small degree of improvement in game performance for both groups. Improvement was not found to be statistically significant for either of the treatment groups or between groups. This result aligns with a number of previous comparative studies, particularly those of shorter duration. Results of this study and those previously would indicate that the duration of instruction is an integral factor on skill development. Studies across badminton (Lawton, 1989) field hockey (Turner & Martinek, 1992) soccer (Mitchell, Griffin & Oslin, 1995) volleyball (Griffin, Oslin & Mitchell, 1995) and now short tennis all indicate a similar lack of significant skill improvement when the instructional duration is less than 10 lessons. Studies to date that show significant improvement in student skill performance have commonly been those of lengthy instructional duration as mentioned previously (McPherson & French, 1991; French, Werner, Taylor et al. 1996).

It has been documented that the development and improvement in motor skill performance may take considerably longer to develop than cognitive skills. French and Thomas (1987) indicated that cognitive skills and knowledge for basketball performance developed at a progressively faster rate than motor skills. McPherson and French (1991) also postulated that in tennis, cognitive components may be gained more quickly in the early stages of the learning process as opposed to motor components. The work of motor learning theorists indicates that cognitive awareness of skill requirements is an essential process before performance can be carried out physically (Pew, 1984; Schmidt, 1991). The complex and time-consuming step in achieving improved skilled performance is the step from applying the cognitive to the physical. This study adds support to this conclusion,

whilst statistically significant improvement was recorded for some cognitive components (declarative knowledge improvement) it was not noted in actual motor skill performance which may take considerably more time to develop.

The posttest means of both treatment groups (see Table 26) would indicate that a large number of shots were being executed inefficiently during games. A lack of consistency in shot making indicated by this result is characteristic of performance at the cognitive or associative stages of learning, where learners are still developing motor programmes for skilled performance (Schmidt, 1991). By the completion of this limited instructional timeframe, most students in this study appeared to be situated within these developmental stages of learning. Collectively, students in both treatment groups had not progressed far enough in skill development to reveal any significant group improvements for this component.

From observation, the fundamental skill levels of some students in all groups appeared very low, this was particularly noticeable in the control group and is reflected by their poorer execution/outcome scores (see Appendix H). It is expected the time needed to see improvement in these students in tennis skills would be even longer than the students entering instruction with a sound general motor skill base. Ulrich (1985) notes that children with a high degree of fundamental motor skill proficiency find it easier to develop specific sport skills than those that do not. The one handed strike is a basic fundamental skill that should be fostered at primary level physical education and developed through a range of games and activities, it was inherently clear that some students in this study had not begun to develop an appropriate motor programme for striking a ball. Research suggests this is a common problem for many students in New Zealand education and overseas (Kirk, 1996; Taggart & Keegan, 1997; Sanders & Kidman, 1998).

The use of game environments in TGFU instruction for developing skills in their appropriate context had no additional benefit to skill improvement during game play. The immersion of students into game environments to perform skills under pressure has been central to the promotion of games as the dominant instructional medium in TGFU. This study indicates no objective data to support game-based teaching over the use of drills for motor skill performance. This finding is

consistent across all comparative studies discussed (with the exception of Allison & Thorpe, 1997), with no study finding significant differences between groups for skill performance.

The lack of significant difference found between treatment groups indicates that traditional skill-based instruction was no more beneficial in improving skill performance than the TGFU orientation. Whilst substantial concern has been expressed in the past regarding TGFU's promotion of the cognitive at the expense of the physical, previous evidence strongly points to both models of instruction fostering significant skill improvement (or a lack of it) at a similar rate, this study supports these findings.

General Discussion

Implementation of an Alternative Model

The introduction of TGFU instruction into an environment where students had not previously encountered it may have contributed to the limited significant improvement found as a result of instruction. The students taught under the TGFU approach in this study were not familiar with it prior to the short tennis unit. Physical education for them up until this point was likely to have consisted primarily of skill-based education. Whilst limited studies have been carried out conducting TGFU research in a naturalistic setting, one such study (Brooker, Kirk, Braiuka & Bransgrove (2000) revealed that the students perceptions of games and game teaching that they were typically involved with presented a considerable challenge to the successful implementation of a TGFU approach. It is possible that the adjustment to a new direction in teaching unsettled some students, whether this affected motivation and consequently performance is an issue for consideration. Certainly the skill-based group would have been well accustomed to the style and structure of the teaching they received. Future studies should seek to investigate the value of prior experience with a teaching model as an influential factor on performance.

Timeframe of Instructional Units

The results of this study have important implications for the physical education fraternity particularly with regard to the current structure of physical education programmes in secondary schools. A criticism of short duration instructional units when promoting cognitive and physical development has been their inability to develop competency in individuals due to insufficient learning time (Werner & Almond, 1990). Hellison and Templin (1991) expressed the concern that many sport skills were taught in multi-activity physical education programmes that promised little hope of success for students. The inclusion of short instructional units (often termed the multi-activity or exposure curriculum) has been and remains extremely popular (in New Zealand and worldwide) in order to allow students to experience a range of sports and activities within the movement medium (Siedentop, 1994; Chandler, 1996). Whilst students gain a sample of each activity under this approach the question remains – what do they actually learn? This study indicates a lack of learning in the psychomotor domain as a result of two typical multi-activity units (8 lessons) in a secondary school. In both groups some significant improvement was noted in declarative knowledge at a cognitive level, but no significant improvement was found in physical performance of tactical decision-making or game skills.

This result was found with the use of a professional experienced teacher and clearly planned lessons developed under the scope of two well-documented instructional models. This result is not dissimilar to others comparative studies involving short instructional duration (Lawton, 1989; Turner & Martinek, 1992). It would appear that if short units (4-8 lessons) are to remain commonplace in secondary school physical education, the instructional model undertaken might not be as influential on physical learning as the lack of instruction time provided.

Whilst frequent criticism has been directed at the multi-activity curriculum structure, particularly since the early nineties, little has changed in the scope of instructional unit duration in schools. Ward (1999) indicates that physical education curriculums have maintained a static nature, clinging to traditional methods with a resistance to adoption of new directions. Whilst short units of instruction remain the

norm, as educators have become further aware of the notion of model-based instruction (Metzler, 2000), alternative models have begun to gain attention and implementation in more recent times, with some advocating longer instructional timeframes.

The introduction of the Sport Education model (Siedentop, 1994) challenged the limitations of the multi-activity approach in meeting educational goals in physical education. This model advocates instruction over a "season" of sport (at least 15 lessons) in order to help develop educated sports people. In this model, students are required to experience different roles within the sporting culture in addition to those of players. The Sport Education model has gradually gained increased implementation in New Zealand schools; helped by the trial and research conducted by Grant (1992) in the New Zealand educational context. It is hoped that this study in the New Zealand context, will further alert educators to the educational limitations inherent in undertaking brief units of instruction and promote discussion on alternative directions for sport instruction units and curriculums.

The game classification system (Thorpe, Bunker & Almond, 1986) has been identified as providing an alternative structure, to allow educators to select fewer games across tactical categories and spend a longer duration within instructional units. The theoretical philosophy is strong, the only way to assess the credibility of this suggestion is trial within school programmes and this provides an exciting area for future research. This research lends support to the suggestion that the existing structure of lessons is not providing sufficient time to allow students to significantly improve sport performance beyond the cognitive domain. Fewer sports and more teaching time appear a logical solution, although this may also be problematic to physical educators. It opens up further questions regarding the selection of sports and games and the significant number that then become a part of the null curriculum through being left out of instruction altogether.

If short units are to remain commonplace, from a purely cognitive level, TGFU may provide a more realistic way of viewing secondary school physical education instruction. Perhaps the main aim of physical educators should be to build up student knowledge of the games and skills involved, whilst focusing more on

offering game experience in the psychomotor domain. Bunker and Thorpe (1982) acknowledge learner understanding and appreciation of games as critical to TGFU through game appreciation and tactical awareness. By offering this education to students, rather than devoting limited available time to teaching sport-specific physical skills, students may become more informed spectators and develop enough interest in the game to further explore it outside of school as a recreational or competitive activity. The results of knowledge performance in this study and others (Griffin, Oslin & Mitchell, 1995; Mitchell, Griffin & Oslin, 1995; Turner & Martinek, 1995b) indicate that TGFU instruction may offer something more to improving learners cognitive understanding of games than traditional teaching - realistically this may be a more achievable aim of game and sport instruction.

Limitations of the Study

A limitation of the game performance assessment adopted in this study and in all game performance assessment concerns the inability to detect cognitive processing of strategies and tactics independently of the physical skill execution variable. In this study, students may well have held an understanding of what to do in certain game situations but a lack of ability to execute the desired skill resulted in their decision-making score receiving an inappropriate code. Blomqvist, Luhtanen, Laasko and Keskinen (2000) highlight this as a key issue with action-based assessment in stating that "response to various game situations is clouded by whether the players correctly execute what they decide to do in response to the game situation that confronts them" (p. 327). This limitation appears unavoidable in game performance assessment due to the nature of physical actions requiring the interrelation of both cognitive and physical components. Blomqvist et al. suggest the use of a video-based procedure where subjects view game situations and are asked to select relevant responses for players to reflect their game understanding. This approach has been validated using badminton and certainly warrants trial and adaptation to a further range of sports. In terms of overall performance however, a test as suggested by the above authors assesses player tactical knowledge but not in a game performance environment where it ultimately must be applied. The clearest solution appears the use of multiple testing measures for understanding, including written, video-based and game performance assessment. The more measures that

can be included the more comprehensive and clearer picture researchers are likely to build.

The use of a technique known as "point interviews" has been used in previous studies for net game analysis (McPherson & Thomas, 1989; French, Werner, Rink et al. 1996; French, Werner, Taylor et al. 1996) and was not included in this study. This technique includes the use of tape recorders and requires players to express a retrospective account of what they were thinking during play at the completion of each point. Whilst this technique has its limitations (including a lack of description of thought processes for individual shots) it provides an attempt to assess and categorise student thought processes during game play and provide insight into where knowledge attention is directed in individuals. Further research and examination into this technique is required in an attempt to provide a valid means of assisting researchers in looking beyond actions alone as a measure of understanding and further into the underlying thought processes of players as they encounter game situations.

Insufficient time to include a more diverse range of assessment techniques was a possible limitation in this study, although student assessment was comprehensive and additional measures are not likely to have altered the key findings presented, it can always be argued that more could be done. In terms of skill performance, this study did not include skill tests as a measure of performance in conjunction with game performance. This would also add another measure to achieving more complete assessment. Game performance assessment provides more contextually authentic and realistic assessment and has been discussed as necessary requirement for analysis, however uncontrolled context effects can influence skill execution results during game play. Rink, French and Tjeerdsma (1996) note that skill performance may be reflective of opponent ability in games. Taking tennis as an example, if an opponent is higher skilled and is hitting the ball harder and into more difficult positions for retrieval, the skill execution result could be different to performance against a low-skilled player. Skill tests do allow researchers to control the assessment context and combined with game assessment, a clearer acknowledgement of contextual influences and student ability may be developed.

The contextual nature of game play reflects the possible limitations in assessing the performance of a player against one opponent, as was the case in this research. Previous study indicates that players adjust their tactics based on the tactics exhibited by their opponent and their opponent's skill levels (French, Werner, Rink et al. 1996; French, Werner, Taylor et al. 1996). Whilst an attempt was made to control this variable in testing by ability-pairing players to provide competitive challenge, assessment of players against a range of opponents would provide more complete data regarding the application of specific strategies based on the competitive context. Unfortunately the time-consuming nature of this process ensured it could not be undertaken in this study and it has not yet been included in any study to date.

The smaller number of students in the control group, was not an ideal situation for analysis between groups in this study. Maintaining an equal number in all groups would have contributed to more complete results regarding control group performance in relation to the treatment groups. The nature of research in a naturalistic setting means that the researchers must be prepared for situations which are beyond their control and this was certainly the case in this instance. In this study, comparison with a control was however still able to be included even though the original sample size was not maintained for posttest procedures.

CHAPTER EIGHT:

CONCLUSIONS AND RECOMMENDATIONS

The conclusions drawn from this study provide physical education researchers and educators with insight into the effects of two models of instruction on student performance in an 8-lesson unit. In the declarative knowledge domain, both treatment groups improved significantly in overall knowledge following instruction. In individual knowledge categories, skill-related knowledge significantly improved in both groups. Comparison between the treatment groups indicated only the TGFU group significantly improved in strategy-related knowledge and that their skill-related knowledge improvement was also significantly greater than the skills-based group.

This finding and the results of previous studies point to TGFU instruction offering something more to the knowledge domain, particularly in strategy and tactical knowledge than traditional instruction. If short instructional units are to remain a feature of physical education curriculums, TGFU may provide a chance for students to develop some important understanding and appreciation of games, even if physical performance is not able to be significantly improved.

Game performance results did indicate some improvement for both groups. Between groups, a trend was identified in tactical performance where the TGFU group improved to a greater degree than the skill-based group on both "Adjust" and "Decisions Made" components. However the results for all GPAI components were not found to be statistically significant. Game performance was not shown to improve significantly over instruction time. With the strong interdependence between skill and tactics, it is concluded that the instructional timeframe was insufficient to develop both to a degree that psychomotor performance was significantly influenced. A follow-up study over a longer instructional period may provide more answers as to what students can learn as a result of TGFU instruction.

The findings in this study certainly indicate no definitive advantage for knowledge or game performance when teaching with a traditional skill-based approach. With no study to date finding significantly better results for skill-based instruction over

game-centered approaches on knowledge or game performance, the long standing dominance that this model has maintained needs to be further questioned. The trial of alternative models of instruction must at the very least be considered.

With the promotion of model-based instruction in physical education pedagogy, educators need to see the benefits and strengths of having a range of approaches in which to call upon and implement (Metzler, 2000). Educators can hopefully come to view models as "tools" from which to use when they see them as most appropriate for instruction. TGFU is building support as a model certainly worthy of a place in the physical education "toolbox". Further research will continue to build a picture of contexts when it is likely to be most effective as a means of game and sport education.

The implementation of TGFU or similar games-based approaches needs to be a gradual process that is well structured with strong support available to educators. Issues such as staff professional development need to be addressed so teachers feel confident using and adapting an approach as they grow increasingly familiar with it. Teacher support will determine whether this model is ultimately able to break into a tight circle of long-held beliefs within physical education that have been largely resistant to change.

Future Research

Future research into TGFU and game-based physical education pedagogy must seek to build on the work being done and investigate additional avenues related to instruction. This is an exciting prospect for researchers and the following are some key areas for further research.

All studies to date have examined the instructional effects of TGFU related to one sport or game, there has been no attempt to investigate whether the learning in one game translates to increased performance in another game. This issue is at the heart of the game classification model where tactically similar games can be grouped, with the vision that extensive instruction in one game will result in understanding of basic concepts that will carry over to other instruction within the same category. Badminton studies need to investigate transfer to tennis or other net game

performance just as basketball instruction can be measured in terms of generic transfer to ultimate Frisbee or netball. Results from this study and others suggest that changes in skill requirement influence the tactics that can be adopted, this may very well be the case when moving across tactically related games containing different levels of skill complexity. Further analysis will help to answer these questions.

Whilst little difference was identified between the instructional models in the cognitive and psychomotor performance domains, the affective domain was not examined in this study. The majority of studies to date have not focussed on this domain with performance assessment dominating analysis procedures. One of the strong theoretical thrusts behind TGFU instruction relates to the motivation and fun students hold and gain for game play. With previous studies identifying similar and often equivocal results across models for knowledge and skill performance (particularly in units of short duration) the affective domain deserves further attention. If student enjoyment and motivation is shown to be significantly greater from game-based instruction, this may provide reason alone for the inclusion of TGFU as a worthy instructional model.

Comparative studies by Griffin, Oslin and Mitchell (1995) and Mitchell, Griffin and Oslin (1995) have attempted to recognise this important domain and assess student motivation, with early analysis indicating more interest and enjoyment for students taught volleyball with a Tactical Games approach. This provides a substantial area for further study with the need for development of instruments for valid and reliable assessment of student motivation and enjoyment.

Future research should attempt to include a deeper analysis of individual student performance. This study was based on group performance levels in order to detect differences as a result of instruction in different models. As Turner and Martinek (1995a) suggest "the learning styles of the students might also be examined in relation to the treatment effects" (p. 59). In acknowledging that students learn in different ways, investigating the relationships between these styles and the methods of instruction inherent in models may provide further information to researchers about the suitability of instruction to individuals.

If there is one criticism of the model-based approach to physical education pedagogy, it appears to be the neglecting of the thought processes undertaken by individual students as they learn. Much literature surrounding TGFU has been based on the promotion of the constructivist orientation underpinning instruction and whilst TGFU and skill-based instruction are based on sound learning theories, they all involve the basic assumption that "if this is how we teach, this is how students learn". Recent literature (Rink, 2001) suggests taking an altered view toward instruction and methods and concentrating on individual students and the learning processes they exhibit. Rink notes that simply because a model of instruction is thought to result in a particular learning process, does not mean it necessarily does for all students. If there is no direct line between a teaching method and a level of student processing, it may be somewhat naïve to continue supporting the use of instructional models without considering the more complex nature of learning. This is not to suggest research based on group performance is any less important nor valuable, but that consideration of individual learners is a crucial implication for the future and may help physical educators to better understand how to effectively apply models of instruction (such as TGFU) for improved learning. "Researchers are going to have to investigate the nature of student processing and engagement and not merely the products of the process" (Rink, 2001; p. 117).

Whilst future research will hopefully continue to provide a further and broadened range of information regarding TGFU and its educational strengths, the research to date has provided enough evidence at the very least to indicate this approach to game and sport instruction is worth continued trial in our gymnasiums and on our sports fields. TGFU was never developed to be the only way to teach (Thorpe, 2000a) and it must not be viewed as such. However, innovation and a willingness to trial new ideas are necessary for continued professional development. The words of Mandino (cited in Kidman, 2001; p. 146) sum up the suggested approach for physical educators in response to TGFU:

"Take the attitude of a student. Never be too big to ask questions,

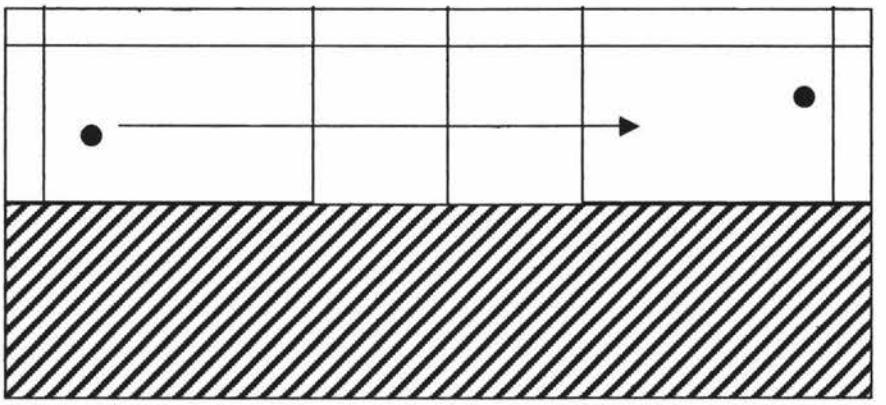
never know too much to learn something new".

APPENDIX A: TGFU SHORT TENNIS TEACHING UNIT OUTLINE.

Net Games 1 - 10 and example discussion questions.

The following publications were consulted in developing this unit: Jones (1982), Dolittle (1995), The United States Tennis Association (1996) and The Lawn Tennis Association (2001).

Net Game 1 – Half Court " Space Attack".



Court - Short tennis/badminton half court (long and narrow) out to the doubles line on one side

Net - Badminton height (1.55 m top middle)

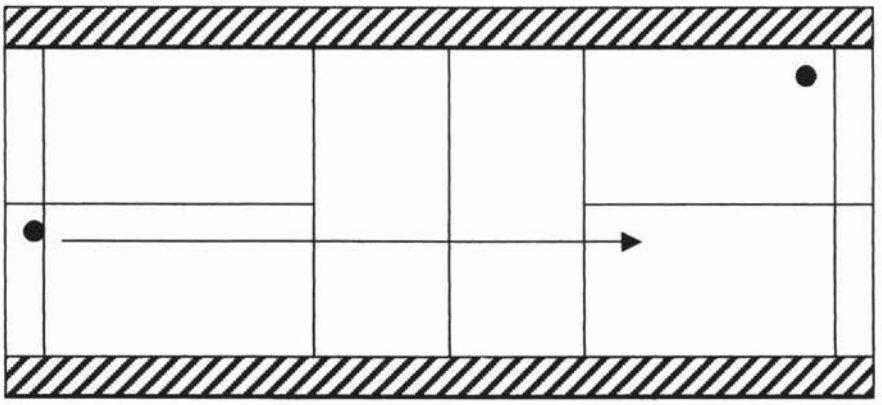
Ball - Volleyball

Rules - Two handed throws only, the ball can be caught one or two handed, players must serve from service box to service box. The ball can only be caught on the full, a 2-second time limit is allowed before release of the ball.

Scoring - Same as tennis, students should begin to understand basic scoring

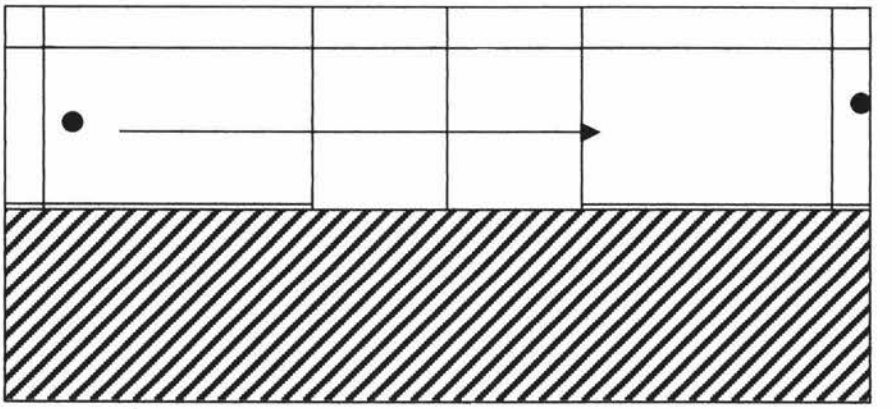
Modifications - Reduce 2-second rule to immediate release (speeds up decision time). One-handed throws allowed (allows for firmer throws).

Net Game 2 – Full Court " Space Attack".



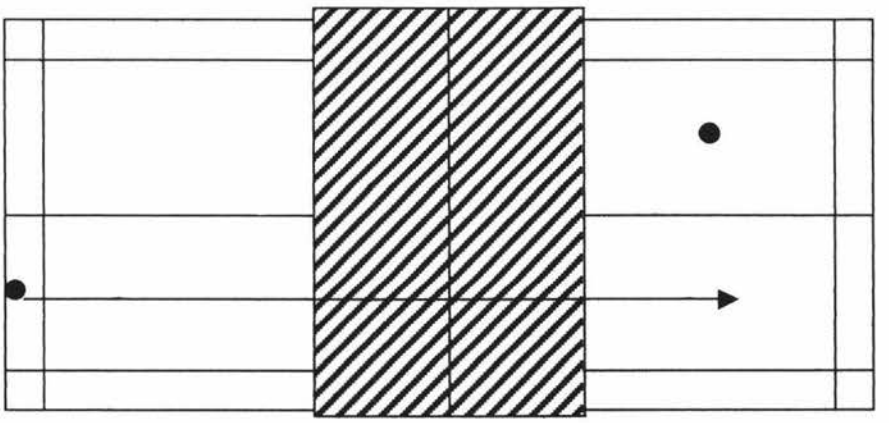
Court -	Short tennis/badminton full court out to singles lines
Net -	Badminton height (1.55 m top middle)
Ball -	Volleyball
Rules -	One or two handed throws, the ball can be caught one or two handed, players must serve from service box to service box. The ball can only be caught on the full, immediate release of the ball.
Scoring -	Same as tennis, introduce alternating of service sides with full court

Net Game 3 – Half Court "Court King"



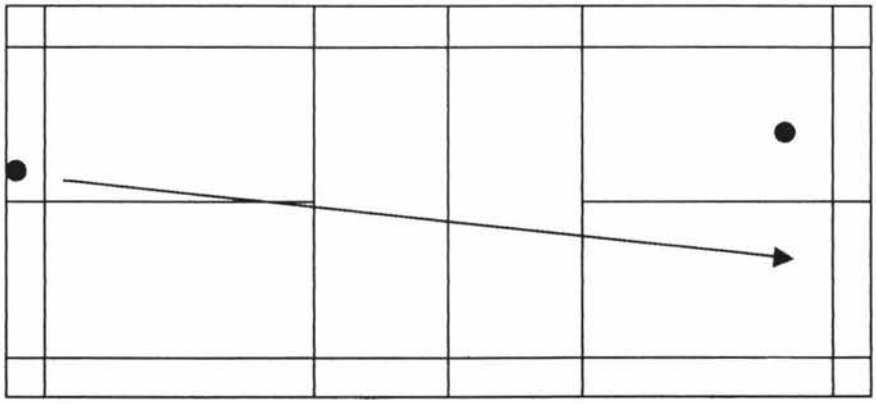
Court -	Short tennis/badminton half court (long and narrow) out to doubles line on one side
Net-	Badminton height (1.55 m top middle)
Ball -	Tennis ball (standard pressure)
Rules -	One handed throwing game, underarm throws only. Immediate release of the ball, one or two handed catches allowed, one bounce allowed, serve from service box to service box with under or overarm serves.
Scoring -	Full tennis scoring, students need to score their own games.

Net Game 4 – "Back Court Challenge"



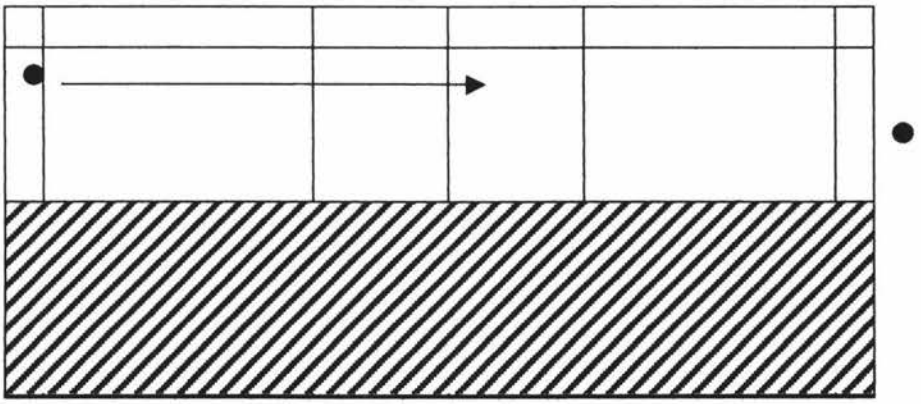
Court -	Short tennis/badminton court out to doubles lines, only mid and back area on each side (behind short service line).
Net -	Short tennis height (.8 - .85 m top middle)
Ball -	Tennis ball (standard pressure)
Rules -	Players cannot step over short service line or a point is deducted. One handed throwing game, underarm throws only, immediate release of ball, one bounce allowed. One or two handed catch, serve from service box to service box – underhand only.
Scoring -	Full tennis scoring

Net Game 5 – Full Court "Court King"



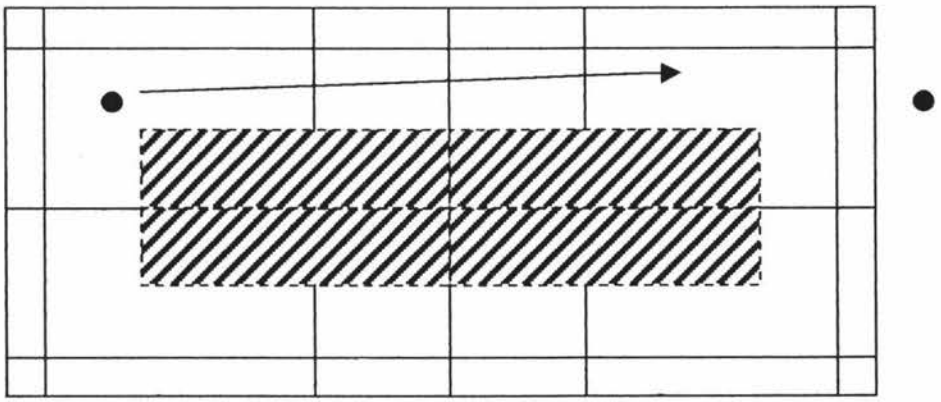
Court -	Short tennis/badminton full court out to doubles lines
Net -	Short tennis height (.8 - .85 m - top middle)
Ball -	Tennis ball (standard pressure)
Rules -	One handed throwing game, underarm throws only, immediate release of ball, one bounce allowed. One or two handed catches, serve from service box to service box (underarm serve only).
Scoring -	Full tennis scoring, introduce information about sets and matches

Net Game 6 – Half Court Short Tennis



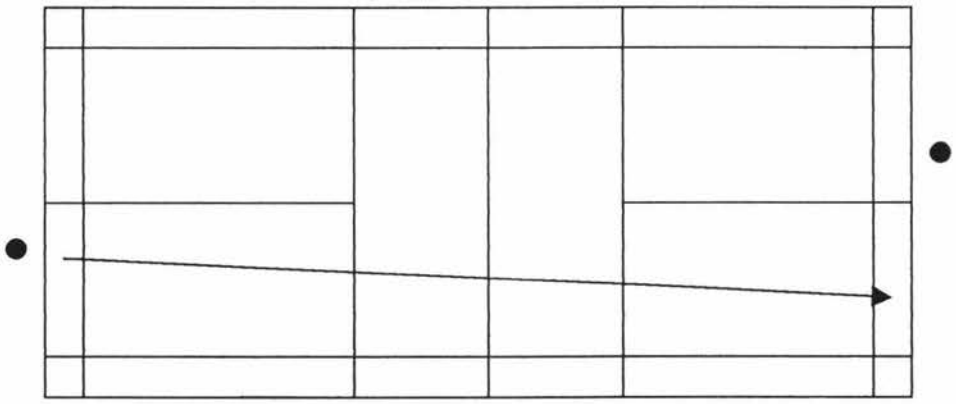
Court -	Half court (long and narrow) out to doubles line on one side
Net -	Short tennis height (.80 - .85 m top middle)
Ball -	Foam short tennis ball, short tennis racquets (plastic)
Rules -	Full tennis rules, tennis striking game, serve from service box to service box (over or under arm).
Scoring -	Full tennis scoring

Net game 7 - Full Court Short Tennis – "No Zone"



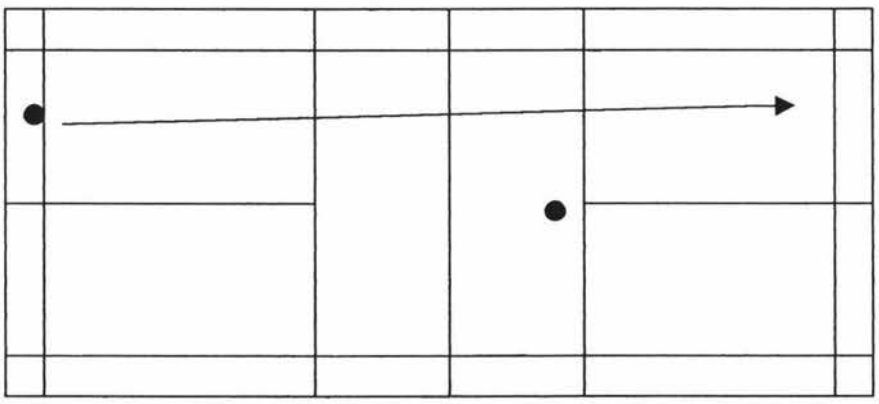
Full court short tennis with standard racquets and a foam ball. However a "no zone" is marked out with tape or chalk (see above), students aim to move opponent around without bouncing the ball in this area or they lose the point. Otherwise scoring is as normal.

Net Game 8 – Short Tennis (modified scoring)



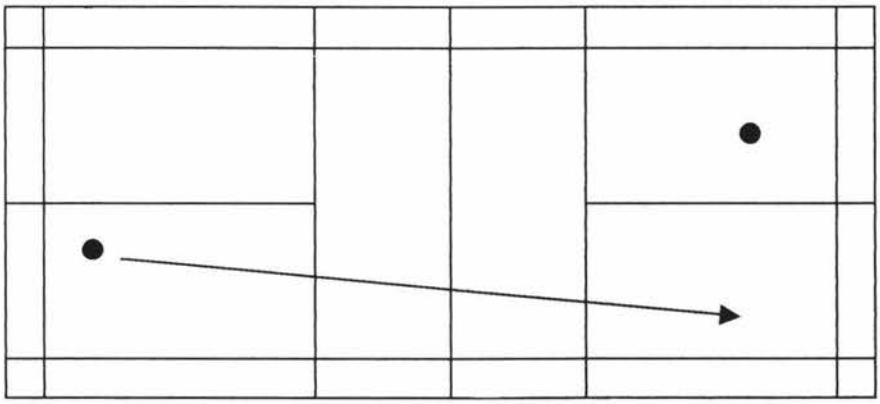
Full court short tennis with normal racquets and a foam ball. There is one rule change – if a player finishes a point with a net attack and a volley or smash they get two points (e.g. from 15 through to 40 or from love to 30 in one rally).

Net Game 9 – Short Tennis (modified scoring)



The same as game 8, but in this game the defending player gains two points if there is an error from a net attack. If the error is from the back court, one point is allocated as usual.

Net Game 10 – Short Tennis



Court -	Short tennis/badminton full court out to doubles lines
Net -	Short tennis height (.80 - .85 m top middle)
Ball -	Foam short tennis ball, Normal tennis racquets
Rules -	Full tennis rules, serve from service box to service box (over or under arm).
Scoring-	Full tennis scoring

Example Discussion Questions (Game Appreciation, Tactical Awareness and Decision-making Development).

The following is a series of questions that promote strategy and tactical thinking in relation to the TGFU net game progression. Some are applicable in the earlier generic games and others in the more specific short tennis modified games. These are used in conjunction with student questions and perceived game challenges arising from playing each game.

What is the aim of the game, what are you trying to do to score points?
Land the ball in open space, force my opponent to make an error.

How can we best achieve this?
Use the front and back space, move your opponent around to open up a space. Making them stretch and run to force an error.

What are the best options if an opponent is at the net?
Throw to the back court, deep and /or high above their head.

What are the best options if an opponent is back on the baseline?
Throw to the front court.

What type of throws can we use?
Flat and deep, high and deep, drop over net, downward throw from up at the net.

The wider full sized court introduces the need for long/short throws and/or left/right throws to move an opponent; it gives the attacker more options for placement.

What types of throws are beneficial?
Depending on where the opponent is – short drop throws (left and right), long flat throws to the baseline and across court (left and right) and high deep throws (lobs).

What are some other things (as well as placement) you can do to throws to make them hard to return?

Throw them hard to reduce reaction time.

Vary the speed and height of your throws to confuse your opponent.

Use spin.

Why do we want to get to the ball quickly?

Cut down the time running, give us time to make a planned throw/shot.

What is a good position to be in to move quickly and help your chances of getting to the ball?

Wide stance, weight on front of both feet so you can move either way, racquet up, head up - looking at the ball.

Do you think it is harder for your opponent to attack you from the baseline or the net?

The baseline.

Why?

They have further to throw and this gives you more time to get back in position.

They have fewer angles to use and more chance of making errors with a longer throw.

They cannot take the ball early and on the full.

How do you send your opponent to the baseline?

Deep throws, flat and with varied angles to move them around at the back of the court.

Where is the best place to try and position yourself after you have thrown the ball?

Middle of baseline area (back court) or the middle of front court in front of the short service line.

Why is the middle of the mid-court not the best place to return to after a throw?
This is called "no mans land" The ball is often bouncing around this area from a deep throw making it difficult to catch and decide whether to take it on the full. It is hard to get in position and move to the ball. This position is best for movement from the back to the front court but not for staying in.

When is it a good option to move to the mid baseline (defensive) position after a shot?
When you have been forced back by a shot.
When you have played a weak shot to the mid-court.

When is it a good option to move to the mid front court (attacking) position after a shot?
When you have been brought forward to the front court by a short shot from your opponent it is easier to keep going forward than to try and turn and get back.
When you have played a deep shot (groundstroke or lob) to give yourself time and force your opponent back.

What is the best place to attack from?
The net (front court).

Why?
You have less distance to hit your shot and you can play it above the net line so there is less chance for error.
You give your opponent less time to recover between shots.
You have a wider range of available angles in which to place your shot to win the point or force an error.

Where is the best area to place your shot if you are going to come to the net?
To the baseline (back court), deep, to the backhand side.

Why?

This gives you more time to move to the net.

This gives you open space at the front of the court as you send your opponent deep.

It gives your opponent less angle and chance of hitting the ball past you or over you.

The backhand is generally a tougher shot so you place more pressure on your opponent.

What shots become important for a successful net attack?

Forehand and backhand groundstrokes, volleys (backhand and forehand).

Is it best to try and get to the net all the time? – Why or Why not?

What can happen if you move to attack off a short approach shot?

Your opponent has a lot more time to move up and make a shot under less pressure.

Your opponent has more angles available to them, as they are closer to the net.

There is more chance of your opponent returning a better shot.

What are your best options when your opponent comes to the net for an attack?

Place the ball over and behind them.

Place the ball past them on the left or the right so the can't get to it or they have more chance of making an error.

When you place the ball high and over them, which side is a good option to aim for?

Their backhand side, this forces a backhand smash which is a tougher shot than a forehand smash.

What is the shot that has the least chance of being successful?

Hitting it straight at them when they are at the net position.

Why?

They are in position and do not have to move for the ball.

What shots become important in defending a net attack?

The defensive lob and the passing shot down the line.

Why is it helpful to have a deep serve?

To force the person to the back court.

Why is it useful to serve wide or down the middle?

To stretch or beat your opponent so they can't get the ball back.

What is the best serve to attack the net from?

A deep serve that keeps your opponent back.

What other things can you do to a serve to make it hard to return?

Hit it hard.

Use spin.

Ideas for discussion questions regarding tactical shot selection in short tennis games.

If I want to move my opponent deep to the back of the court and I am in the back court, What is a good tactical shot to play?

If my opponent is in the left back court and I am at the net, What is a good tactical shot to play from his or her return?

If my opponent has forced me to the back court and assumed the attacking net position, what are my shot options?

If you are going to attack the net, What is a good shot to play as an approach and where should you aim to move your opponent? Why?

If my opponent plays a weak ground stroke which I move to and play at the front of the mid court, What is a good shot option from here? Why?

If I have been stretched wide to the back court and my opponent has stayed on the baseline, What is a good tactical shot option to give me time? Why?

If I am in the front court and my opponent forces me back with a lob over my head and he/she comes to the net what are my shot options?

If my opponent is stranded in the mid court and does not move back or forward, What are my tactical shot options? Why?

APPENDIX B: SKILL-BASED SHORT TENNIS TEACHING UNIT OUTLINE (LESSONS 1 - 8).

Publications used for teaching points, warm up ideas and skill drills included: Brown, (1989), The Hillary Commission (1991) and The Lawn Tennis Association (2001).

Lesson 1

Warm up – jog, stretches, racquet and ball control drills
Skill Focus–Ready position, Footwork, Forehand ground stroke

Teaching Points

Grip – Eastern forehand is most common (shake hands grip). Students pretend they are shaking hands with the racquet. The palm is on the side of the racquet with the thumb over top. The alternative grip (not as common) is the semi-western; here the palm of the hand lies underneath the racquet so students must turn their hand around the outside of the racquet. This is a good grip for topspin. If a student finds it more comfortable they can use it.

Ready position – This is the position taken between shots so you are ready to turn either way to play a shot and get to the ball quickly.

* Feet shoulder width apart
* Body bent over toward racquet
* Knees slightly bent with weight on balls of feet
* The racquet should be held in the forehand grip with one hand and the other up on the throat of the racquet
* Focus eyes on opponent

Drill – Students hold the racquets down by sides when you call "ready" they move quickly into the ready position

Drill – To emphasise shuffle step to move short distances to the ball. Students get in pairs and stand about 5 metres apart, they roll a ball to each other to left and right, when they move to the ball they shuffle without crossing their feet, emphasise quick movement and keeping knees low.

Forehand groundstroke – This shot is the most common in tennis, it is played when the ball comes to the side of your racquet hand from the bounce.

Forehand Skill Breakdown.

* Ready position
* Take racquet back and turn hips side on to the ball
* Draw racquet back and then downward with bodyweight on back foot
  (Cue - over the rainbow, fingers in the pot of gold)
* Step forward with front foot and turn hips to transfer weight
* Bring racquet through swinging in a low to high motion (cue - throw the gold)
* Contact ball in front of leading hip at approx waist height
* Wrist remains firm, follow through high to opposite shoulder

Teach this in steps without the ball until students can get a reasonable swing going and learn to get back to ready position in between shots. Students should move as quickly as possible from learning the stroke in steps to putting the whole swing together till it begins to feel comfortable.

Forehand drills –a good structure for larger numbers is to have students hitting to each other over the net and aiming to keep the ball on their partner's forehand side. Challenges can include how many shots can you get in a row and also placing cones toward the back of the court providing an area to aim for. Another structure is to have two feeders of balls on each court and once a student plays a shot they go and get their ball and place it back by the feeder.

Use accuracy drills and drills that encourage developing a good firm shot as well, sometimes it is good for students just to practice the swing and get it feeling right without too much concern about where a ball lands.

Lesson 2

Warm up – Jog, stretches and racquet drills
Skill Focus – Forehand continued, ready position and backhand groundstroke.

Teaching Points

Grip – Eastern backhand is used for this stroke, it is important to get students used to this grip even if it feels a bit uncomfortable because it produces a much more accurate and firmer backhand. For the grip you turn your hand inward until your thumb sits diagonally across the back of the handle.

Get students moving from the ready position to this grip and ready to take the racquet back to the backhand side (this involves using their free hand to adjust their grip as they bring the racquet back

The two-handed backhand grip involves the hand nearest the racquet taking an eastern forehand or a continental/chopper grip and the front hand an eastern forehand grip.

Let students try both grips and practice getting into the correct position from the ready position. If a two handed backhand is going to be played, hands should be touching in the ready position. If it is a one-hander, hands should be slightly spread to allow the front hand to guide the racquet when changing the grip.

Backhand groundstroke – A stroke played when the ball bounces on your non-racquet hand side – this forces you to step and play the ball across your body. It is considered more difficult to play than the forehand groundstroke.

Backhand Skill Breakdown

* Ready position
* Take the racquet back early and change grip using front hand for support
* Turn shoulders and hips to become side on
* Draw the racquet back and across your body with weight on your back foot
* Step forward with front foot and turn hips through
* Bring the racquet through in a forward swing from low to high with firm wrist
* Contact the ball slightly in front of leading hip and drive up with knees
* Follow through high extending arm forward (remain side on)

The two-handed version is very similar but the ball is hit slightly closer at a comfortable arms length for the two handed grip. The follow through is high and the arms follow up to the shoulder

The following cues can be helpful for students when learning the backhand:

Set up "can of coke" – students imagine there is a can of coke sitting on the top of their racquet during the backswing – this helps keep the racquet in line and controlled

Swing and contact "ski Lake Taupo" – students skim the racquet as if going along the top of the water as they bring it forward and shift their weight

Follow through (one hander) "to the beach" – students bring the racquet through and point it straight out in front of them remaining side on. You can also use "no aeroplanes"- if students come around so their arms are out at their sides they have moved too far on the follow through

Follow through (two hander) "scratch and win" – students bring the racquet up with two hands till they can scratch the back of their shoulder in a high position.
Let students go through the swings without the ball and practice returning to the ready position

When you introduce a ball and let them practice in pairs let them try both shots and decide which one they like best and are going to stick with, this allows them to focus on one shot

Point out the advantages and disadvantages of each stroke
A one handed backhand allows for greater reach to the ball but less control
A two – handed backhand has to be played closer to the body so you have to be in position earlier, but it does give more control and power

When they have selected their preferred backhand move into technique drills and finish with game of short tennis where they get plenty of quality practice at their chosen shot

Emphasise both forehands and backhands and the racquet set up in between shots.

Introduce the scoring structure of tennis; let students serve under or over arm at this stage of skill development.

Lesson 3

Warm Up – Jog, stretches and ball tag with foam balls
Skill Focus – Backhand continued, ready position and forehand volley.

What is a volley? A shot played before the ball bounces usually from the front of the court. It is the easiest shot in tennis but it is made difficult because you have less time to get in position to play it.

Teaching Points

Grip
Chopper /continental – used for the serve also. This grip allows for the playing of forehand and backhand volleys. To get the correct grip, students get into a forehand grip (shake hands) and move their hand around until their palm just sits on top of the handle.

Forehand volley skill breakdown

* Ready position
* Take a short backswing (the racquet should go back no further than the shoulder)
* Step forward with your opposite foot to transfer weight
* Contact the ball when it is level with your front foot and a little to the side of you
* Keep your wrist firm and "punch" at the ball
* Do not follow through, return to ready position

Cues – "back" "step" "punch" "return"

The emphasis is on speed of footwork and a short "jab" at the ball, when players take huge swings accuracy and balance is lost for this stroke. The wrist should aim to be kept above the elbow for a downward angle. Let the students practice without the ball and then up against the wall, check grips and that they are stepping with the correct foot to keep balanced. Work through the volley drills.

Lesson 4

Warm Up – Jog, stretches and ball tag with foam balls.
Skill Focus – Forehand volley continued and backhand volley.

Teaching Points

Grip
Same as forehand volley, if students continue to take a "shake hands" forehand grip they will find this shot very difficult.

Backhand volley skill breakdown

* Ready position
* Short backswing (keep your front hand on the racquet for support)
* Step forward with your racquet hand foot to transfer weight
* Contact the ball when it is level with your front foot and a little to the side of you
* Take your supporting hand away as you punch the ball
* Do not follow through, return to ready position

Same cues as the forehand volley apply.

Again students can practice without the ball and using a wall, followed by volley drills and short tennis games to finish if desired.

Lesson 5

Warm Up – Jog, stretches and dodge ball with foam balls.
Skill Focus – Backhand volley continued and the overarm serve.

What is the serve?
The serve is the shot which starts play after every point it is taken from behind the baseline and must land in the service box. The most powerful serve is the overarm serve because it allows you to get more of a downward angle on the ball.

Teaching Points

Grip – Beginners will often use the semi western (shake hands grip) but the ideal grip is the continental or chopper (see previous lesson). This involves moving your hand around inwards until your palm is on top of the racquet (as if you were chopping wood with the racquet).

Serve Skill Breakdown

* Ready position – grip, stand side on behind baseline, feet shoulder width one behind the other
* Begin with the ball and racquet held together in a relaxed position in front of you
* Bring your ball hand forward and up and your racquet hand backward and up together
* Throw the ball up and slightly in front of you at the top of your reach (throw it higher than you can reach with your racquet)
* Bring your racquet hand back behind you ready to throw it forward and strike the ball as it hits the top of its throw and begins to fall
* Bend your knees and throw the racquet forward, contact the ball in front of you with a fully extended body, arm and racquet
* Follow through forward and down in the direction of the ball

  Cue – "arms up together" "scratch your back" and "throw" racquet

Students can practice the ball toss separately and the swing without the ball before attempting to put the whole movement together.

The serve takes a lot of practice so use a structure where students get as much chance as possible, also you could use peer teaching whereby students work in twos or threes and give each other feedback on technique by identifying key points of the serve.

Students could begin by serving at the wall and move into a court/game situation for practice. All students should now be encouraged to serve overarm to start play.

Lesson 6

Warm Up – Stretches and gauntlet run (foam balls).
Skill Focus – Overarm serve continued and the drop shot.

Teaching Points

Serve – see previous lesson and drills.

The drop shot – a disguised shot that lands in the front court area making it hard to retrieve.

Drop Shot Skill Breakdown

* Take the forehand or backhand grip and turn side on to the ball
* Bring the racquet back and through as with a normal forehand
* As you are about to make contact reduce racquet speed and touch the ball lightly
* Take a short slow follow through

Skill extra – slice down on the back of the ball as you make contact to apply backspin which slows the ball up even further.

Students should get lots of practice in drop shot drills reducing the pace on the ball and disguising this shot from the forehand and backhand sides.

Lesson 7

Warm up – stretches, racquet sense and control drills.
Skill Focus – Backhand and forehand lobs and smash.

Teaching Points

The lob is a shot played similar to a backhand or forehand drive but emphasis is placed on reducing the pace of the ball and putting it high in the air.
The smash is a shot played on the full from a ball that is higher than your head, it involves generating a lot of power and a downward angle to try and finish the point.

Lob skill breakdown

Same as forehand and backhand drives except:
* Open the racquet face more when you make contact to send the ball high
* The swing starts off a little lower to get under the ball and gain "lift"
* The follow through is a little higher

Skill extension – brushing up the back of the ball puts topspin on the lob.

Smash skill Breakdown

* Ready position
* Move back with a sideways movement or forward until you are underneath the ball
* Position yourself side on to the ball and point at it with your non –racquet hand outstretched
* Bring your racquet back and "scratch your back" as with the serve
* Throw the racquet head at the ball in a downward direction
* Follow through in the direction of ball and recover to the ready position

Cue – "point at ball" "scratch back" "smash"

Students can do some forehand and backhand drills for the lob and practice changing from one shot to another, include drills involving both the lob and the smash for practice. Students can also work through some smash drills on their own practicing their timing when the ball is coming down from height.

Lesson 8

Warm Up – Jog, stretches, racquet sense drills.
Skill Focus -Lob and smash continued and tournament play

Teaching Points

See lesson 7 for lob and smash teaching points.

This is the final lesson so provides a chance to revisit any skills and drills if you wish, a good way to finish would be to set up a tournament situation for students to apply their skills in short tennis games.

APPENDIX C: DECLARATIVE KNOWLEDGE TEST.

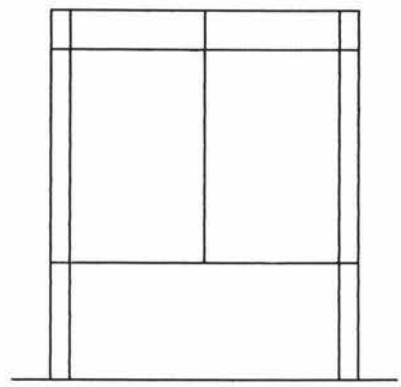
Name:

Please answer all questions as best you can. Write them on the question paper. The answers are the same for both short tennis (indoors) and normal tennis.

On the half court diagram below, please complete the following:

1 Draw an "**X**" where you think you stand to serve at the beginning of a game.

2 Draw an arrow to and label the "baseline"



3 If the ball lands on a part of the line in tennis is it in or out?

4 How is a game of tennis scored? – Fill in the score given for each point below.

1st point	2nd point	3rd point	
_____	_____	_____	Game Won

5 What is "deuce" in tennis scoring?

6 A normal "set" of tennis is the first player to win ___ games.

7 "Matches" are usually finished when a player wins the best of ___ or ___ sets.

8 You can win a point in tennis if your opponent does a number of things, list as many as you can.

9 What are the strokes/shots used in the game of tennis, List as many as you can?

10 What are the "tactics" you can use in tennis to help you win, list as many as you can under the two areas below?

"Attacking" Tactics (when you are hitting the ball)

"Defending" Tactics (when you are waiting for the ball to come back on your side of the court).

APPENDIX D: GPAI CODING SHEET.

Player: Pretest / Posttest

Codes

Adjust - A (Appropriate), IA (Inappropriate)

Decisions Made - A (Appropriate), IA (Inappropriate)

Skill Execution
(Contact and Outcome/Execution) - E (Efficient), IE (Inefficient)

ADJUST		DECISIONS MADE		SKILL EXECUTION			
				Contact		Execution/Outcome	
A	IA	A	IA	E	IE	E	IE

APPENDIX E:

Table 30 – GPAI Scores of Students Classed as High and Low Ability.

High Group

Player	Adjust	Decisions Made	Skill Contact	Skill Outcome
1	4.25	2.32	7	1.88
2	1.09	2.71	34	1.69
3	0.81	2	20	2.32
4	0.59	1.45	25	2.13

Low Group

Player	Adjust	Decisions Made	Skill Contact	Skill Outcome
1	0.46	0.17	1.5	0.03
2	0.06	0.65	3.88	0.11
3	0.25	0.31	2.13	0.04
4	0.25	0.34	0.89	0.26

APPENDIX F: KNOWLEDGE TEST MARKING CRITERIA.

Rules/Scoring

1 "X" drawn behind the baseline on the right side of the court (left when viewing) between the centre line and the outside singles line. (1 mark).

2 The baseline is the back line of the court, running horizontally (1 mark).

3 The ball is in (1 mark).

4 1st point – 15, 2nd point – 30, 3rd point – 40 (1 mark).

5 Both players on 40 points together (1 mark, 1/2 marks allocated).

6 The first player to win 6 games (1 mark)

7 The best of 3 or 5 sets (1 mark, ½ marks allocated)

8 Double faults on service
Misses the ball/ mishits the ball
Hits the ball out of court
Doesn't get to the ball before the second bounce
Hits the ball into the net
(5 marks, 1/2 marks allocated)

Strokes/Shots

9 Serve, forehand groundstroke, backhand groundstroke, smash, lob, volley, drop.
(7 marks, ½ marks allocated).

Strategies

10

A - Move the other player around (vary length and speed of shots).
Hit the ball to an open space on court (dependant on where opponent is)
Keep your opponent back at the baseline (to prevent net attacks)
(3 marks, ½ marks allocated).

B - Move to a defensive mid-court position on or near the baseline (to bisect available shot angles).
Move to an attacking mid-court position at the net from a short shot or deep approach shot (to cut down opponents angles and time).
(2 marks, ½ marks allocated).

APPENDIX G:

Table 31 – Individual Player Knowledge Test Scores for All Categories.

Skill-based Group

Player	A	B	C	D	E	F	G	H	I
Rules and Scoring (12)									
Pre	3.5	11	3.5	2.5	4	4.5	6	7.5	4
Post	4	11	4.5	7	5.5	5.5	7.5	6.5	2
Shots/Strokes (7)									
Pre	0	5	0	0	0	0	0	0	1
Post	2	5	1	1	0	0	1	1	1
Strategies (5)									
Pre	1	2	1	0	0	1.5	1	0	0.5
Post	1.5	3	1.5	0	0	1	1	1	0.5
Overall (24)									
Pre	4.5	18	4.5	2.5	4	6	7	7.5	5.5
Post	7.5	19	7	8	5.5	6.5	9.5	8.5	3.5

TGFU Group

Player	J	K	L	M	N	O	P	Q	R
Rules and Scoring (12)									
Pre	1.5	2	2.5	7	10	8	10.5	3.5	4
Post	4	6	3.5	8	12	8	9.5	8.5	3.5
Shots/Strokes (7)									
Pre	0	1	0	1	3	1	3	1	0
Post	0	2	3	3	5	5	4	2	1
Strategies (5)									
Pre	0.5	1	1.5	1.5	2	1.5	0	1.5	1.5
Post	1	1.5	2	2	3	1.5	0.5	1.5	1.5
Overall (24)									
Pre	2	4	4	9.5	15.5	10.5	13.5	6	5.5
Post	5	9.5	8.5	13	20	14.5	14	12	6

Control Group

Player	S	T	U	V
Rules and Scoring (12)				
Pre	2	2.5	1.5	1
Post	2	2.5	2.5	1
Shots/Strokes (7)				
Pre	0	2	0	0
Post	0	2	0	0
Strategies (5)				
Pre	0.5	2.5	0.5	0
Post	0	2	1	0
Overall (24)				
Pre	2.5	7	2	1
Post	2	6.5	3.5	1

APPENDIX H:

Table 32 – Individual Player GPAI Scores (All Components).

Skill-based Group

Player	A	B	C	D	E	F	G	H	I
Adjust									
Pre	0.58	4.25	0.13	0.3	0.25	0.25	1.09	0.31	0.59
Post	0.63	3.74	0.28	0.52	0.24	0.2	1.97	0.24	0.37
Decisions Made									
Pre	0.7	2.32	0.34	0.58	0.31	0.34	2.71	0.35	3.18
Post	1.63	3.28	0.59	0.45	0.5	0.31	2.26	0.44	2.91
Skill Contact									
Pre	2.43	7	1.78	1	2.13	0.89	34	3.45	4.67
Post	10.3	26.7	4	2.83	5.2	29.3	13.5	9.44	9
Skill Outcome									
Pre	0.71	1.88	0.19	0.15	0.04	0.26	1.69	0.67	0.52
Post	0.55	2.95	0.48	0.1	0.19	0.3	1.56	0.4	1.18

TGFU Group

Player	J	K	L	M	N	O	P	Q	R
Adjust									
Pre	1.21	0.64	0.78	0.81	3.64	0.59	0.61	3.42	1.6
Post	0.85	1.06	0.91	1.48	3.33	1.64	1.09	3.12	2
Decisions Made									
Pre	0.64	0.67	0.54	2	0.48	1.45	1.58	0.88	1.09
Post	0.95	0.81	0.88	1.68	1.68	1.5	1.32	1.13	1.67
Skill Contact									
Pre	12.1	8.83	41	20	14.3	25	16	9	5.88
Post	10.5	58	8	31.5	53	17.6	17.6	15.75	20
Skill Execution									
Pre	0.23	1.03	0.46	2.32	1.42	2.13	0.35	1.07	0.45
Post	0.59	1.07	0.43	2.25	1.57	1.95	0.58	1.09	0.47

Control Group

Player	S	T	U	V
Adjust				
Pre	0.06	0.21	0.37	0.46
Post	0.12	0.18	0.19	0.39
Decisions Made				
Pre	0.65	0.26	0.77	0.17
Post	0.42	0.22	0.55	0.4
Skill Contact				
Pre	3.88	4.6	1.7	1.5
Post	3.33	10.25	2.69	2.63
Skill Execution				
Pre	0.11	0.47	0.21	0.03
Post	0.26	0.45	0.14	0.01

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