Developing Pupils' Performance in Team Invasion Games

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Abstract

Background: To develop pupils' team invasion games (TIG) performance within PE, practitioners have traditionally adopted teacher-centred, skill-focused approaches (Williams and Hodges, 2005). Teaching Games for Understanding (Bunker and Thorpe, 1982) and the Tactical approach (Griffin, Mitchel and Oslin, 1997) are alternative approaches to TIG teaching that aim to develop overall game performance, including decision-making performance.

Purpose: The main purpose of this study was to conduct an ecologically valid investigation into the effects a tactical teaching approach had on game knowledge, game playing performance and pupil perception of decision-making ability compared to authentic teaching in a Scottish secondary school.

Participants and setting: Fifty-two pupils (24 female; 28 male; age = 12.5 $\pm$ 0.3yrs) participated in this study. The pupils were made up of two secondary 1 (S1) classes from a Scottish urban state secondary school. Both classes were heterogeneous in terms of gender and ability and the pupils from each class had similar pre-secondary school PE experiences. Two teachers, Lisa and Anthony took part in this study. Both Lisa (age=23yrs) and Anthony (age=27yrs) had taught in the school for one year.

Intervention: The overall aim for both teachers was to develop the pupils' performance in a game of 4v4 basketball over a 5-week block. The teaching

strategies Lisa used to reach this aim were based on the Tactical approach to teaching games (Griffin, Mitchell and Oslin, 1997). Using pupil-centred teaching strategies such as problem-solving, discussing and reflecting, Lisa's aims were to develop the pupils' tactical understanding and game performance in relation creating space on and off-the-ball to keep possession and progress towards target, re-gaining possession and counter attack, and denying space in the key area. Anthony followed the PE department's guidelines for teaching basketball to improve the pupils' performance in 4v4 basketball. This involved the application of direct teaching strategies to teach the chest pass, the bounce pass, dribbling, the set shot, the jump shot and the lay-up.

Data collection: Data from focus group interviews was gathered in order to elicit pupils' knowledge and experiences of learning to play TIG. The pupils were recorded on video before and after the intervention to determine any differences in game playing performance between groups. Finally, a questionnaire was administered in order to establish the pupils' perception of their own decision-making abilities both on and off-the-ball.

Data analysis: The focus group interview data were analysed by two experienced researchers who identified key experiences (or bodies of knowledge) about basketball that the pupils in each group discussed. In order to analyse the participants' game performance in offence both on and off-the-ball, their tactical decisions were coded as 'good' or 'poor', and their on-the-ball skill execution was coded as either 'successful' or 'unsuccessful'. The questionnaire data were analysed

using a mixed design two-way repeated measures ANOVA to test for differences between the two groups in their perception of decision-making ability.

Findings: During the focus group interviews, the group that took part in the traditional, more skill-focused, lessons discussed the technical components of basketball skills, and the pupils from the game-based lessons discussed the different principles of play that they applied during practices and games. The 4v4 game performance data demonstrated that the game-based group made significantly more good decisions on and off-the-ball compared to the skill-focused group. There were no significant differences between groups post intervention in terms of on-the-ball skill execution. The pupils in the game-based group believed that their decision-making abilities both on and off the ball had improved. In contrast, the class that took part in the skill-focused lessons believed that their decision-making abilities had deteriorated over the five-week period.

Conclusion: The findings from this research provide valuable information in relation to the learning outcomes produced by different teaching approaches during an investigation high in ecological validity. In order to further our understanding teaching TIG, future research should examine the teaching and learning *processes* involved when adopting such approaches.

Keywords: Game-based; Skill-focused; Decision-making; Off-the-ball; On-the-ball.

Introduction

Team invasion games (TIG) such as hockey, rugby and soccer play a very important, and prominent role within the Scottish Physical Education (PE) curriculum. Not only do they have a key role to play from a historical and cultural perspective (Bairner, 2000; Massie, 2000), but also from the point of view that successful performance in TIG requires the development of important cognitive, affective and psychomotor skills (Mandigo and Holt, 2004). Consequently, improving pupil performance in TIG should be one of the main aims of teaching in PE. Additionally, improvements in performance can lead to improvements in perception of competence, which is particularly important because those pupils high in perception of competence are more likely to apply more effort to learning, and continue to participate in PE and physical activity (Deci and Ryan, 2000; Papaioannou et al., 2006).

In order to develop pupils' TIG performance within PE, they have traditionally been taught using a teacher-centred, skill-focused approach (Williams and Hodges, 2005). The aim of this approach is to provide pupils with the opportunity to develop and refine skills in isolation from the game before attempting to apply them in game contexts. The skills are usually practiced in a 'drill' format so that the pupils can focus on key technical components of the skill in order to replicate a model performance provided to them by the teacher (Williams and Hodges, 2005). The teacher facilitates this process by providing the pupils with feedback linked to predetermined technical components of the skill. One of the problems with this traditional approach to TIG teaching is that when the skills are presented in isolation from the game context, pupils do not develop an understanding of the situations during the game that necessitate the application of such skills, in other words, they do not develop decision-making skills.

The decisions that have to be made about the most appropriate skill to execute, and how to execute it, are cognitive in nature. They are based on the players' knowledge of the game, its objectives, principles, and the tactics associated with the game and the team (Vaeyens et al., 2007; Williams and Davids, 1995). Grehaigne, Richard and Griffin (2005) identified three critical elements in relation to developing game knowledge and performance, namely observation, critical thinking and transformation. They describe how pupils develop their game knowledge firstly by

making their own observations about the game or the learning environment. This provides them with data upon which they can reflect. Such refection involves critical thinking, where they apply various processes such as planning, strategy and/or evaluative reasoning in order to make a decision about the task at hand. Satisfactory decisions, and the reutilisation of satisfactory decisions, results in transformation, whereby new knowledge is learned and able to be adapted and applied to new situations to solve new problems.

From a TIG perspective, skills such as observing, reflecting and applying, are indicative of teaching approaches such as Teaching Games for Understanding (TGfU) (Bunker and Thorpe, 1982) and the Tactical approach (Griffin, Mitchell and Oslin, 1997). Although these approaches differ slightly in terms of the way teaching is structured, the aim of both methods is to develop game understanding through tactical awareness and game appreciation. The role of the teacher is to select the tactical problem that has to be addressed and the learner works out the most appropriate game specific motor skills required to solve the problem. These skills are developed through question, answer and active participation in the game or game-like activity. The teacher has a less direct role in the learning process and pupils are given more responsibility for their own learning. Kirk and MacPhail (2002) claim that learning in this type of environment enables pupils to develop 'clusters of capabilities', for example perceptual, strategic and technical capabilities that are required to be successful during games play. Teaching approaches such as TGfU and

the Tactical approach aim to facilitate the development of such capabilities by encouraging pupils to work within small teams or groups so that they can collectively and publicly share ideas and solve authentic problems. Such verbalisation of ideas (before, during and after task performance) is very important because it can enhance pupils' game knowledge, and result in improved efficiency in performing tasks (Caverni, 1988; Schunk, 1986).

This reflects both a constructivist and a situated perspective on learning, both of which emphasise the interactions of the learner within the environment in the construction of knowledge. In highlighting this more multifaceted view of learning, Light (2008) describes 'complexity theory', based on the premise that, although there are different types of constructivism, they all revolve around three key tenets. Firstly, that learning is an ongoing process of adaptation shaped by the learner's experiences. Secondly, that cognition is both an individual process and a social process, and finally, it rejects objectivist views of learning that knowledge is an internal representation of an external reality and accepts that 'learning involves interpretation in which there is no pre-given external reality' (p. 28). Both constructivism and situated learning theories have been used to explain the processes that underpin TIG performance in PE. However, although they provide a useful explanation of how game knowledge is acquired, they do not provide adequate information in terms of how functional *movements* emerge during performance. Chow et al. (2007) refer to constraints theory to explain how TGfU lessons can facilitate improvements in game

185 performance. Like constructivism and situated learning, this theory supports the
186 notion that human intentions are 'embodied' and constrained by a number of factors
187 including mind, body, social and biological contexts (Davids et al., 2008). However,
188 constraints theory also proposes that movements emerge from the interaction of these
189 constraints with the task (the equipment, rules and boundaries of the game) and the
190 environment (the surface, weather, light). When teachers modify games (manipulate
191 task constraints), set problem-solving tasks and apply questioning techniques, pupils
192 explore a variety of movement solutions within authentic contexts and, as a result,
193 goal-related, decision-making behaviours emerge without the need for prescriptive
194 instructions (Chow et al., 2007).
195
196 Both constructivist theories and constraints theory have been used to explain the
197 positive results that have emanated from TGfU-based research. Generally, such
198 research has found that learners developed better tactical knowledge, as well as
199 increased enjoyment and intrinsic motivation, when compared to more traditional
200 skill-based approaches (Allison and Thorpe, 1997; Jones and Farrow, 1999;
201 Rovegno, Nevett and Babiarz, 2001; Turner and Martinek, 1999). However, some of
202 the research that has investigated the effects of tactical approaches on players'
203 performance has provided equivocal results. This is partly because of the artificial
204 and inauthentic teaching methods that have been investigated (Chow et al., 2007), for
205 example, teaching only techniques then tactics or only tactics then techniques
206 (McMorris, 1998). There is a need, therefore, for more ecologically valid research

that integrates theory with practice to further enhance our understanding of games teaching approaches within PE.

Consequently, the main purpose of this study was to investigate the effects a game-based teaching approach had on game knowledge and performance of a group of secondary 1 pupils (S1; ages 12-13) from a Scottish state secondary school. A secondary aim of this study was to investigate the effects of this approach on the pupils' perception of their decision-making ability.

Method

Participants

Fifty-two pupils (24 female; 28 male; age = 12.5 $\pm$ 0.3yrs) participated in this quasi-experimental study. The pupils in this study were made up of two secondary 1 (S1) classes from a Scottish urban state secondary school. Both classes were heterogeneous in terms of gender and ability and the pupils from each class had similar pre-secondary school PE experiences. Twenty seven pupils took part in the 'game-based' lessons (11 female; 16 male; age = 12.5 $\pm$ 0.3yrs) and twenty five pupils took part in the 'skill-focused' lessons (12 female; 13 male; age =12.5 $\pm$ 0.2yrs).

Two teachers, Lisa and Anthony took part in this study. Both Lisa (age=23yrs) and Anthony (age=27yrs) had taught in the school for one year. This was Lisa's second

year and Anthony's first year teaching as qualified teachers. Both teachers had a background in coaching and playing soccer and attended the same Edinburgh based Initial Teacher Education Institution.

Permission to survey, interview and video the pupils was obtained from the Head Teacher and all of the pupils provided informed parent/guardian consent to take part in this study. Informed consent to take part in this study was also obtained from both of the teachers, and pseudonyms were used in order to ensure teacher anonymity. All of the participants were told that their involvement was voluntary, that they were free to withdraw at any time and were assured that their responses would remain confidential. The study protocols were approved by the Ethics Committee of the University of Edinburgh, Scotland.

Setting

The urban state school in this study was selected because 96% of pupils in Scotland attend state schools and the greatest proportion of pupils in Scotland attend schools in 'large urban areas' such as Edinburgh (36%). Smaller proportions of pupils attend schools in 'other urban areas' (32%), 'accessible urban areas' (12%), 'small rural towns' (4%), 'accessible rural areas' (11%) and 'remote rural areas' (5%) (Scottish Executive, 2007). Moreover, the pupils in this school were representative of all socio-economic levels and ethnicity (Scottish Executive, 2007). Additionally, the PE content covered followed the 5 – 14 Expressive Arts Guidelines and the Standard

Grade curricula for Scottish primary and secondary schools (SOED, 1992; SEB, 1988). The activities taught during the academic year for S1 pupils comprised of dance, gymnastics and games, including the TIG soccer, rugby, hockey and basketball. The school offered a variety of extra curricular activities, although the most popular activities were soccer, rugby and hockey.

Intervention

Game-based approach

Lisa taught a five-week block of basketball based on the Tactical approach to teaching games (Griffin, Mitchell and Oslin, 1997). Lisa had some previous experience of teaching in this way as an undergraduate PE student, where she completed an eleven-hour module that focussed on games-based approaches to teaching games. However, as this was Lisa's only experience, she was guided through the planning stage of each lesson by the lead researcher who had seven years experience teaching and researching tactical approaches to teaching games. The overall aim of the five-week course was to develop the pupils' performance in a game of 4v4 basketball. More specifically, the aim was to develop the pupils' ability to create space for themselves and/or the ball carrier in order to move towards the target and score. Thus, the tactical elements Lisa focused on were: creating space on and off-the-ball to keep possession and progress towards target, re-gaining possession and counter attack, and denying space in the key area.

The Tactical approach to teaching TIG emphasises tactical understanding and the development of motor skills as a means of solving tactical problems within a game-practice-game format. The teacher decides on the tactical problem that has to be addressed and presents games and practices that both emphasise the specific tactical problem, and maintain varying degrees of contextual relevance. In order to facilitate the pupils' understanding of the problem, Lisa encouraged them to observe demonstrations and posed open-ended questions. She also asked the members of each team to share, apply and evaluate ideas until they agreed on the most effective solutions to the problem. Importantly, she also encouraged the teams to search for movement solutions to the problem. Thus, in attempting to satisfy the constraints of the task (conditions of the game), goal directed behaviour emerges without the need to provide explicit and prescriptive instructions. A summary of the first lesson of the five-week block can be seen in appendix 1.

Skill-focused approach

This group was taught by Anthony, who delivered a five-week block of basketball that followed the PE department's programme for teaching basketball. His overall aim was the same as Lisa's, namely, to develop the pupils' performance in 4v4 games. Anthony intended to achieve this aim by teaching the chest pass, the bounce pass, dribbling, the set shot, the jump shot and the lay-up. Anthony was not guided in any way by the researcher. His objective was to use his own knowledge and beliefs

about teaching to deliver the programme set out by the PE department. A summary of the first lesson of this five-week block can be seen in appendix 2.

In order to interpret and understand the teaching approaches used by both teachers, the lead researcher observed each lesson. To support these observations, and ensure face validity, the teachers were interviewed after each lesson to encourage them to discuss and explain their teaching strategies. The results from this process form part of a related study that aimed to further examine and understand their teaching behaviours during each lesson (Gray, Sproule and Morgan, in press).

To enhance the ecological validity of this study, there were no changes made to the pupils' pre-determined time-table, hence basketball was the focus activity and all of the lessons took place once a week and lasted one hour and twenty minutes. The time available for on-task activity was reduced to approximately 60 minutes to allow time for changing and administrative duties. The S1 basketball blocks took place during the term from January to March.

Data Collection

Focus group interviews

From the 52 participants involved in this study, a stratified random sample (Cohen, Manion and Morrison, 2000) of eight pupils from each class (8 female; 8 male) took part in focus group interviews. All of the interviews took place in a classroom free

316 from distraction. Due to the time constraints placed upon the pupils by their
317 curricular commitments, each focus group interview only lasted for approximately 20
318 minutes. The classrooms were set up so that the pupils sat in a semi-circle and desks
319 were removed in order to create a less formal environment. All interviews were
320 recorded using an audiocassette recorder and transcribed verbatim.
321
322 The aim of the focus group interviews was to encourage the pupils to discuss their
323 experiences when learning to play basketball during PE lessons and their knowledge
324 about the game of basketball (Kitzinger, 1995). The questions posed to the pupils
325 during the pre-intervention focus group interviews encouraged them to discuss their
326 experiences of learning to play basketball when they were in primary 7 (aged
327 between 10 and 11). The post-intervention focus group interviews encouraged the
328 pupils to discuss their learning experiences during the five-week block of basketball
329 (see Appendix 3 for guidelines). Probes were used where necessary in order to seek
330 elaboration and/or clarification on key issues raised by the pupils (Finn, Elliot-White
331 and Walton, 2000) and to ensure that all of the pupils contributed to the discussion.
332 Additionally, at the end of each question, the pupils' comments were summarised to
333 check for understanding and accuracy, and notes were taken to highlight the key
334 issues raised by the pupils.
335
336 *4V4 games performance*

In order to ascertain whether or not the pupils' playing performance had been influenced as a result of the basketball lessons, eight pupils from each class were recorded on video playing a ten-minute 4v4 basketball game, both the week before and the week after the basketball block. The teams consisted of the same pupils from the focus group interviews. The players in each team were the same for both games and each team played against the same opposition. The only exception to this was the post block game for the game-based group. On the day of filming, one of the boys from the sample was absent and, as a result, the class teacher selected another boy from the same class to take his place.

The tactical skills inventory

In order to gather information about any changes in the pupils' tactical knowledge, all of the pupils (n=52) had to complete a modified questionnaire both before and after the block of basketball. The modified questionnaire derived from the Tactical Skills Inventory for Sport which has been previously been tested for internal consistency, test-retest reliability and construct validity (Elferink-Gemser et al. 2004). This is a self-reporting, 13-item, inventory designed to measure an individual's perception of his/her ability to perform the right action at the right time (tactical skills). It is made up of a series of game situations, both on and off-the-ball, in attack and in defence. The situations are sub-divided into four categories including: knowing what to do when your team has the ball; knowing about other players in the game; making decisions (with the ball and without the ball), and; being ready and able to adapt when possession changes. The only change to the stem of the

questionnaire was the modification to relate to the game of basketball and it was organised using a structured alternative format (Harter, 1982). An example is shown below:

Knowing what to do when your team has the ball.

Really true for me	Sort of true for me			Sort of true for me	Really true for me
	✓	I always know exactly when to pass to a team mate and when not to	Or	I almost never know exactly when to pass to a team mate and when not to	

The purpose of the Tactical Skills Inventory was explained to the pupils and they were given five minutes to read the questionnaire instructions. They were reminded that the information they disclosed would be confidential and anonymous, and they were encouraged to be as honest as possible. All pupils were given as much time as they needed to complete the questionnaire and were supported whenever they required assistance. It took approximately 10 minutes for the pupils to complete the questionnaires.

Data Analysis and Results

Focus Group Interviews

The two researchers involved in the process of analysing the data generated by the focus group interviews were both experienced PE teachers and used this experience, knowledge and background to analyse the data in a responsive, adaptive and holistic way (Maykut & Morehouse, 1994). The first stage of analysis involved reading and re-reading the transcripts by the lead researcher, in order to become familiar with the pupils' responses. The second phase of the analysis involved the identification of key experiences or bodies of knowledge about basketball that the pupils in each group discussed. Reference to the field notes that were taken during the interviews supported this process. The third phase of this analysis involved the independent identification of the pupils' experiences and knowledge by a second researcher. Finally, both researchers discussed their findings in order to come to a consensus about their interpretation of the pupils' responses and to ensure that all of the key issues had been identified from the transcripts (Morgan, Sproule, et al. 2005; Sproule et al., 2002).

Skill-Focused Group: Pre-Intervention

When asked to discuss the things they knew about the game of basketball, or the things they remembered from their previous basketball experiences, the main areas of discussion were the game skills, the practices they took part in to develop game skills and the rules of the game:

> *We did shooting practice at the basketball net and we all had different positions. I remember shooting from different angles.* (Male pupil 1)

> *If you're dribbling the ball and you hold it in your hand, both hands and you start dribbling again, that's a double dribble.* (Male pupil 4)

One pupil remembered playing a conditioned game that aimed to develop their ability to beat the defence to score:

> *It was like five and five but it was more diamond shaped so you passed to one person before you could make the other person move sort of game. It was trying to get three people as a defence for one net and you had to get your diamond past those three people to score.* (Male pupil 3*)*

Another pupil remembered playing in a mini tournament and described it in terms of how the tournament was organised:

> *I remember we used to get split into four teams and there used to be different colours for each team. We used to play two games and then the winner would play another team.* (Female pupil 2)

Skill-Focused Group: Post-Intervention

The focus of the pupils' discussion about what they had learned, or what they remembered, from the five-week block of basketball was very similar to the discussion they had during the pre-intervention focus group interview. They mainly discussed how they had learned the skills of the game of basketball, although some of the pupils did place these skills within a tactical context, for example:

> *We learned different types of baskets that you could score, like lay-up and we learned what to do when you are dribbling, so a defender can't take your ball away.* (Female pupil 1)

One of the pupils talked about attacking and defending, but did so in a rather vague and confused way:

> *Well we learned like advanced techniques as well, we learned how to defend rather than just always attacking. So we learned opposite as well as normally… Well like if an attacker was coming up on the left, that if there was a person next to them you can pass… like you have to mark one of them and if you have got another person to mark them but also to keep close to the hoop.* (Male pupil 3)

There was also some mention of the rules that they learned during the five-week block:

> *We learned some of the rules and simple rules, like double dribble, some signals as well, and we also learned another rule which was like its non contact sport so you can't hit them, you can only like hit the ball out their hand if they have got one hand on the ball.* (Male pupil 1)

Game-Based Group: Pre-Intervention

Like the skill-focused group, the game-based group mainly discussed skills and rules when asked to recall the things they learned, or remembered, from their previous basketball experiences in primary school:

> *Different ways of throwing it and passing and shooting, like the chest pass and the bounce pass.* (Male pupil 3)

> *You're not allowed to run with the ball in your hand, you've got to bounce it or dribble it.* (Female pupil 2)

Game-Based Group: Post-Intervention

When asked to discuss the things that they had learned, or remembered from the five-week block of basketball, the game-based group's response was quite different from their pre-intervention discussion, and from the discussions held by the skill-

focused group. The main areas of discussion were related to the principles of play that they had learned during the course. They highlighted the counter attack, zone defence, width and possession, as well as some basic skills and rules. For example, two pupils described zone defence in terms of:

> *Well we get formation and then stop the other team getting near a basket cause they get a better shot percentage from right under the basket.* (Male pupil 3)
>
> *you dinnae (don't) want them to win, so to avoid them from winning you zone under the basket so they cant score kind of thing.* (Male pupil 1)

Two of the pupils also described how to penetrate a team's zone defence:

> *Pass it to your wide players and just keep possession of the ball as long as you can...The other team start coming out of their zone, and then someone runs into their zone and then shoots.* (Male pupils 3)
>
> *It gives you more space and it gives you time for other people to make a run.* (Female pupil 1)

One of the girls in this group described, in a rather vague way, some of the basic rules she had learned:

> *Well the thing that we learned is how to like play, like the rules of the basketball and it's like what to do…What to do and to learn what you can do… Just basic stuff like the ball goes out it's the other teams ball, and stuff like that.* (Female pupil 2)

4v4 Games Performance

In order to assess the participants' game performance in offence both on and off-the-ball, a modified coding procedure initially developed by Blomqvist, Vanttiinen and Luhtanen (2005) was applied. This coding procedure was developed in order to evaluate students' game performance (decision-making and skill execution) in soccer. For the purpose of this study, the coding categories were modified to reflect good or poor decisions on and off-the-ball in the game of basketball (Table 2). The first part of the coding process involved dividing the games into decision-making units (DMU). Each DMU began when the player had control of the ball and ended when the ball reached its target (team-mate/basket), was intercepted or went out of bounds. This was carried out using Game Breaker software (www.sportecinternational.com) that was set up to include two seconds of play leading into and following each DMU, thus providing some context for the analysis. Game Breaker was a useful tool for analysing the data because each DMU could be played back at various speeds and in different orders so that comparisons could be made between any two or more DMUs. All of the pupils' tactical decisions during each DMU were judged as 'good' or 'poor' according to the relevant coding category. Additionally, on-the-ball skill execution during each DMU was coded as either 'successful' or 'unsuccessful' (Table 3).

Insert table 1 here

Insert table 2 here

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515

516 *Reliability.* Two researchers were involved in the coding process and both had
517 previous experience of analysing S1 pupils' basketball performances. The two
518 researchers watched the games on tape and discussed the coding categories devised
519 by Blomqvist, Vanttiinen and Luhtanen (2005) until they agreed on the interpretation
520 of each category in relation to the game of basketball. The games were then divided
521 into DMUs and together both researchers coded a sample of play for one of the teams
522 in each game, both pre and post intervention, for the first 12 DMUs (20% of all
523 DMUs). The next day, the main researcher re-coded the same sample.

524

525 Consistent with the procedures adopted by Blomqvist, Vanttiinen and Luhtanen
526 (2005), a percent agreement reliability test was used (number of agreements/number
527 of agreements + number of disagreements). For the skill-focused team that was
528 coded then re-coded, the agreement for decision-making was 94% both pre and post
529 intervention. The agreement for the game-based teams pre intervention was 92% and
530 94% post intervention. Following this procedure, the main researcher coded all of the
531 DMUs for each game. Finally, one week after all of the games had been coded, the
532 second researcher returned to re-code the first 12 DMUs for the same teams both pre
533 and post intervention. For both teams, this resulted in 94% agreement for the pre
534 intervention game and 92% for the post intervention game. For all of the games that

were coded and re-coded, inter-observer agreement was 100% for the on-the-ball skill executions carried out within each DMU.

Statistical analysis. Pre-post performance for each group was compared by repeated measures ANOVA. Where appropriate post hoc pupil t-tests (paired test for within group differences and independent test for between groups) with the Bonferroni correction factor were used. Effect sizes for the ANOVAs were calculated using the η^2 method and for t-tests by Cohen's d. Sphericity was measured by Mauchly's test and where appropriate the Huyn-Feldt Epsilon correction factor applied.

There were no significant differences between groups for decision-making on and off-the-ball pre-intervention (Table 4). For the on-the-ball 'good' DMU dependent variable there were significant differences ($F(1,14) = 5.09$, $p < 0.05$, $\eta^2 = 0.27$) post intervention, with the game-based group making better decisions (Table 5). For good support (off-the-ball 'good') there were no significant differences between groups in the pre-test but the game-based group performed significantly better in the post–test ($t(14) = 8.23$, $p < 0.001$, $d = 4.12$) (Table 5). The game-based group also demonstrated a significant pre-post difference ($t(7)$ 5.74, $p < 0.001$, $d = 2.85$) for good support (off-the-ball 'good'). Application of the Bonferroni correction factor meant that the probability for significance in the post hoc pupil t-tests would be 0.013. There were no significant differences pre-post for the skill-focused group for good support.

Insert table 3 here

Insert table 4 here

There were no significant differences either between or within groups for skill execution pre to post intervention. However, the game-based group increased their successful skill execution by 38%, compared to only 10% of an increase for the skill-focused group (Table 6).

Insert table 5 here

The Tactical Skills Inventory

A mixed design two-way repeated measures ANOVA was used to test for differences between the game-based and skill-focused groups in the dependent variable of tactical knowledge. Results reveal a significant interaction effect between groups (skill-focused versus game-based) in tactical knowledge (Wilks's Lambda = .88, F (1,50) = 6.61, p = .01, eta sq = .11, observed power = .71). A lower score indicates a greater perception of tactical knowledge, therefore differences in the pre-post intervention means (Table 1) revealed that the game-based group believed that they had greater tactical knowledge as a result of the intervention programme.

579

580 Insert table 6 here

581 **Discussion**

582 *Game knowledge*

583 We found no differences between the two classes in terms of the ways in which they
584 verbally articulated their knowledge about the game of basketball before the five-
585 week block. However, when asked to discuss what they had learned (or what they
586 knew) about the game of basketball after each block, the topics of discussion were
587 quite different for each group. The group that took part in the skill-focused lessons
588 discussed the technical components of basketball skills and made very few references
589 to the tactical contexts in which the skills are applied. In contrast, the pupils from the
590 game-based lessons discussed the different principles of play that they applied during
591 practices and games that enabled them, and their team, to reach their intended goals.
592 Wright and Forrest (2008) suggest that learners' should develop a language about
593 games, and that this takes place when the teacher poses open questions that
594 encourage debate, discussion and deliberation. This type of verbalisation during
595 learning is very important and can improve, not only the learners' language and
596 knowledge of the task, but also their performance in the task (Caverni, 1988; Schunk,
597 1986; Wright and Forrest, 2008)

598

599 Another possible influence on the different ways in which the pupils discussed their
600 basketball experiences was that, although both teachers had the same overall aim for

the five-week block, both the content that was delivered by each teacher and the means of delivery by each teacher were quite different. In some ways, the results reflect comments made by McMorris (1998) regarding previous 'skills versus tactics' literature, that teaching tactics leads to better tactical understanding and teaching techniques leads to improvements in technique. Importantly, the teaching in this investigation was not skills only compared to tactics only. The skill-focused group spent a large part of their time learning about skills and learning to perform skills, but they were also presented with some opportunities to play games at different stages of each lesson. However, these game opportunities do not appear to have made an impact on the pupils' knowledge of the game beyond the execution of basketball skills. By contrast, the pupils from the game-based class appear to have developed a more sophisticated understanding/language about the game, even in a relatively short period of time (five weeks). This may be because they were explicitly engaged in problem-solving activities that encouraged them to draw upon prior knowledge, and the knowledge of other pupils in their team, thus providing them with opportunities to think critically, solve problems and construct new knowledge. However, Grehaigne, Richard and Griffin (2005) claim that, not only should learning imply interaction, cognition and construction, it should also imply plasticity. That is, to infer learning, one must be establish the learners' capacity to apply new knowledge in a number of different situations over a period of time. Unfortunately, the time constraints imposed upon the present study made it difficult to determine if this level of learning took place.

623

624 *Game performance*

625 The 4v4 game performance data shows that the game-based group made significantly
626 more good decisions on ($p<0.05$) and off-the-ball ($p<0.001$) compared to the skill-
627 focused group. These results highlight the importance of decision-making off-the-
628 ball since the most significant difference between the groups' performance was in
629 their decision-making off-the-ball. This finding has extremely important implications
630 for teaching, learning and assessing TIG within PE. Firstly, this evidence lends
631 support to the suggestion that pupils' overall game performance may be enhanced if
632 teachers facilitate the development of pupil knowledge of, and performance in,
633 situations and decisions that occur off-the-ball, even over a short period of time.
634 Grehaigne, Richard and Griffin (2005) described a similar experiment (The Avallon
635 Project) where performers in a tactical teaching group showed the greatest
636 improvements in performance compared to performers in a technical teaching group
637 in week six of a twelve-week intervention. It is very common for PE departments in
638 schools in Scotland to organise 'blocks' of activities that only last for five weeks, so
639 it is important that pupils experience some improvements in performance over a
640 short period of time. This may positively influence their perception of competence in
641 that activity, and in PE in general.

642

643 Secondly, the game performance results suggest that pupils need to be made more
644 aware of their performance off-the-ball, and the contributions that they can make to

the game off-the-ball. This may encourage pupils to distribute the ball more equally (and appropriately) during game play, which could have a positive influence on their involvement in the game, especially in classes of mixed ability. Such awareness should also impact positively on the pupils' perception of competence in TIG, as well as other affective factors such as enjoyment and motivation. Finally, teachers should be aware that when they assess their pupils' performance in games, they ought to take into account what their pupils are doing when they do not have the ball. Assessing changes in performance both on and off-the-ball throughout a games block will give a much more accurate account of any improvements made by the pupils, and may also highlight improvements in performance for those pupils who are less able at executing on-the-ball skills during the game.

In this investigation there were no significant differences between groups post intervention in terms of on-the-ball skill execution. This finding may be explained by the fact that the pupils throwing, catching and dribbling skills were already developed to a level that would make any changes in performance difficult to detect. Nevertheless, the mean scores did indicate a trend towards an increase in 'successful' skill execution and a decrease in 'unsuccessful' skill execution post intervention for both groups. Importantly, when these results are considered together with the game-based group's significant improvements in decision-making on-the-ball post-intervention, one could deduce that the game-based group's overall performance improvements were greater than the skill-focused group. This is because game

667 specific skills have to be executed within decision-making contexts, thus facilitating
668 the attainment of the player's (and the team's) game objectives. From a teaching
669 perspective, this highlights the need to turn more attention towards the development
670 of decision-making skills, especially since players make more tactical decisions
671 during TIG than on-the-ball skill execution (Blomqvist, Vanttiinen and Luhtanen,
672 2005), and because players can take part in TIG even with low levels of skill (Bunker
673 and Thorpe, 1982). Unfortunately, previous research has shown that the focus for
674 teachers when teaching TIG is on developing pupil proficiency in executing game
675 specific motor skills, often in the absence of authentic games contexts (Curtner-
676 Smith, 1999; Curtner-Smith et al., 2001).
677
678 *Perception of decision-making ability*
679 In the present study, the pupils in the game-based group believed that their decision-
680 making abilities both on and off-the-ball had improved as evidenced by their
681 increased scores from the Tactical Skills Inventory (Table 6). In contrast, the skill-
682 focused class believed that their decision-making abilities had deteriorated over the
683 five-week period. This may be linked to differences in the pupils' knowledge about
684 the game of basketball, but it may also be because Anthony predominately taught on-
685 the-ball skills, yet the majority of the of the items in Tactical Skills Inventory were
686 related to situations that occur off-the-ball. Blomqvist, Vanttiinen and Luhtanen
687 (2005) suggested that if game performance is to be improved, then decision-making
688 has to be taught explicitly, particularly decision-making *off-the-ball* because the

majority of a player's time is spent off-the-ball. Additionally, a player's effectiveness off-the-ball ultimately impacts on overall game performance and involvement, which has implications not only for improvement, but also for perception of competence. Indeed, in the present study, the pupils in the games-based group improved in their decision-making performance and had a higher perception of their decision-making competence, both of which can enhance important affective factors such as enjoyment and motivation (Papaionnou et al., 2006).

Conclusion

The findings from the present study show that when a pupil-centred, game-based approach was used to teach S1 basketball, pupils developed more sophisticated game knowledge/language, improved their game performance in 4v4 games and improved their perception of decision-making abilities. Although this type of information is extremely valuable in relation to understanding the effectiveness of different teaching approaches, they should also be considered with some reserve. The present study aimed to conduct ecologically valid research that attempted to integrate theory with practice. However, there are many difficulties with this type of research. For example, it is difficult to make claims about pupil learning after only five weeks of teaching. Unfortunately, the school in which the research was conducted organised their curriculum in five-week blocks. Ideally, to make more definitive claims about pupil learning, the intervention would have taken place over a longer period. However, the results demonstrate that constructivist approaches can elicit gains in

711 performance over a short period of time, and even though these gains may not be
712 permanent, they still yield some significance for two main reasons. Firstly, it has
713 been reported that teachers tend to use rote learning, behaviourist teaching strategies
714 because they believe that this is an efficient teaching method under the pressures of
715 time, particularly when they have exam deadlines to meet (Thorburn and Collins,
716 2006). Secondly, improvements in performance (whether short-term or permanent)
717 may have a positive effect on pupils' perception of competence, which is particularly
718 important because those pupils high in perception of competence are more likely to
719 apply more effort to learning, and continue to participate in PE and physical activity
720 (Deci and Ryan, 2000; Papaioannou et al., 2006).
721
722 **It is also important to recognise that there are problems with conducting**
723 **comparative research, particularly in relation to 'construct equivalence' and**
724 **'causality' (Mills et al., 2006).** For example, although there were many similarities
725 between the two teachers involved in this study, it would be wrong to suggest that it
726 was the way they designed and presented the tasks that was the sole influence on the
727 pupils' learning and performance outcomes. Future research in this area could address
728 this issue by adopting a crossover design. In this way, the two teachers would teach a
729 block of TIG using one of the two games teaching approaches (game-based or skill-
730 focused). After a period of time to allow any treatment effect to wash out, the
731 teachers would change their teaching approach to the one that they had not previously
732 used. Any effect of retesting (or anything that happened between the tests) could then

be subtracted out by an appropriate analysis (Hopkins, 2000). However, the integration of theory with practice in a school setting is a major strength of the study from which physical educators might learn valuable lessons.

Future research could also examine the teaching and learning *processes* involved when adopting different approaches to teaching TIG. For example, what was it about the teachers' behaviour that impacted on pupil learning when they adopted each approach to teaching TIG? Also, how did pupils react to such teaching strategies? Previous research that has examined teaching and learning processes in PE suggests that when teachers adopt pupil-centred approaches to teaching, they exhibit more mastery behaviours. For example, they set differentiated tasks and encourage pupils to set self-referenced goals for improvement (Morgan, Kingston, et al. 2005). When a mastery motivational climate is created in PE, pupils report higher levels of enjoyment, perceptions of competence, intrinsic motivation and a positive attitude towards PE (Morgan and Carpenter, 2002; Morgan, Kingston et al., 2005; Morgan et al., 2006). What, therefore, is the relationship between teaching using a game-based (or skill-focused) approach and motivational climate? How does this relationship impact on the pupils' experiences in TIG lessons? Only by investigating the teaching and learning process in more detail can we begin to fully understanding why game-based, pupil-centred, problem solving approaches to games teaching approach seem to have a positive influence on pupil learning and performance.

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Appendix 1: An outline of the lesson from week one of the game-based class.

Focus	Content	Content Objective

Keep the ball and reach the target.	1. 3v3 basketball	Work out **AS A TEAM-**How do you reach the target **AS QUICKLY AS POSSIBLE**? Why is this important?
	2. Pass and move in grid, on the whistle, move to the grid opposite as quickly as possible and shoot. 3. As above, defender can move into grid on the whistle. 4. As above, 3v1. Second defender introduced on whistle.	To develop the players ability to get the ball to the shooting zone and target as a team as quickly as possible. To encourage scanning, showing for the pass, receiving on the move and sending a catchable pass.
	5. 3v3 basketball	To encourage each team to determine effectiveness of working as a team, looking for team-mates, show for the pass, moving away from defenders – toward the target.

Appendix 2: An outline of the lesson from week one of the skill-focused class.

Focus	**Content**	**Content Objective**
To introduce and develop dribbling and passing skills.	1. With a ball each, find a space and begin to dribble anywhere in the hall.	To move with ball whilst looking up to move into a space.
	2. Same task, use left hand and then the right hand. 3. Move around the hall and when you hear the whistle, do a jump stop.	To develop stopping ability - two feet, wide base, flex ankles and knees, ball in two hands.
	4. Right hand then left hand dribbling only. 5. Dribble the ball and protect it with arm and body, change on the whistle. 6. Ball handling skills.	To understand how and why you protect the ball when you are dribbling.
	7.Passing in pairs.	
	8. 4v4 Benchball	No dribbling, pass to score.

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969 Appendix 3: Focus Group Guidelines

Pre-Intervention	
What primary school did you go to? What types of activities did you do in Primary 7 PE? Did you learn to play team invasion games such as football? Did you learn to play basketball? What you remember? What did you learn? What do you remember about the things the teacher did during the lessons? What do you remember about your performance?	 What, where, when? When, who, how often? What do you know? Activities/tasks/games? Good/bad?
Post-Intervention	
Can you describe some of the things you did during your basketball lessons? What were the main things you learned during this 5-week block? What else do you now know about the game of basketball? What do you remember about your performance?	Activities/tasks/games? What stands out/important? What does that mean? Can you explain further? What did you do during the game?

970
971 Table 1: Modified coding categories for decision-making

Decision	1=good	0=poor
On-the-ball	Pass to a team mate who is open. Holding the ball (no team mate open). Moving with the ball towards the target/appropriate space (according to the flow of the game/no team mate open). Good scoring attempt.	Pass to a covered team mate. Pass to a team mate too close or too far. Holding on to the ball (passing or shooting more appropriate). Moving with the ball (passing or shooting more appropriate/away from target or support resulting in isolation). Blocked shot or inappropriate distance.
Off-the-ball	Movement required by the flow of the game. No movement needed (already in space). Moving into a position to receive a pass (appropriate distance)	Inappropriate movement as required by the flow of the game. No movement when needed (standing covered, no purpose). Poor movement (too close, far or crowded, next to another team mate).
No decision	Situation happens too fast for player to react.	

972

973 Table 2: Modified coding categories for skill execution

Action	1=successful	0=unsuccessful
Passing	Own team mate maintains possession of the ball.	Opponent gains possession of the ball or the ball goes out of bounds.
Dribbling	Player maintains possession of the ball. Does not double dribble.	Player loses the ball when dribbling or the ball goes out of bounds.
Shot	Basket.	No basket.

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976 Table 3: Mean (±SD) decision-making on and off-the-ball pre-intervention

	On-the-ball 'good'	**On-the-ball 'poor'**	**Off-the-ball 'good'**	**Off-the-ball 'poor'**
Skill-Focused	8.62 (3.62)	6.25 (4.83)	21.75 (6.9)	21 (9.56)

Game-Based	11.62 (5.53)	5 (4.56)	24.12 (5.08)	22 (14.15)

Table 4: Mean (±SD) decision-making on and off-the-ball post-intervention

	On-the-ball 'good'	**On-the-ball 'poor'**	**Off-the-ball 'good'**	**Off-the-ball 'poor'**
Skill-Focused	9.25 (6.71)	3.75 (3.54)	17.87 (4.85)	20.37 (11.96)
Game-Based	17 (7.03)*	3.28 (2.12)	39.12 (5.46)***	19.5 (6.35)

*p<0.05 and ***p<0.001

Table 5: Mean (±SD) skill execution pre and post-intervention

	Pre Intervention		**Post Intervention**	
	Successful	**Unsuccessful**	**Successful**	**Unsuccessful**
Skill-Focused	10.0 (7.48)	9.25 (6.27)	11.0 (10.3)	4.75 (4.24)
Game-Based	13.75 (7.92)	8.12 (6.38)	19.0 (10.68)	6.62 (4.14)

Table 6: Means (standard deviation) for tactical knowledge

	Pre-Intervention		**Post-Intervention**	
	Skill-Focused (n25)	**Game-Based (n27)**	**Skill-Focused (n25)**	**Game-Based (n27)**
Tactical Knowledge	2.26 (0.40)	2.30 (0.49)	2.30 (0.41)	2.04 (0.55)**

**p<0.01