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Promoting Students' Metacognitive Behavior in Physical Education Through TGFU

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Abstract

The aim of this study was to examine the effectiveness of the TGfU (Teaching Games for Understanding) model in promoting metacognitive activity in physical education classes. TGfU is a tactical-game approach to teaching games which utilises modified game forms (e.g., adapting equipment, playing areas, or rules) with the aim of reducing the demands of the game, and by implication, the complexity of learning. Seventy-one students aged 11 and 12 years old were divided into two groups: (i) an experimental group consisting of 29 students (13 boys and 16 girls) and (ii) a control group of 42 students (19 boys and 23 girls). An experimental intervention study in basketball was conducted with pre- and post-tests. Teachers in the intervention classes applied the tactical-game approach (TgfU), while within the control group the skill-based approach was applied. Metacognition was assessed pre and post-intervention using questionnaires, and through observation of problem-solving situations. Repeated measures analysis showed that there were statistically significant differences between groups. The results imply that the tactical-game approach is an effective way to improve metacognitive behavior in physical education classes.

Keywords

Metacognitive Beahavior, Tactical-Game Approach, Basketball, Elementary School

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1. Introduction

Several studies have established the importance of metacognition upon the acquisition of learning skills and knowledge transfer (Alexander, Fabricius, Fleming, Zwahr & Brown, 2003; Hartman, 2002). Moreover, it has also been posited that when students acquire more metacognitive knowledge, they are able to transfer this newly acquired knowledge into new areas of learning (Schraw, 2002).

Metacognition is defined as "thinking about thinking" and it is classified by way of three components, which include knowledge of cognition, regulation of cognition and metacognitive experiences (Flavell, 1987; Schraw, 2002). Knowledge of cognition incorporates declarative, procedural and conditional knowledge (Schraw, 2002). Declarative knowledge refers to knowledge about oneself as a learner and the factors which influence individual performance. Procedural knowledge is the knowledge of how to perform a specific task, and conditional knowledge refers to knowing when and why to use a procedure skill or strategy (Schraw, 2002). Regulation of cognition refers to how well students can control their own learning and includes three essential skills: (a) planning-which refers to the appropriate selection of strategies for an effective performance, (b) monitoring-which is about one's awareness of comprehension and task performance, and (c) evaluating- which is about the product appraisal of a student's work and the efficiency of his/her own learning (Schraw, 2002).

Studies have found that students who use metacognitive strategies develop a greater tendency to learn, recall with greater efficiency, and behave more strategically, flexibly,

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and productively (Hartman, 2002; Schraw, 2002). There is a notion that metacognition is teachable (Chatzipanteli, Grammatikopoulos & Gregoriadis 2013) and within academic subjects, researchers have said that it is productive for students to be metacognitively trained (Lin, Schwartz & Hatano, 2005). Student-activated teaching methods, where students take an active role in their own learning process, seem to be functional to the development of metacognition (Chatzipanteli, 2015; Chatzipanteli, Digelidis & Papaioannou, in press).

Developed within the area of physical education; “Teaching Games for Understanding” is a constructivist teaching approach, where teachers help students to learn under the guidance of effective questioning, rather than direct delivery of information (Light, 2002). This approach was introduced by Bunker and Thorpe (Griffin & Butler, 2005) and is compartmentalized into four game categories: invasion games, net games, striking games and target games (Mitchell, Oslin & Griffin, 2003). In this approach the teacher alters a game by making teams smaller or modifying equipment, and utilizes effective questioning to stimulate student's’ thinking (Griffin & Butler, 2005). This approach provides teachers with the opportunity to introduce higher order thinking, such as problem solving (Howarth, 2000; Kirk & MacPhail, 2000; Light, 2002) and tactical transfer across games - a key element of learning in TGfU (Hopper, 2002; Oslin & Mitchell, 1998).

In the traditional technique-based approach, teachers emphasize the skills of a sport, out of the context of the game and only a few of them require students to think beyond the recall of information (Mawer, 1995). In contrast, in a tactical-focus approach, such as TGfU, teachers use prompts and questioning; in conjunction with modified game forms (e.g., adapting equipment, playing areas or rules) in order to reduce the demands of a sport and its complexity (Chow, Davids, Button, Shuttleworth, Renshaw & Araujo, 2007).

A typical lesson (within a generic structural framework), begins with a modified game, and subsequent to this, conversation is then guided by the teacher, with the aim of developing a deeper understanding of the rules and the strategic nature of the game. This conversation encourages students to solve specific tactical problems. Finally, skill execution and performance are assessed by observing the outcomes of decisions during the game (Turner & Martinek, 1999). This approach is a method that reduces the skill demands and highlights the intellectual dimensions of games, such as decision-making (e.g. what, how and when to perform certain skills, or how to create enough space to shoot the ball) (Howarth, 2000; Kirk & MacPhail, 2000; Harvey & Jarrett, 2013).

There are studies that have examined differences between technical and tactical approaches to knowledge acquisition. One fundamental outcome from such a study was that metacognitive behavior was developed in students who were taught with the TGfU approach in volleyball (Chatzipanteli, Digelidis, Karatzoglidis & Dean, 2014). Other studies have shown that the tactical approach has also been shown to be an effective method for learning within soccer, particularly in off-the-ball movement and decision-making (Mitchell, Griffin & Oslin, 1995). Further work has demonstrated improvements in declarative knowledge (what to do) in field hockey (Turner, 1996) and volleyball (Griffin, Oslin & Mitchell, 1995).

Harvey and Jarrett (2013), reported that a game-centered approach, in contrast with a skill-focused approach provides improvements in intellectual aspects of learning, game concepts, declarative knowledge and decision making. Also, performance enhancement was found in invasion games, in terms of “off-the-ball” movement (Gray & Sproule, 2011; Lee & Ward, 2009). Further endorsement for the TGfU approach was also to found within (Turner, 2003), who highlighted significant improvements of declarative knowledge and improved decision making related to performance in tennis.

In addition, Allison and Thorpe (1997) noticed a better understanding of game concepts (offence-defence) in both field hockey and basketball. In terms of the affective domain involved in Physical Education, students found the TGfU model to be more enjoyable, and as a result displayed higher levels of motivation towards participation in physical education classes (Griffin et al, 1995). Finally, improvements in game-understanding, involvement and enjoyment have been observed (McKeen, Webb & Pearson, 2005; MacPhail, Kirk & Griffin, 2008).

On the other hand, other research did not find significant differences in declarative and procedural knowledge between technical and tactical-focus approach for field hockey (Turner & Martinek, 1992) and badminton (Lawton, 1989) although the TGfU group did display a better understanding of game tactics and strategies.

To date, there is very limited research based on promoting metacognitive behavior and developing game understanding within elementary school settings (Chatzipanteli et al, 2014; Mitchell, 2005). Arising from that dearth, the main aim of this study was to examine the effectiveness of the TGfU model in promoting metacognitive behavior in invasion games. The more specific aim was to examine regulation of cognition and the ability of the students to solve problems successfully within an elementary school setting. It was hypothesized that TGfU model could enhance metacognitive abilities.

2. Method

2.1. Participants and Setting

Seventy-one students aged 11-12 years old (32 boys and 39 girls) participated in this study. The sample came from four classes of two primary schools, both from the same rural region of Central Greece. None of the students had any previous direct exposure to basketball and hence could be considered as novices.

The sample chosen was based on convenience criteria with classes randomly divided into two groups of approximately equal size. Two classes from one school served as the experimental group while the other two classes from the other school served as a control group. The experimental group consisted of 29 students (13 boys and 16 girls) and the control group of 42 students (19 boys and 23 girls). Informed consent was obtained from all participants and their parents.

2.2. Design and Instruments

Metacognition was quantitatively assessed in both groups, before and after the basketball session. Additionally, within the experimental sample only, qualitative data were collected. This data was collected to assess metacognitive behaviour, and the aim of the data collection was to find out how students thought, planned and evaluated their actions during a tactical problem situation in invasion games, after the support of a tactical approach. Think-aloud protocols about students' metacognitive behavior in problem solving situations, were used in order to meet the research requirement for multi-method approaches when assessing metacognition (Veenman, 2005, as cited in De Backer, Van Keer, & Valcke, 2012).

Metacognitive Process in Physical Education Questionnaire (MPIPEQ)

The Metacognitive Process in Physical Education Questionnaire (short version) was used in order to assess students' metacognition. This instrument; developed by Theodosiou and Papaioannou (2006), is based on Brown's (1987) framework. While the initial form of the questionnaire had 9 scales and 52 items (Theodosiou & Papaioannou, 2006), its short form has been abbreviated to include 9 items and is uni-dimensional. The construct validity and reliability of the instrument has been tested in previous studies (Theodosiou, Mantis & Papaioannou, 2008; Papaioannou, Theodosiou, Pashali & Digelidis, 2012). Responses are recorded on a five-point Likert-type scale grading from strongly agree = 5 to strongly disagree =1 (see, Table 1).

Qualitative assessment of metacognitive behaviour

"Think-aloud" protocols during the problem-solving situations were used in order to assess students' metacognitive behaviour, and were coded according to the five-phase metacognitive model (Maykut & Morehouse, 1994). This model (see, Table 2) has been used to assess metacognitive behavior in mathematics (Yimer & Ellerton, 2010) for the reason that metacognitive processes such as students' ability to monitor and regulate, are at work to a greater degree when problem-solving. (Schoenfeld, 1992). According to this model, five groupings were designated as the five phases: engagement, formulation, implementation, evaluation and internalization. Each phase included sub-categories which were observed within the solution processes of at least one student (e.g., engagement: initial engagement, restating the problem). And, researchers have suggested that the engagement in these phases is the result of metacogntitive behaviors (Yimer & Ellerton, 2010).

2.3. Intervention Characteristics

During the four weeks of the study, the students in each group received eight 45 minutes lessons of basketball. The intervention program was planned according to lesson plans for elementary invasion games teaching (Mitchell et al, 2003) and was taught from the regular teacher who had experience in the TGfU model. In order to facilitate the teacher's work and to check if lesson-plans were being effectively implemented; the investigator was also present during the implementation of the eight lessons

The focus of each lesson plan was on tactical aspects, together with decision making components of basketball game-play. Whilst motor skills were practiced when required, a tactical problem within a game situation was the starting point and fulcrum of each lesson. Examples of tactical problems that were posed include: "creating space to attack", "playing a 2v1 game without dribbling", and "making two consecutive passes and bringing the ball back to the target player". The latter was introduced in order to understand students how to apply the "give-and-go" cue in a game that leads to the creation of space. Knowledge items that were introduced were basic fundamentals of basketball- such as maintaining possession of ball, obtaining possession, score, preventing scoring etc.

During each lesson, the teacher stopped the games at various points in order to question students (e.g. how can you quickly pass the ball to your teammate?). The teacher encouraged the students to think about the variables that they had to examine, and questioning rotated around the goals of the game or the appropriate skill for each phase. Below is a brief description of the approach used in this study.

Structure of TGfU lesson plans:

(a) A tactical problem (keeping possession, keeping the ball and attacking etc) was the starting point for each lesson.

(b) Motor skills (e.g. passing, catching, dribbling, shooting) were introduced and practiced when the teacher clarified exactly students understood what to do and they had to learn how to perform it.

(c) The teacher stopped the game at appropriate points in order to set questions to the children.

Metacognitive cue structure of TGfU lessons:

(a) Knowledge items were introduced (e.g. moving into space, closing down space, supporting for possession) in order to expand knowledge of cognition.

(b) Questions were put to the children during lessons. Via this questioning the learners were asked think about the variables they had to examine, the aim of the game and the appropriate skill for each phase. Specifically they were asked to monitor, evaluate and reflect on their ideas. All of these are factors which trigger regulation of cognition.

2.4. Procedures and Design

There were two phases of measurement:

(a) Before the start of the intervention and

(b) At the end of the 4-weeks period of the intervention.

Before the start of the intervention program, all participants completed the "Metacognitive Process in Physical Education Questionnaire," (a mechanism used to measure metacognitive activity). This questionnaire was administered during regular school hours under the supervision of one of the researchers. This portion of the lesson lasted approximately 20 minutes.

The Experimental group then faced a problem-solving situation: 'how to effectively act in order to score a basket in a game form (two versus one)'. Prior to presenting this tactical problem, the researcher asked ten students (5 boys and 5 girls) to participate in this procedure- (to "think aloud" while working on the task), in order to be able to identify their metacognitive behaviour. The researcher then gave didactic instructions and provided a short demonstration of how to verbalize. Following from this, the students engaged in a sample exercise to practice verbalizing their thoughts. They practiced until they could think aloud clearly, and following successful practice; were given instructions on the research protocol.

Students were not prompted in any way with guiding questions, i.e. they expressed their thoughts, feelings, difficulties independently, and it was during periods of silence that the investigator began to intervene, with simple questions such as "Could you tell me what are you thinking?".

At the end of the intervention program, all participants completed the same questionnaires. However, students from the experimental group had to solve a more difficult tactical scenario (two versus two) than the previous occasion (two versus one). The researcher asked the same ten students to "think aloud" while solving the scenario. Students were thinking aloud alone, and each individual needed approximately 20 minutes to express their thoughts. Ten tape recordings were taken in order to record each student individually, and the audiotapes were then transcribed verbatim. Afterwards, students checked their responses in order to make sure that they were accurate.

In the control group, there was no intervention, and the teaching approach directly focused upon motor-skill acquisition, which is already included as part of the school curriculum. Each lesson consisted of an introductory activity and a skills' practice and then the lesson concluded with a 10 minute period of game. The 5v5 game-play at the end of the lesson was played in a half-court, in order to facilitate simultaneous participation for every student. Students from the control group were introduced to four lessons focal upon passing and catching, one for dribbling, two for shooting and the last lesson was a combination of all these skills.

2.5. Coding Scheme and Procedure

The think-aloud protocols were transcribed verbatim and ten of them coded by two trained coders, working in accordance with the five-phase metacognitive model (Maykut & Morehouse, 1994). According to this model, the metacognitive behaviors identified in one student's problem-solving efforts (of one specific problem), were compared with the same student's work on different problems. In addition, other comparisons were made with other students' metacognitive behaviors; displayed during their problem-solving efforts with the same problem.

Firstly, the two investigators coded a sample of transcripts independently, writing down metacognitive behaviors as they occurred. They then met again to compare the results and to resolve any differences. Finally, they coded all of them and the inter-rater agreement was calculated. Cohen's kappa ($\kappa = .86$) indicated high overall reliability for each category (κ engagement = .88, κ formulation = .85, κ implementation = .86, κ evaluation = .85 and κ internalization = .87).

3. Results

The internal consistency of the *MPIPEQ* was of an acceptable level in accordance with Moss et al. (1998) who have supported that Cronbach alpha value above 0.6 is acceptable. So, in the first wave an α equal with .66 was gained; in the second an α equal with .79.

Repeated measures analysis was conducted in order to examine the differences between the initial and final measurement. The data analysis indicated that the experimental group showed significantly higher scores than control group. Descriptive statistics from the two measurements are presented in Table 3.

Table 1. Metacognitive Process in Physical Education Questionnaire (Papaioannou, Theodosiou, Pashali, and Digelidis, 2012)

Metacognitive activities	Items
1. Declarative knowledge	"…I realized which exercises I could perform right"
2. Procedural knowledge	"… I had a clear view of how to put in practice a learning method that I have been taught"
3. Conditional knowledge	"… when I wanted to grow better in a game, I put into practice a learning strategy"
4. Information management	"… I thought if the games I played were similar to others"
5. Planning	"…it is clear for me what I want to learn"
6. Self-monitoring	"…the moment I perform an exercise, I check if I actually learn it right"
7. Problem solving strategies	"… when I got confused I stopped to see the whole thing from the beginning"
8. Evaluation	"… since I have learned an exercise I compared the way I had learned it with other ways"
9. Imagery	"… before I perform an exercise I imagined myself to perform it"

Table 2. Metacognitive model used in the qualitative analysis of data (Adapted from Yimer & Emmerson, 2010).

Phases	Sub-categories
1. Engagement	Initial engagement, restating the problem, assessing familiarity (e.g., understanding the tactical scenario)
2. Formulation	Analysis of information, identifying patterns (e.g., making connections based on previous experiences)
3. Implementation	Exploring the essence of the plan, performing the plan, monitoring the performance on the plan
4. Evaluation	Reflecting on the solutions, monitoring and justifying the solution (e.g., checking for errors)
5. Internalization	Assessing difficulty, confidence in finding the solution (e.g., finding different ways of solving it)

Table 3. Descriptive statistics of the two measurements

	Experimental group				Control group					
	Pre-test		Post- test		Pre-test		Post-test			
	M	SD	M	SD	M	SD	M	SD	F	η2
Metacognitive activity	3.67	.76	4.12	.72	3.57	.58	3.38	.42	24,65**	.03

Note: ** = p < .001.

According to think-aloud protocols, students from the experimental group, showed different orientations and solution processes before and after the intervention program. They showed different degrees of understanding, better depth of analysis, and greater control in solving the tactical problem after the program. Examples of a student's actual responses during the "think aloud" procedure are presented in tables 4 and 5.

Table 4. John's actual responses during "think aloud" procedures before the intervention and its categorization based on the model

Metacognitive behaviour	Metacognitive behaviour Sub-categories	Actual student's responses before the intervention
Engagement	- Initial engagement - Restating the problem -Assessing familiarity	-Reads the problem. "into a 2vs1 game what are the most appropriate movements ....." -"The most appropriate movements?" -"Wow! I know only one"
Formulation	-	-
Implementation	-Find a solution	- " He has to dribble the ball to move closer to the basket and shoot"
Evaluation	- Assessing reasonableness of the solution	- "I think this is the most appropriate movement"
Internalization	-	-

At the first tactical problem all the students from the experimental group, read the problem and restated it. Three of the ten re-read the problem, observed the positions of the players, and found a solution. The other four concluded that they had reached a solution and finally the remaining three found two solutions.

Regarding the second problem, students showed regulatory behavior by considering more cases, meaning that they checked more factors; such as the position of their opponents and teammates, the open space, the distance from the basket etc. Four of them began engaging with the task by reading the problem and restating. This demonstrated an understanding of the problem. They noted that they had to face similar problems in their class, and they created a pencil drawing to understand the problem in order to find more than one solution. The drawings facilitated better analysis of the information and enabled creation of new observations. Every new observation led them to assess the monitoring of their moves, and the formulation of solutions was accompanied by with excitement. (e.g., "What should I do now? "I need to re-read the scenario... Oh, okay. I get it"). Every time a solution was found they assessed their own success and noted their satisfaction (e.g., "..Yeah..I found it!"). A curiosity was developed as to whether the problem had different solutions (e,g., "…"I'm wondering ... is there another way to score?). Three of the students found three solutions and only one found two solutions.

Table 5. John's actual responses during "think aloud" procedures after the intervention and its categorization based on the model

Metacognitive behaviour	Metacognitive behaviour Sub-categories	Actual student's responses after the intervention
Engagement	- Initial engagement - Restating the problem - Assessing familiarity	-Reads the problem." what are the most appropriate movements ....." -"Which way is better to score?" -"Wow! I have confronted such problems before but this is more difficult"
Formulation	-Analysis of information - New observation - Identifying a pattern - Reflecting on assumptions - Considering more cases	- "I see that there are 2x2 players" -" It looks like man-to man defence" - "I see that is difficult for play-maker to pass the ball to his team-mate" - "So his fellow has to go to an open space" - "Maybe not" - "Maybe it is better for play-maker to dribble and then to score by himself"
Implementation	- Exploring the essence of the plan. - Assessing the plan with specific cases - Performing the plan - Monitoring the performance on the plan - Excitement -Find a solution	- "I need to justify it. No I think that it isn't so good idea" - "Let me try something else. May be the play-maker has to dribble and then pass the ball to his fellow" - "I see this is a more quick way to score, if his team-mate is going near to the basket" -"Yes!! That's it" - "His team-mate must go first in an open space in order to catch the ball"
Evaluation	- Assessing reasonableness of the solution - Mental activity - Reflecting on the solutions - Monitoring and Justifying the solution	- "Let me see what I did" - (No verbal communication) -"Yes!" - " Think that there are more than one solution" - "but the most quick movement is for play-maker to pass the ball to his team-mate who has to be near the basket"
Internalization	- Assessing difficulty - Confidence in finding the solution -Reflecting	-"Wow! That is challenging. But I am really happy that I found a solution to this problem" - "I'm wondering ... Is there a better way to score?"

The other three appeared to display a degree of discomfort; demonstrating through language that it was difficult to find three solutions to the problem (e.g., "…I don't know what else to do…I'm confused"). They re-read the problem and continued to try to find patterns, and from those patterns make estimations in order to find the second or third solution (e.g., "…let's see what I'm going to do now"). They expressed their feeling about the difficulty they faced and continued to refer to their pencil drawing for information about player positions etc. From these events, metacognitive behaviors were in evidence during their assessment and also during the monitoring of their solution process (e.g., "...Let me see what I did"). Finally, two found three solutions and only one learner found two solutions.

The remaining three students found correct solutions to the problem-solving situations. They read the problem; created a diagram and stated a solution. They then reflected upon the accuracy of this solution. Following this, they followed the same procedure to find the other two solutions.

4. Discussion

This study investigated the effect of the TGfU approach upon metacognition, and specifically on regulation of cognition in invasion games, in physical education classes. The results from data analysis revealed that the experimental group, compared with the control group, possessed higher scores in metacognition. The findings are consistent with findings from other researchers who claim that declarative knowledge (what to do) and procedural knowledge (how to do it) were higher for students who experienced the TGfU approach in volleyball and field hockey (Griffin et al, 1995; Turner, 1996). Moreover, the results from the tactical problem assessment revealed that post- intervention; students from the experimental group improved their metacognitive behavior. That means students improved not only the knowledge of cognition but regulation of cognition, which supports their ability to plan, monitor, evaluate and reflect on their actions.

Within the first phase, answers were quick and poorly conceived; however that may be due to the students' perception regarding their own lack of ability to find solutions, in addition to an absence of metacognitive abilities. Students did not show evidence of each of the sub-components in every phase, and no single student was found to exhibit all of the phases. After the intervention, students became consciously aware of constructing and analysing their own thoughts and ideas. Attempts to explore the scenario's in greater depth were evidenced, through observing students reading the scenario to find the most effective solutions. And as learners analyzed and reflected on the degree of familiarity or difficulty, they were triggered to evaluate their cognitive background. They paid more attention to the goals of the tactical scenario; activating prior knowledge in order to solve it successfully. In relation to formulation and implementation, students became more sensitive to the deeper processing of information and it should be noted, that this was a common practice for all participants at the second phase.

After the intervention, a clear majority of students tried to solve the tactical scenario by attempting to gain answers to their own critical, thought-provoking questions. These findings are consistent with the notion that learning-by-discovery and 'learning-by-doing' encourages students to activate metacognitive processes (Veenman & Beishuizen, 2004). They made judgements about their solution, and developed a tendency to 'step back' and re-interpret the scenario, with due consideration of the symbiosis between task objectives and their own orientations and solutions. The significant increase in metacognitive internalisation is noteworthy. Students were searching for more effective solutions, and expressing enthusiastic levels of satisfaction about what they had achieved. It has been said that evidence of internalization phases by problem-solvers can be interpreted as metacognitive maturity (Yimer & Ellerton, 2010). So, although in the first phase, learners didn't go through all the five stages of problem solving situations, in the second phase, such metacognitive elements as monitoring while planning for a solution, executing a plan and checking solutions were evidenced.

The tactical approach, aligned with the task constraints outlined within this work, created an environment for students to learn in sequential fashion; from the simple to more complex. Every time students faced a different constraint (modified rules, potent offence), they had the opportunity to plan actions from the beginning and in doing so, developed a repertoire of strategies to utilize appropriately. Modified equipment combined with the limited number of teaching cues during motor skill acquisition, enabled students to play the game more effectively, and consequentially pay more attention to tactics. Learning strategies in less complex environments (fewer players, reduced space, etc.) and the reduction of skill requirements gave students the opportunity to enhance their procedural knowledge about how to react. Moreover, conditional knowledge was developed, which Luke and Hardy (1999) suggest, is necessary in order to perform effective movements.

So to underline; after the intervention program, students had acquired a fund of cognitive strategies and skills, which must be present when metacognitive strategies are used in problem-solving situations (Rosenzweig, Krawec & Montague, 2011). Additionally, the forms of questioning (e.g. "*IF* the open space is in front of you *THEN* what might the next course of action be?") which the teacher applied during the sessions, promoted an 'opening up' of higher order thinking skills, in order to accomplish the goal of a modified game. And this is the difference between the traditional method where teachers ask for students only to recall information and perform skills correctly, rather than learning how to play effectively.

In TGfU approach teachers utilized guiding questioning methods regarding variables like offense/defence or the goals of the game. As a corollary, this helped students to think more globally, and by implication improved knowledge of how to react, how to look for open space, and determine where other players were positioned. This is perhaps the central reason students wrote out better solutions to a more difficult scenario (2v2) after the intervention program; because they learnt to think and act appropriately in varied game situations. These findings are consistent with the notion that such activities encourage the development of adaptive performers, who are more equipped to discover the best solution at any one moment in time (Button, Chow & Rein 2008, as cited in Renshaw, Chow, Davids & Hammond, 2010).

Both quantitative and qualitative assessments produced a positive influence of TGfU on students' metacognitive activity and behavior. Researchers claim that it's the tactical approach which encourages students to engage in self-discovery; and it is that which could lead to greater engagement in sport and physical activity (Renshaw et al, 2010). The very positive likelihood of increasing adherence to life-long physical activities, seconded by giving learners a greater capacity to apply their knowledge to other school subjects, is truly reinforcing the popular “sport as a metaphor for life” apothegm.

This research solely examined how students think and plan their actions after receiving basketball tuition, within the framework of a tactical-focus approach. A future study could investigate the differences in students’ thinking after consuming a traditional approach, as opposed to a tactical-game approach.

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