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## Impacts of the Game-Centered Approach on Cognitive Learning of Game Play and Game Performance during 5-week of Spring Season with Intercollegiate Female Soccer Players

Kanae Haneishi  
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Impacts of the Game-Centered Approach on Cognitive Learning of Game Play and  
Game Performance during 5-week of Spring Season with Intercollegiate Female Soccer  
Players

A Dissertation Presented

by

KANAE HANEISHI

Submitted to the Graduate School of the  
University of Massachusetts in  
in partial fulfillment of the requirement for the degree of

DOCTOR OF EDUCATION

May 2014

College of Education

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## DEDICATION

To my loving family.

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## ABSTRACT

# IMPACTS OF THE GAME-CENTERED APPROACH ON COGNITIVE LEARNING OF GAME PLAY AND GAME PERFORMANCE DURING 5-WEEK OF SPRING SEASON WITH INTERCOLLEGIATE FEMALE SOCCER PLAYERS

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Game-centered approaches have been increasingly recognized for their features and the impacts in coaching profession. Research with the game-centered approach is still underdeveloped in coaching sports and physical activities. Therefore, the purpose of this study was to describe the impacts of the game-centered approach on cognitive learning of game play and game performance during 5-week of spring season with intercollegiate female soccer players.

Game performances at beginning, mid, and end of the season were examined through Game Performance Assessment Inventory (GPAI) with seventeen participants. Cognitive learning of game play was also assessed with instant recalls and practice journals with all participants as well as simulated recall with three target players.

Results indicated the potential to improve the players' game performance with the game-centered approach through reinforcing the recognition of more quality game information in larger scale and the adjustments on and off the ball movements. In the complex and dynamic game learning situation, the players were seemed to identify the key tactical/technical components of the soccer game. The learning process supported the cognitive learning of game play by interacting mind

and body as well as building different domains of game knowledge through the game-centered approach. The players used the game information to make adaptations through the complex game situation, and then constructed and built the cognitive representation which became more meaningful knowledge in the game. Additionally, this study positively supported the game learning through social interaction. The players were encouraged to communicate with each other, construct the tactical meaning through the interaction with other players, and reflect on their learning in the game situation.

In conclusion, the players' cognitive learning with and without the ball was enhanced by being able to analyze more quality game information and linking different domain-specific knowledge. There were also some positive components which could have indicated the potential improvement of actual game performance. Additionally, the players seemed to be encouraged to carefully observe the game situation, analyze them, make tactical decisions, and construct game knowledge through the collaboration of body and mind as well as the social interaction with other players.



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# **CHAPTER I**

## **INTRODUCTION**

Coaches are constantly seeking effective ways to foster learning of game play and improve players' game performance. Researchers, like French and McPherson (2004), supported a close relationship between experts and their game knowledge in sports. In that sense, a coach's job is to modify the practice condition and environment to foster game learning. Thus, cognitive processing during game play as well as actual execution of game performance are important components for game-centered approach research in coaching. The games-centered approaches (i.e., Game Sense by Australian Sports Commission, 1991; Coaching In Game by National Soccer Coaches Association of America: NSCAA, 2011; Games Approach by Martens, 2004) have been increasingly recognized in the coaching profession for its characteristics of encouraging game learning, tactical awareness, and game performance. Although there has been more research on the game-centered approach in coaching sports and physical activities (SPA), the relevant research still remains underdeveloped (Light, 2006; Oslin & Mitchell, 2006), especially compared to the number of studies examining the game-centered approach in teaching physical education (PE). Therefore, it is necessary for coaches and researchers to continue exploring the game-centered approach, by testing related theories with carefully designed studies that produce empirical data (Griffin, Brooker, & Patton, 2005).

While research findings in teaching PE are helpful resources for coaches, there are critical differences between teaching PE and coaching SPA (Table 1). For example, the primary expectation for coaches is to improve game performance in competition as a



team while teachers in PE focus more on individual students' development in a class. As well, players in SPA generally choose to participate in a sport and often have several years of experience playing it. Consequently, such individuals are not novices. On the other hand, students in PE may not choose the sport in which they are engaged in class, and generally have less technical and tactical knowledge about it. Therefore, considering the differences between teaching in PE and coaching in SPA, more research focusing on the effectiveness of deploying the game-centered approach in coaching SPA is necessary.

Table 1: Differences between teaching PE and coaching SPA.

	Coaching SPA	Teaching PE
Educator	Coach who often specializes on certain sport	Teacher who needs to teach an array of sports and other physical activities
Learner	Motivated player with experience in the sport	Student who may not be motivated to learn a particular sport and typically has less knowledge about it
Duration	Season (i.e., months) – relatively longer	School unit (i.e., weeks) – relatively shorter
By-Product (Outcome Assessment)	Game performance in competition (More team oriented) – Learning and performance	Individual performance (More individualized) - Learning
Learner’s Commitment Level	Relatively high	Varies (wide range)
Learner’s Experience (Game knowledge)	Experienced (game knowledge – not zero)	Varies (game knowledge – wide range)

In the historical perspective of this pedagogical approach, Teaching Games for Understanding: TGfU (Bunker & Thorpe, 1982) has expanded to be various formats,

such as the Tactical Games Model (Mitchell, Oslin, & Griffin, 2006), the Revised TGfU Model (Kirk & MacPhail, 2002) and the Expanded TGfU Model (Holt, Streat, & Bengoechea, 2002). Although those models were mainly applied in teaching PE, the concept of the game-centered approach was rooted in coaching SPA back in the 1960's. TGfU and Play Practice (Lauder, 2001) were influenced by the English soccer coaches' development (Wade, 1967), which introduced the use of small-side games and emphasized the principle of tactical play. Later, Game Sense was emerged at coaching workshops in Australia conducted by Thorpe and the Australian Sport Commission in 1996 (Towns, 2002). Based on this historical background with the game-centered approaches, this study uses the term "game-centered approach" to describe a teaching/coaching approach that is "indirect" and primary uses "game situations to teach games" (Oslin & Mitchell, 2006).

### **Cognitive Understanding of Game Play**

It is reported that expertise in games was developed by constructing game knowledge (i.e., understanding of game play) under new challenges as well as connecting with previous experiences (Grehaighe & Godbout, 1995; O'Donnell, 2012). Experts demonstrated their effective ways to utilize domain-specific knowledge (Placek & Griffin, 2001) while they addressed dynamic problems in games (French & McPherson, 2004; Griffin, et al., 2005). Game knowledge has been also suggested as an indicator for the decision-making components in the game (French & Thomas, 1987). Thus, game knowledge is one of the critical factors in team sports in order to build comprehensive understanding of game skills, tactics, and strategies (Henninger, Pagnano, Patton, Griffin, & Dodds, 2006).

With the previous researchers, the information processing perspective and the situated learning theory has been commonly applied by the sport pedagogy researchers to address how players gain sport knowledge during game play (Butler, 1997; Griffin, et al., 2005; Light & Fawns, 2001; Light & Wallian, 2008; Kirk & MacDonald, 1998; Kirk & MacPhail, 2002; Piltz, 2003). The information processing view explains that players create mental representations (i.e., game knowledge in the player's information processing system) and applies cognitive processes (i.e., procedures the player applies to mental representations) to them (Mayer, 2012). Learning is about engaging in appropriate cognitive processing, thus it is important for coaches to create learning environment that guides to the appropriate cognitive process (Mayer, 2012).

In the history of the information processing, learning is initially viewed as strengthening and weakening of associations to the learning materials. In this sense, a coach's job is to provide rewards and punishments to players. This concept is related to the previous studies, such as coach's behavior (i.e., positive feedback) in sport psychology (for example, Chelladurai & Saleh, 1980) and trial-and-error studies in psychology (Mayer, 2012). On the other hand, this response strengthening perspective lacks its connection with how meaningful learning occurs. Players are also viewed as passive learners rather than active learners. The information acquisition perspective later developed and explained learning as aggregating information into mental representation that could be retained in long-term memory. This view reflects the implementation in computer simulations of cognition; however it viewed a player in a passive role, and it also weakens the relationship with existing knowledge (Mayer, 2012). For example, two

players can perceive same information differently and it depends on their existing game knowledge.

Unlike the strict behavioral approach which views the strengthening/weakening of bonds as the route to acquiring information, constructivists assert that meaningful learning is a personal and constructive activity (Mayer, 2012). Instead of simply computing the information, players use information to construct mental representation which then becomes more meaningful knowledge. In this view, learning is about building a cognitive representation in working memory. Here the coach's role is to help players try to make sense of their sport by selecting information that a player processes, helping her/him organize it in working memory, and integrating such constructions with existing knowledge in long-term memory. During a game, players process game information, build knowledge, and by so doing develop a richer understanding of the game. In this sense, the game-centered approach supports the constructivist framework by helping players make sense of their expanding experiences with what the player has previously come to understand (Butler, 1997; Light & Fawns, 2001; Light & Wallian, 2008).

Structures of mental representations (i.e., knowledge) are complex, and they can be changed under various conditions over time (Dodds, Griffin, & Placek, 2001). Placek and Griffin (2001) proposed that knowledge is primarily domain-specific, which refers to the particular realm of sports knowledge as well as alternative conceptions about phenomena in a particular subject of physical activity (Placek & Griffin, 2001). Domains of knowledge are primarily categorized as declarative or propositional, procedural, conditional, and strategic knowledge. These are used across specific domains and assists

in performing, regulating, and evaluating the execution of the performance (Dodds, et al., 2001). Furthermore, understanding of these differences in knowledge provides deeper understanding of how a player develops tactical knowledge during game play. For example, a soccer player might have knowledge to make a short pass with the inside of his/her foot (i.e., declarative or propositional knowledge), but he/she may not know when and how to use the passing skill in a game situation (i.e., conditional knowledge). Coaches in this sense manipulate the practice environments to foster learning for certain domain-specific knowledge. To guide players to appropriate cognitive processing, it is important for coaches to be aware of the individual's prior domain specific knowledge (i.e., what he/she has already knows about playing the sport).

While constructivist notions view players as active learners, and explain how new information is merged with existing knowledge, it is limited in describing other critical variables associated with learning such as player's motivation, player's strategies, player's belief, and social context of learning (Mayer, 2012). Coconstructive views of information processing helps to explain the social component of learning. It involves building cognitive representations in working memory, which are shaped by the social interactions one has in a group (Mayer, 2012). Players are encouraged to construct the tactical meaning of the game and reflect on their learning as they interact with other players in the complexity of the game situation (Piltz, 2003). Situated learning theory (Lave & Wenger, 1991) has been applied to describe the social component of constructivism (Griffin, et al, 2005). In this theory, knowledge is inseparable from the culture, the contexts and the activities in which it develops (Wenger, 1998). A key to improve game learning is to provide the opportunities for players to become legitimate

peripheral participants in the communities of practice (Griffin, et al., 2005). Knowledge and skill are acquired when new members move toward full participation in the sociocultural practices of a community (Lave & Wenger, 1991). In this type of learning participation, players have authentic learning experiences that are valued by both themselves and other member of the community of practice (Kirk & MacPhail, 2002).

Recently, Light (2008) argued that there were wide and diverse approaches of constructivism including psychological and social constructivism, and it confused to understand that different views in constructivism. Thus, he suggested complex learning theory which offered an inclusive and broad term for the diverse range of constructivist approaches. In this theory, learning is described as a complex, multifaceted, and continuous process of change that takes place within an activity (Light, 2008). Learning occurs through a complex process of understanding what is already known and what has been reflected in as well as making an action and an engagement of their bodies and minds in adaptation and modification. In that perspective, personal knowledge and activity as well as cognition closely connected with social interaction (i.e., collective knowledge) and activity, which relates to the situated learning theory (Lave & Wenger, 1991) in constructivism.

The complex learning theory recognizes game learning as being more spontaneous, more unpredictable, and more alive rather than a mechanical process which traditional information processing theory considered. In that sense, the complex learning theory supports games in the game-centered approach and views games that is complex, dynamic, and unpredictable (Light, 2008). Following the idea, Storey and Butler (2012) proposed complexity thinking model of game-based learning (Figure 1). The model

views games as complex adaptive systems which values the idea of ecological theory and are closely related to surrounding environment of body and mind (Storey & Butler, 2012). The model also offered the definitions of components which are involved in game learning and which help to describe the learning process in game play.

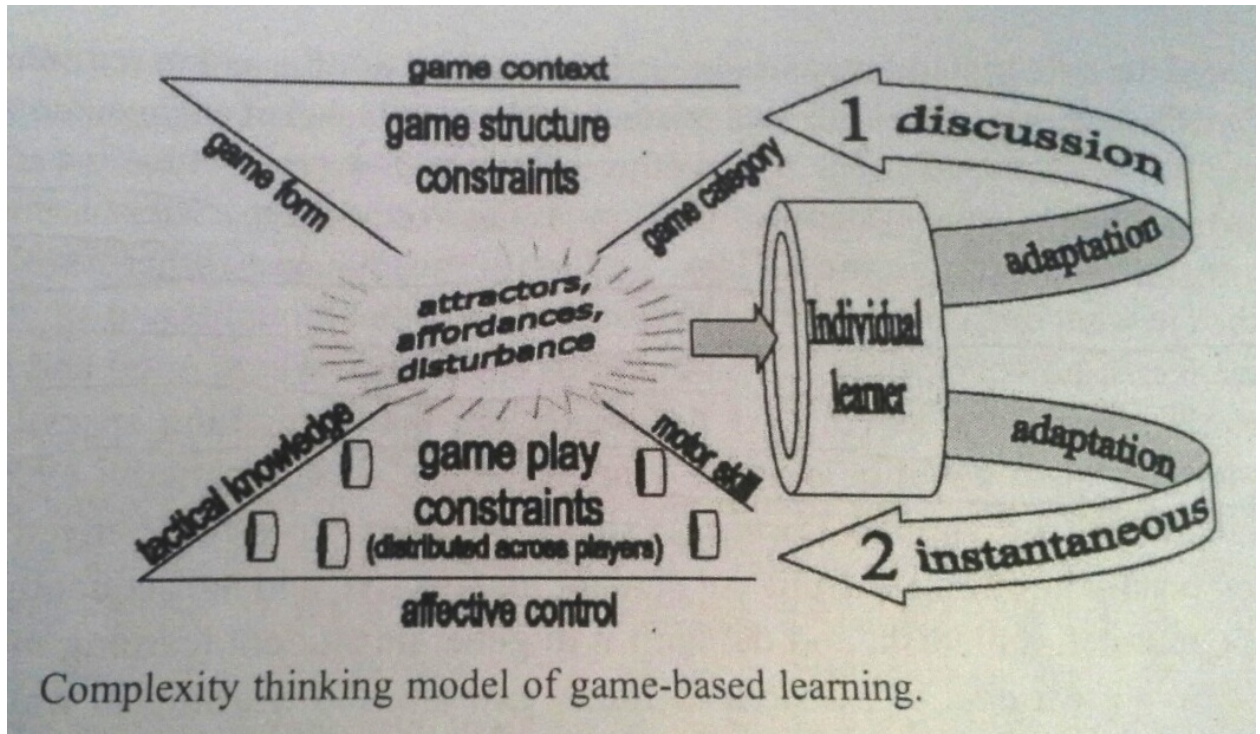


Figure 1: Complexity thinking model of game-based learning. (Storey & Butler, 2012)

### Game Performance

While developing cognitive/constructive game knowledge is critical to improve game play, the deployment of game performance on the field needs to be emphasized especially when game performance in competition matters. Grehaigne and his colleagues (Grehaigne, & Godbout, 1995; Grehaigne, Godbout, & Bouthier, 1997; Grehaigne, Godbout, & Bouthier, 2001; Grehaigne, Richard, & Griffin, 2005) introduced the



comprehensive analysis of game play. Force ratio, a choice of motor skills, as well as individual and collective strategies were indicated as the main characteristics of team sports. These three characteristics are further analyzed in a relation to 1) space and time, 2) information during the game, and 3) organization in the game (Grehaigne, et al., 2005). There are also three levels of game play analysis; a) individual scale in an isolated situation (analytical model), b) a collective group scale, such as a team (structuralist model), and c) an oppositional relationship scale (systemic model). Internal log of play is called the rapport of strength and refers “antagonist links existing between several players or groups of plays confronted by virtue of certain rules of a game that determine a pattern of interaction (Grehaigne, et al., 1997, p. 516).” The rapport of strength is strongly connected with the opposition relationship (i.e., force ratio) during each sequence of play (Grehaigne, et al., 1997). Each segment is examined at the different levels based on the rapport of strength. For example, figure 2 shows two levels of game analysis in an inversion game. The primary opposition relationship is at the one-to-one level, where the ball carrier makes two essential decisions (i.e., penetration or possession). The penetration is the decision to go directly to the target in order to shoot or to move the ball closer to the goal (Grehaigne, et al., 1997). The possession is the decision to move the ball to create the better position for the next penetration play (i.e., changing the point of attack). The initiatives of the primary level is affecting to the partial level (i.e., attacking group vs. opponent’s defense group) as well as the match level (i.e., team vs. team).

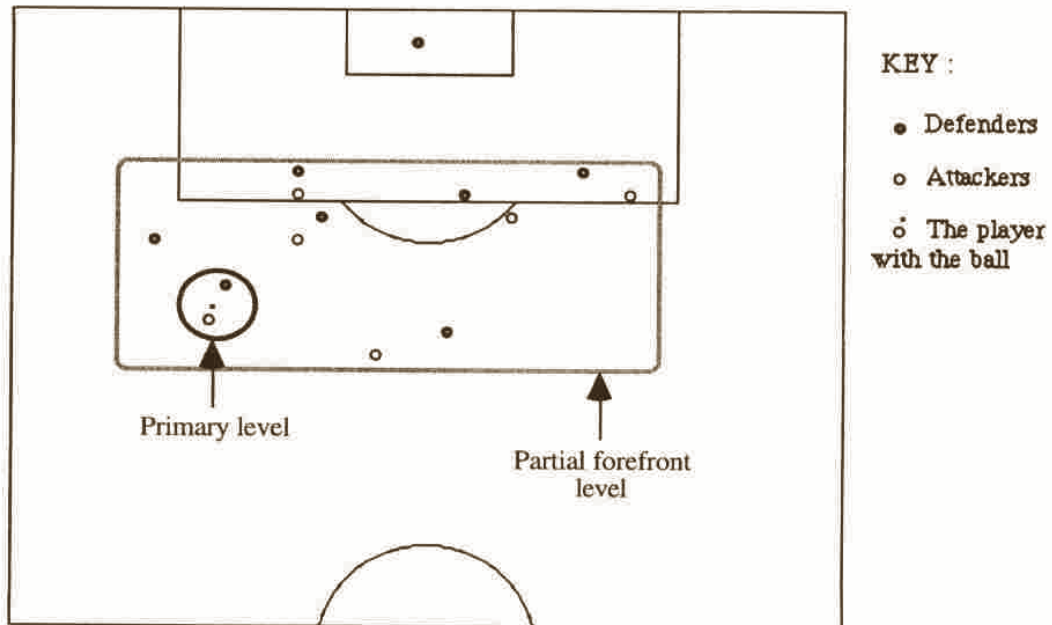


Figure 2: Partial forefront and primary organizational levels. (Grehaigine, et al., 1997)

According to Grehaigine and other colleagues (2005), success of team performance is determined by the most appropriate choices (i.e., decision-making) among various solutions at the players' levels and by the speed of decision-making (i.e., anticipation). In that sense, the primary purpose of practicing game play is to improve individuals as well as team tactics. In other words, coaches need to develop a group of players who can make decisions quickly based on information generated during the game and then execute responses efficiently and effectively to produce a team advantage (i.e., scoring goals and winning the game). Tactical efficiency implies the capacity of deciding in a timely manner (i.e., fast), and this capacity depends on the ability to formulate solutions (Grehaigine, et al., 2005). The decision making process is also influenced by the inter-relationship between attackers and defenders as well as the space around them (i.e., behind, between and in front of them). This inter-relationship can be

analyzed with past experience of similar situations and learning materials (i.e., experience and knowledge). Then, based on that comparison, a decision of what action to take can be made (Grehaigne, et al., 2005). Additionally, each player needs take into account his/her own ability (i.e., in relation to the abilities of the opposition), the physical condition of the field, the score at that particular moment, and the area of the field in which the action is taking place (Grehaigne, et al., 2005).

Grehaigne and others (2005) further explained the team performance during the game play. They referred that relative positioning of players on both teams was referred to as configuration of play. It is related to the possession and the location of the projectile ball as well as to the various players' movements. During the game, players need to be able to adjust their movements from one configuration of play to another in order to understand the progression of the game play (Grehaigne, et al., 2001). In connection with perceptual and decision-making skills, the construct of configuration of play is crucial because it allows players to optimize their activity during play (Grehaigne, et al., 2005). The tactical decision- making requires knowledge (i.e., knowledge of the game, knowledge of opponents, knowledge of one's own ability), which uses constancy to recognize and solve the unexpected configuration of play in the game (Grehaigne, et al., 1997).

Another important aspect of game performance is anticipation (Grehaigne, et al., 2001; 2005). Grahaigne and others (2001) reported that experts in team sports tend to have a speed advantage rather than an accuracy advantage in their decision-making. With their superior knowledge (i.e., both declarative and procedural knowledge), experts are able to collect proper information in the game and predict the upcoming play faster

than others (Grehaigne, et al., 2001). As a result, experts are capable of making quick decisions, initiating action in a timely manner, and succeeding against the opponents. Sources of anticipation are described at both the individual and collective levels. Individual strategy, player's cognitive map or knowledge base, tactical knowledge, and player's resources are the key elements for individual decision making. Decision making at the collective level is influenced by three primary factors, such as 1) the collective strategy, 2) the rapport of strength (force ratio), and 3) the competency network (Grehaigne, et al., 2001). All of these detailed analyses and definition of game play (both individual game performance and team performance) help to describe the game performance in more meaningful ways, especially with a complex game situation analysis like soccer.

When assessing game performance, it has been mainly assessed through observational procedures (French, & Thomas, 1987; Oslin, Mitchell, & Griffin, 1998). While independent observation protocols were utilized for some studies (French, & Thomas, 1987; Turner & Martinek, 1999), Game Performance Assessment Inventory: GPAI (Oslin, Mitchell, & Griffin, 1998) and Team Sport Assessment Procedure: TSAP (Grehaigne, et al., 1997) are the two most common assessment tools for game performance. Additionally, Gutierrez (2008) recently introduced the Game Performance Evaluation Tool (GPET) to assess decision-making and the execution of technical-tactical actions in invasion games. Since GPAI has been widely used in various coaching situations and it covers the critical components of game play (i.e., off-the-ball movement) based on Grehaigne, et al. (2005), this study utilized GPAI for the game performance analysis.

Previous studies reported positive impacts of the game-centered approach in coaching to improve game performance in comparison to the traditional skill-based approach. For example, the game-centered approach group performed better compared to the skill-based approach group in field hockey (Turner & Martinek, 1999), in a soccer class with the 7th grade girls (Chatzopoulis, Drakou, Kotzamanidou, & Tsorbarzoudis, 2006) and in basketball with secondary students (Gray & Sproule, 2011). Similar result was determined in coaching college soccer (Haneishi, Griffin, Siegel, & Shelton, 2009). On the other hand, some studies found no differences between the two approaches in terms of making impacts on game performance (French, Werner, Rink, Taylor, & Hussey, 1996; Turner & Martinek, 1992). Further examination of the game-centered approach is necessary so researchers and coaches can understand the impacts of the approach and use it effectively to improve the players' game performance.

### **Significance of the problems and purpose of the study**

The game-centered approach in coaching SPA is increasingly recognized within the U.S. The American Sport Education Program introduced the game-centered approach (i.e., games approach) as a successful coaching pedagogy to engage athletes and enhance tactical awareness (Martens, 2004). There are also various coaching workshops and coaching journals that support the game-centered approach (Charlesworth, 1994; NSCAA, 2011). For example, one of the largest soccer coaching associations in the U.S. (i.e., NSCAA) introduces Coaching In Games (CIG) to coaches as one of the primary coaching approaches during their educational program. Those resources, however, mainly focus on applied and practical aspects, so they usually lack theoretical and empirical foundation.

Previous coaching research also reported that coaches often develop their coaching theory only from their personal experiences and observation (Cushion, Armour, & Jones, 2003). Coaches tend to establish their knowledge, their skills, and their roles to deal with problems within their own contexts (Reeves, 1999). There is often a limited connection between coaches and research-based resources. Consequently, research in coaching with the game-centered approach described that coaches have experienced difficulties and have expressed hesitation to apply the new approach (Harvey, Cushion, & Massa-Gonzalez, 2010; Roberts, 2011). For example, England cricket coaches determined various types of dilemmas, including pedagogical, cultural, and political dilemmas when they applied the game-centered approach into their coaching practices (Roberts, 2011). Coaches, though, acknowledged that the game-centered approach develops more complete players (Light, 2004; Roberts, 2011). Thus, more research with the game-centered approach is necessary to connect coaching education and practice with the game-centered approach.

Furthermore, Light (2004) suggested that given the complexity in coaching the wide range of research that seeks to provide different insights into the nature of coaching is necessary. Considering the fact that research with the game-centered approach in coaching SPA remains limited (Light, 2006; Oslin & Mitchell, 2006), the purpose of this study was to describe the impacts of the game-centered approach in coaching female college soccer players during a 5-week of spring season. This study will focus on assessing the players' cognitive understanding of game play during the game-centered approach practices as well as the changes in game performance throughout the spring season.

## **Research Questions**

The following research questions were mainly focused throughout the study and discussed with the previous research.

- To what extent did the game performance of the players from both cognitive processing and performance execution perspectives change with the game-centered approach through the spring season?
- How were players processing tactical game challenges and constructing game knowledge during the game-centered approach practices?

## CHAPTER 2

### REVIEW OF LITERATURE

Teaching Games for Understanding (TGfU) was originated from the concept of English soccer coaching (Wade, 1967) and provided a new idea of teaching games in 1982 (Bunker and Thorpe, 1982). TGfU later developed in various formats, such as Tactical Games Model (Mitchell, Oslin, & Griffin, 2006), Play Practice (Lauder, 2001), the Revised TGfU Model (Kirk & MacPhail, 2002), the Expanded TGfU Model (Holt, et al., 2002), Game Sense (Australian Sports Commission, 1991), Coaching In Game (NSCAA, 2011), and Games Approach (Martens, 2004). While each model has some unique features and concepts, the terminology “game-centered approach” is widely utilized to describe the teaching/coaching approaches which are “indirect” and primary use “game situation to teach games” (Oslin & Mitchell, 2006).

This chapter intended to review the previous findings and theories which are relevant to the game-centered approach. In addition, the team sport and game play are further analyzed based on the configuration of game play (Grehaigne, et al., 2005). Lastly, three assessment tools for game performance were reviewed since improving game performance is an essential aspect in coaching.

#### **Historical Perspectives and Development of the Game-centered Approach**

Since TGfU was proposed by Bunker and Thorpe (1982), researchers has modified the model and added various theoretical perspectives. This literature review begins with the overview of historical background of the game-centered approach. While the game-centered approach was primary applied to teachers in physical education (PE)



in early research, coaches in sport and physical activities (SPA) has adopted the idea and modified in the coaching fields.

### **Game-centered Approach Development in Teaching PE**

The game-centered approach was originally proposed by Bunker and Thorpe (1982) as “Teaching Games for Understanding (TGfU).” They observed strong motivation to play games from students in PE. Thus, TGfU uses a game-like situation to teach games. TGfU also focuses on tactical awareness and social aspects of game play (Bunker & Thorpe, 1982; Griffin, & Patton, 2005). While a typical traditional lesson in PE starts with teaching skills before they move on to playing a game, TGfU begins a lesson with introducing the game with a modified game. By starting with a game structure, students can experience the whole picture of the game and understand the importance of games tactics. Depending on the students’ needs, the game is broken down to the small parts of the game and the students focus on the game component of skill execution. During the skill execution phase, the students are already aware of how those skills can be applied in a game situation from the first modified game. The lesson ends with a game formation in order to emphasize the overall game performance (Figure 3). While applying TGfU into teaching games, it is important to modify the games depending on the students’ skill levels and the capability (Kirk, & MacPhail, 2002) as well as their previous knowledge about the game play (Nevett, & French, 1997). Thorpe, Bunker, and Almond (1984) proposed four primary fundamentals for planning a games curriculum; 1) sampling, 2) modification in representation, 3) modification in exaggeration, and 4) tactical complexity. The tactical framework in TGfU consists of the

condition (i.e., space and time), the players (i.e., self and others), the possession, and the relationship of tactics-to-skill.

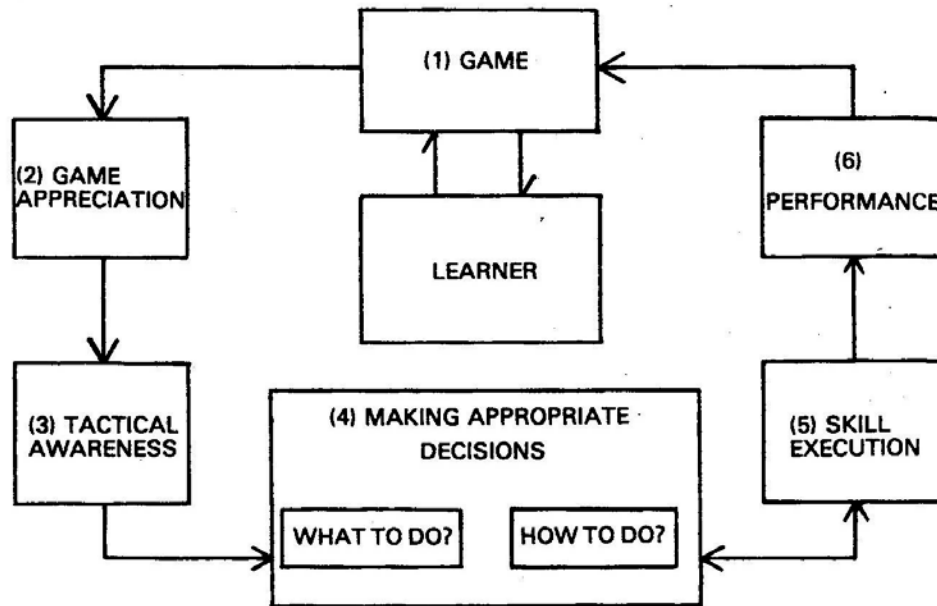


Figure 3: Teaching games for understanding model. (Bunker & Thorpe, 1982)

Further, researchers have expanded the TGfU idea and modified the model into various formats (i.e., TGM, Play Practice and Revised TGfU Model). For example, Tactical Games Model (TGM), which was introduced by Mitchell, Oslin, and Griffin (2006), provided a useful guideline for teachers in PE to plan their lessons. TGM is structured with the simple three sections in a lesson, which is similar to the idea of whole – part – whole learning model (Swanson & Law, 1993). The three components consist of 1) game form, 2) tactical awareness, and 3) skill execution (Figure 4). This lesson sequence created the organized framework and helped to motivate students by providing the clear student-oriented objectives (Mitchell, et al., 2006).

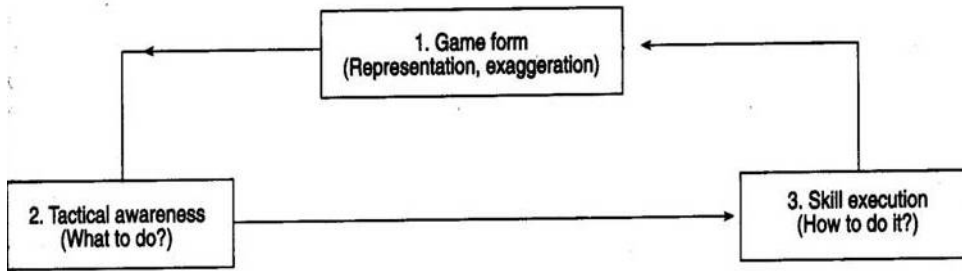


Figure 4: Tactical games model. (Mitchell, et al., 2006)

Lauder (2001) also proposed Play Practice for teachers in PE as well as coaches in SPA. It was a practical and functional approach which was influenced by TGfU and the English soccer coaches development program in 1960's (Wade, 1967). While both TGfU and Play Practice emphasized on understanding of the game, Play Practice primary aimed to provide a fun playing experience and to teach ability to play the game for beginners (Lauder, 2001). Because those players in Play Practice are intensively playing the game which is continuously changing, mistakes are not critical. Thus, the game environment allows the players freedom to try new game movements and skills without fear of failure (Lauder, 2001).

Kirk and MacPhail (2002) added the situational learning perceptiveness in TGfU and introduced the Revised TGfU Model. According to the situated learning theory (Lave & Wenger, 1991), a learner actively adapts new information within socially, culturally, and actively organized form, called communities of practice (Wenger, 1998). Thus, teachers/coaches need to provide the best learning environment for the learner's ability in the TGfU structure (Kirk & MacPhail, 2002). In other words, it is important to carefully modify the games (e.g., number of players and size of fields) depending on the learners' ability and previous experiences. Further, the Expanded TGfU Model presented with the

additional concepts of “when” to introduce the tactical/technical skills as well as the notion of learner’s previous experience (Holt, et al., 2002). Teachers/coaches need to consider the timing of the teaching materials and the already existed knowledge/skills in each lesson because every learner comes into the lesson with different previous sport knowledge and skill level (Holt, et al., 2002).

### **Game-centered Approach Development in Coaching SPA**

Implementation of the game-centered approach in coaching SPA originates in 1960’s. TGfU and Play Practice were both influenced by the English soccer coaches’ development program that introduced the use of small-side games and emphasized the principle of tactical play (Wade, 1967). Later, Game Sense was titled at the coaching workshops in Australia conducted by Thorpe and the Australian Sport Commission in 1996 (Towns, 2002). Game Sense is a game-based coaching approach where coaches ask questions to stimulate tactical thinking with the players rather than telling them what to do. Since coaches work as facilitators and use questions to develop the players’ thinking abilities, Game Sense helped to empower players and develop independent thinkers (Kidman 2001 & 2005; Light, 2005). The approach also focuses on off-the-ball movement (i.e., where, when and how to move without the ball). The off-the-ball movement is one of the most important aspects in playing games because the players spend majority of their game time without the ball (Light, 2005), especially inversion games like soccer and basketball.

The game-centered approach has also increasingly popular in the U.S. coaching profession (Charlesworth, 1994; Martens, 2004; NSCAA, 2011). For instance, the American Sport Education Program introduced the game-centered approach (i.e., Games

Approach) as a successful coaching pedagogy to engage athletes and enhance tactical awareness (Martens, 2004). The program outlines the basic guideline of the game-centered approach (e.g., starting with a game and emphasize tactics). The approach, however, is not connected with the TGFU model and lacks with theoretical backgrounds (e.g., situated learning theory and information processing theory). NSCAA which is one of the largest coaching associations in the U.S. uses Coaching In Games (CIG) as one of their primary coaching approaches at their coaching courses (NSCAA, 2011). The main concept of CIG is extremely similar to the other game-centered approach (i.e., Game Sense and TGFU), but it focuses more on practical coaching techniques on the field. For example, coaches are expected to recognize the coaching moments during game play which should be related to the objective of the practice. Then, the coach 1) freezes the play, 2) indicate certain techniques or decisions depending on the objective of the practice, 3) demonstrate the ideal plays if it is necessary, 4) ask the player(s) to rehearsal the play a few times, and 5) restart the game play from the adjusted play (NSCAA, 2011). Because the CIG coaching mainly focuses on practical coaching aspects, there is limited connection with theories and data-based concepts.

### **Developing Own Coaching Approach and Coaches' Perception**

Despite of the increasing popularity of the game-centered approach in coaching, there is still limited connection between coaches and related research. Cushion and his colleagues (2003) indicated that coaches often develop their own coaching theories mainly from their personal experiences and peer observation. Coaches tend to establish their knowledge, their skills, and their roles to deal with problems within their own contexts (Reeves, 1999). When coaches implement the game-centered approach, the

often experienced difficulties and expressed hesitation to apply into their coaching fields (Harvey, et al., 2010; Roberts, 2011). For example, England cricket coaches described various types of dilemmas including pedagogical, cultural, and political dilemmas when they applied the game-centered approach into their practices (Roberts, 2011). Coaches also indicated more complex social process in coaching than ones that the coaching literature determines (Light, 2004). Some coaches experienced that the game-centered approach (i.e., Game Sense) required longer time to improve game performance than the direct instruction approach. The coaches still emphasized that the game-centered approach is the preferred way to develop more complete players (Light, 2004; Roberts, 2011).

### **Theoretical Background of the Game-centered Approach**

While trying to make sense the game learning during the game-centered approach, researchers used various theoretical perspectives to explain the learning process. There are mainly two components of game learning; 1) physical and motor learning perspective and 2) cognitive and constructive learning perspective. While researchers support the simultaneous learning of body and mind through the game-centered approach (Light & Fawns, 2001; 2003), relevant theories were separately categorized in motor performance or cognitive learning. It helps to understand the complex learning of body and mind during game learning with the game-centered approach. Further, recent constructivist perspective proposed the integration of body and mind during game learning.

### **Motor Development Perspectives**

Motor development of game play with the game-centered approach tightly connects with various theoretical frameworks in motor learning and development

literatures. Those theoretical perspectives help to explain implication of learning and improving game performance during the game-centered approach.

**Schema Theory.** Schema Theory (Schmidt, 1975) of motor learning still provides rich framework of learning in the game-centered approach. The brief review of the Schema Theory and the connection with the game-centered approach were summarized in this section. Schmidt (1975) developed Schema Theory to explain the contradiction of Closed-Loop Theory (Adam, 1971) and expanded explanation on slow movements. Based on the idea of general motor program (GMP), a program for a particular class of action is stored in memory and executed whenever it is needed. Within this framework, a unique pattern of activity can result when the program is executed since various parameters are theorized to be input on each instance the program runs (Schmidt, 1975). Constant features of the program have been theorized to include the sequencing of elements, their relative timing, and their relative force. Variable features of the GMP are believed to include its overall duration, its overall force generated, and the muscles and limbs used. Schmidt (1975) hypothesized that a learner develops motor programs and the capability to parameterize them through practice that allows the learner to evaluate and store four types of information. The first one relates to the initial conditions that existed before the movement began, such as body position or the weight of an object to be propelled. A second source of information entails the actual response specifications used prior to movement. The third source of information leads to the response outcome. Finally, the sensory consequence of the movement (i.e., how the movement felt and sounded) is stored.

From this information, two kinds of schema are developed. When a person is required to make a response, for which he/she has a GMP, he/she creates the movement parameters for the program from the relationships previously experienced between the past outcomes combined with initial condition and past response specification (i.e., Recall Schema). When an individual has no experience with the desired movement, he/she predicts the response specification as well as the expected sensory consequences of the movement from past sensory consequences and past actual outcomes combined with initial conditions (i.e., Recognition Schema). Figure 5 shows the recall and recognition schema in relation to various sources of information. In addition, Figure 6 explains the motor response schema in relation to the events occurring within a trial.

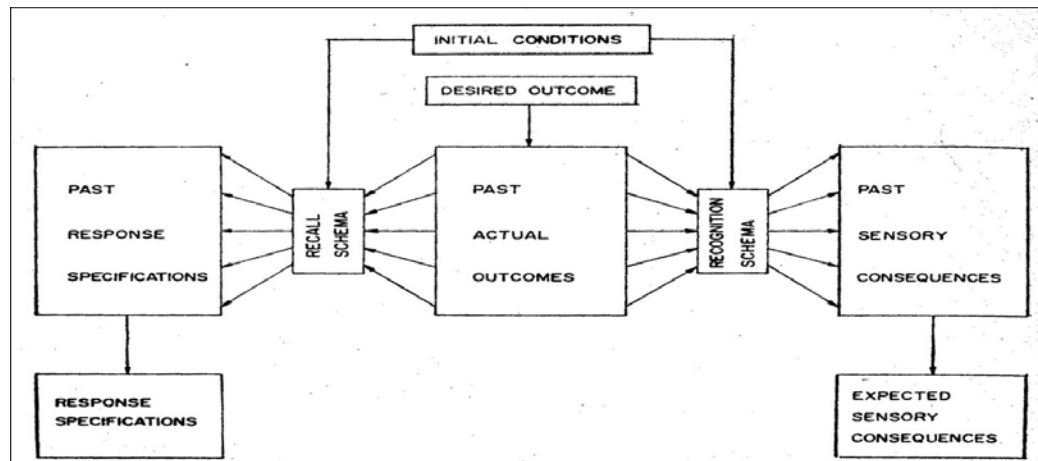


Figure 5: The recall and recognition schema in relation to various sources of information.

(Schmidt, 1975)



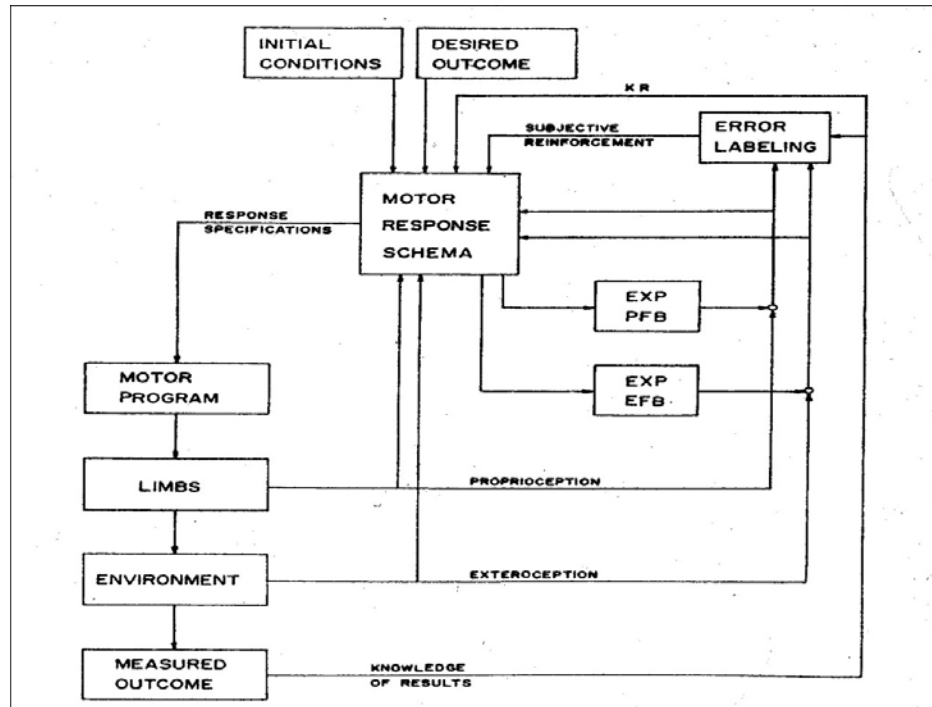


Figure 6: The motor response schema in relation to events occurring within a trial (recall and recognition schemata are combined for clarity) Abbreviations : KR = knowledge of results ; EXP PFB = expected proprioceptive feedback ; EXP EFB = expected exteroceptive feedback. (Schmidt, 1975)

According to Schema Theory, people learn skillful movements by learning a set of rules about how their bodies work under a variety of condition. In contrast to the Adams' closed-loop theory, Schema Theory hypothesizes that there is positive benefit from the production of movements even though they may be inaccurate. Because the schema is sets of rules based on the relationship among all stored elements, this relationship is strengthened just as much from incorrect movements as for correct ones.

From the Schema Theory perspective, the motor program transfers motor skills to various conditions and facilitates learning by understanding (Pigott, 1982). The theory

predicts that variability of practice within a GMP is beneficial since a player learns both the invariant features of the program as well as how to parameterize it for different conditions (e.g., passing a short distance or a longer one). The schema and motor program that were developed in the game-centered approach are utilized to execute in various forms of game performance.

**Dynamic System Theory (Ecological Theory).** Instead of focusing on the internalized knowledge structures or executive regulators, Dynamic System Theory (or Ecological Theory) explains motor performance by articulating the organism-environment synergies within a specific context that decreases and regulates the degrees of freedom for players (Handford, Davids, Bennett, & Button, 1997). This perspective emphasizes on changing relationship between player's perceptions and performance environment. It also supports practice protocols that enhance player's experimenting and manipulating with bodily and environmental constraints so that a finest solution to the body-environment interface can be discovered (Handford, et al., 1997). In that sense, the player's objectives in practice are to understand environmental challenges as well as to identify internal (i.e., bodily) and external (i.e., environmental) assets and constraints. The players are also expected to experiment through trial and error or with the guidance of a coach to find the solution to a particular game performance problem, as well as retain the solution for future game situations.

The Dynamic System Theory explains that although a player is responsible for making decisions about what to do, deeper level mechanisms (i.e., dynamic systems) within the body are responsible for working out the details of responses. For example, in

kicking a soccer ball, the coordination between excitation and inhibition in the hamstrings and the quadriceps is not consciously controlled. However, the function of the contingencies in which a player finds herself/himself relevant factors, such as the ball position and the velocity, the friction of the field for foot contact, the opponents positions, the offensive intentions, as well as the instantaneous stretch and/or springiness of the leg muscles. From practice experiences that require the players to interact with an array of game situations and response with required movement solutions, the internal systems within the player find the most economical ways to regulate themselves to achieve the desired goals.

The perspective of Dynamic System Theory supports that the ultimate objective of coaches would be to design a practice situation that closely reflects the game environment in which skills will be actually executed. Thus, the practice provides players with ample opportunities to allow their bodies, and the dynamic systems within them, to find optimal ways to be configured (i.e., find optimal attractor states Hansford, et al., 1997, p. 628). Particularly, for an open activity such as soccer in which environmental contingencies are in constant change as are the degrees of freedom with which players work, the game-centered approach practice helps to provide the types of variable experiences that a player needs for learning how to adjust systems to match an array of changing environmental contingencies. The manipulation of constraints could also enhance the development of tactical and strategic skills in the ecological framework (Handford, et al., 1997). During the game-centered approach practices, the game structures are usually modified rather playing a full-field game (i.e., various field size and different number of players). Thus, it is important for coaches to carefully plan practices

based on what they want to accomplish from each practice. The targeted game situation can help players to develop the dynamic system within them to be optimally configured of their performance.

### **Information Processing Perspectives in Learning and Instruction of Game Play**

Information processing view explains that human creates mental representations (i.e., knowledge in learner's information processing system) and applies cognitive processes (i.e., procedures the learner applies to mental representations) to them (Mayer, 2012). Learning is about engaging in appropriate cognitive processing, thus it is important for coaches to create learning environments that guides to the appropriate cognitive process of the game (Mayer, 2012). The information processing perspective on learning has progressed from information acquisition to constructivist, and recently to complex learning perspective. These perspectives help to describe how learning of game play works during the game-centered approach.

**Response Strengthening and Information Acquisition.** Learning is initially viewed as strengthening and weakening of association to the learning materials. In this sense, the coach's job is to provide rewards and punishments to players. This concept is related to the previous studies, such as coach's behavior (i.e., positive feedback) in sport psychology (for example, Chelladurai & Saleh, 1980) and trial-and-error studies in psychology (Mayer, 2012). On the other hand, this response strengthening perspective lacks its connection with how meaningful learning occurs. Players are also viewed as passive learners rather than active learners.

Information acquisition explains learning as computing information (i.e., mental representation) to long-term memory. In this concept, coaches provide information to the

player's empty memory container (Mayer, 2012). This view reflects the implementation in computer simulations of cognition; however it viewed learners are in passive roles, and it also weakens the relationship with existing knowledge (Mayer, 2012). For example, two players can select different mental representations after they receive same information. Players perceive information differently and it depends on their existing knowledge when coaches provide the information about game play.

**Constructive Learning of the Game Play.** Meaningful learning is a personal and constructive activity (Mayer, 2012). Instead of simply computing the information, learners construct the information and form mental representation as knowledge. In this knowledge construction view, learning is about building a cognitive representation in working memory where under coaches' guide players try to make sense by selecting incoming information, organizing in working memory, and integrating with existing knowledge in long-term memory (Figure 7).

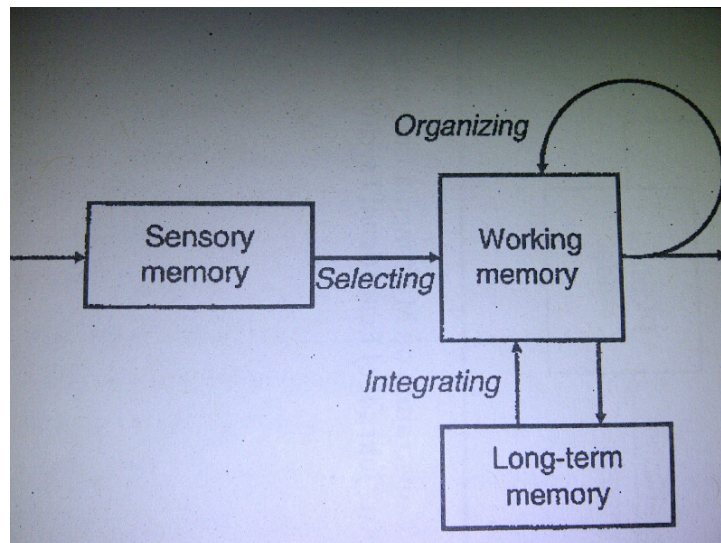


Figure 7: Basic information processing model. (Mayer, 2012)

Expertise in sports is also developed by constructing the new challenges and connecting with previous experiences (Grehaigne & Godbout, 1995; O'Donnell, 2012). In a game, players are in process of taking in game information, building knowledge, and understanding of the game. In this sense, the game-centered approach is operating the constructivist approach and making sense by synthesizing new experience into what the player has previously come to understand (Butler, 1997; Light & Fawns, 2001; Light & Wallian, 2008). Players seek out information in relation to the task at hand and the environmental conditions existing at any given time, and evaluate her capability within the context formed by the task and the environment (Kirk & MacDonald, 1998).

The mental representations (i.e., knowledge) structures are complex, and they can be changed under various conditions over time (Dodd, et al., 2001). Placek and Griffin (2001) introduced that the knowledge is held as primarily domain-specific, which refers to the particular realm of sports knowledge as well as alternative conception about phenomena in a particular subject of physical activity (Placek & Griffin, 2001). The domains of knowledge are primarily categorized as declarative or propositional, procedural, conditional, and strategic knowledge. Declarative or propositional knowledge includes knowing about things. Procedural knowledge is the knowledge about how to do. Conditional knowledge is the understanding of when and how to use the declarative or propositional knowledge. Strategic knowledge is a special type of procedural knowledge that involves goal-directed procedures. It is used across specific domains and assists in performing, regulating, and evaluating the execution of the performance (Dodds, et al., 2001). Further, understanding of these differences in knowledge provides the sources of how a player develops tactical knowledge during

game play. For example, a soccer player might have knowledge to make a short pass with the inside of his/her foot (i.e., declarative or propositional knowledge), but he/she may not know when and how to use the passing skill in a game situation (i.e., conditional knowledge). Coaches in this sense manipulate the learning environments to foster learning. To guide players to appropriate cognitive processing, it is important for coaches to be aware of the individual's prior domain specific knowledge (i.e., what he/she has already known about play the sport). Further, Griffin et al., (2005) suggested coaches to ask effective questions in order to gain insight from the players about what they are processing or not processing.

**Coconstructive Understanding of Game Play.** While the perception of constructivist addresses learner as active learner as well as explains the relationship with existing knowledge, it is limited to describe other aspects of learning such as the learner's motivation, the learner's strategies, the learner's belief, and the social context of learning (Mayer, 2012). Coconstructive view of information processing helps to explain the social component of learning. The social perspective of constructivism (Green & Gredler, 2002) involves building cognitive representations in working memory, which is also facilitated by interacting with others in a group (Mayer, 2012). Players are encouraged to construct the tactical meaning of game and reflect on their learning as they interact with other players in the complex game situation (Piltz, 2003). The constructivism (i.e., coconstructivist) consists of three components, such as active learners, social learners who construct them in dialogue with others, as well as creative learners who creates/recreates knowledge for themselves (Perkins, 1999).

Situated learning theory helps to explain the social component of constructivism (Lave & Wenger, 1991). In this theory, knowledge is inseparable from the culture, contexts and activities in which it develops and identifies “community of practice (Wenger, 1998).” A key to improve learning is to provide opportunities for learners (i.e., players) to become legitimate peripheral participants in the communities of practice. The legitimate peripheral participation is defined a descriptor of engagement in social practice that entails learning as an integral constituent (Lave & Wenger, 1991). The forms of the legitimacy of participation are a defining characteristic and way of belonging. It leads full participation which is intended to do justice to the diversity of relations involved in varying forms of community membership. In this type of learning participation, players have authentic learning experiences that are valued by themselves and other member of the community of practice (Kirk & MacPhail, 2002). Knowledge and skill are acquired when new members move toward full participation in the sociocultural practices of a community (Lave & Wenger, 1991).

Kirk and MacDonald (1998) emphasized that the social and cultural situation of teaching/coaching environment influences significantly to what is learned and how players learn. They added the situated learning perspective into TGfU model and proposed the revised TGfU model (Figure 8). Learning is an active process of engagement with socially organized forms of subject matter. The learning is also occurred through perceptual and decision-making processes and the execution of appropriate movement responses (Kirk & MacPhail, 2002). Griffin et al. (2005) also pointed out that the game-centered approach (i.e., TGfU and Revised TGfU) can provide the situated learning environment within a community of practice where meaningful and



purposeful learning occur. Players in the game-centered approach rely on each other so it also demonstrates positive interdependence (Griffin, et al., 2005).

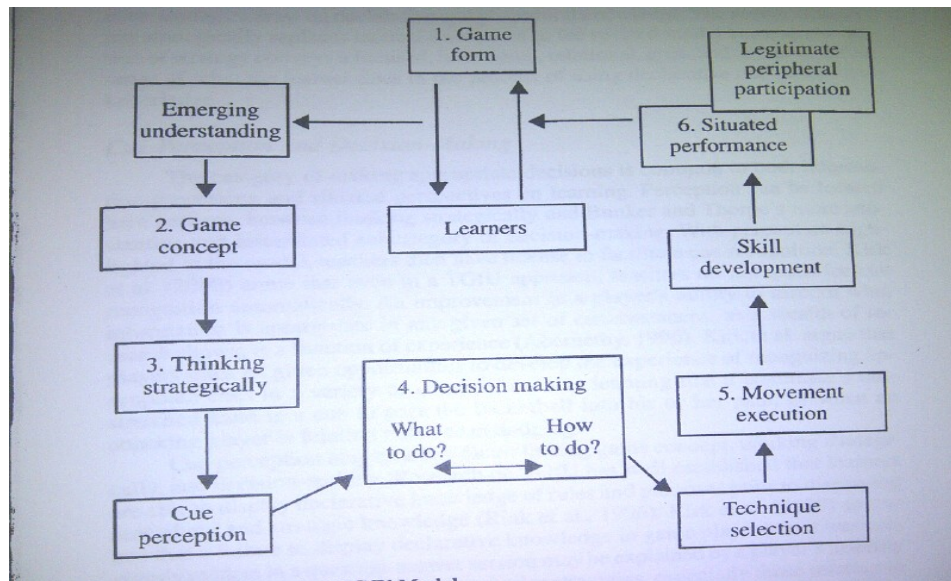


Figure 8: The revised TGfU Model. (Kirk & MacPhail, 2002)

**Complex Learning Theory.** Recently, Light (2008) argued that there were wide and diverse approaches of constructivism including psychological and social constructivism, and it confused to understand that different views in constructivism. Therefore, he suggested complex learning theory and viewed learning as a process that is complex and cannot reduced to a complicated number of parts (Light, 2008). This complex learning theory offers an inclusive and broad term for the diverse range of constructivist approaches. In this theory, learning is described as a complex, multifaceted, and continuous process of change that takes place within an activity (Light, 2008). Learning is also a dynamic corroboration of body and mind which are related to each other and cannot be separated when it considers learning. Learning occurs through a complex process of understanding what is already

known and what has been reflected in as well as making an action and an engagement of their bodies and minds in adaptation and modification. Light (2008) also indicated that learning involves the projection of the individual's life history of experience in a process of change and adaption as an act of interpretation shaped by experience. In that perspective, personal knowledge and activity are enfolded in and unfold from social interaction (i.e., collective knowledge) and activity, which relates to the situated learning theory (Lave & Wenger, 1991) in constructivism. Similarly, cognition is perceived as a social process with learning arising from social interaction (Light, 2008).

The complex learning theory recognizes game learning as being more spontaneous, more unpredictable, and more alive rather than a mechanical process which traditional information processing theory considered. In that sense, the complex learning theory supports games in the game-centered approach and views games that is complex, dynamic, and unpredictable (Light, 2008). Based on the idea of the complex learning theory, Storey and Butler (2012) proposed the complexity thinking model of game-based learning (Figure 9). The model views games as complex adaptive systems which values the idea of ecological theory and are closely related to surrounding environment of body and mind (Storey & Butler, 2012). The complexity thinking model of game-based learning provided the adaptive, complex, dynamic learning process in game play. The model also offered the definitions of components which are involved in game learning and which help to describe the learning process in game play.

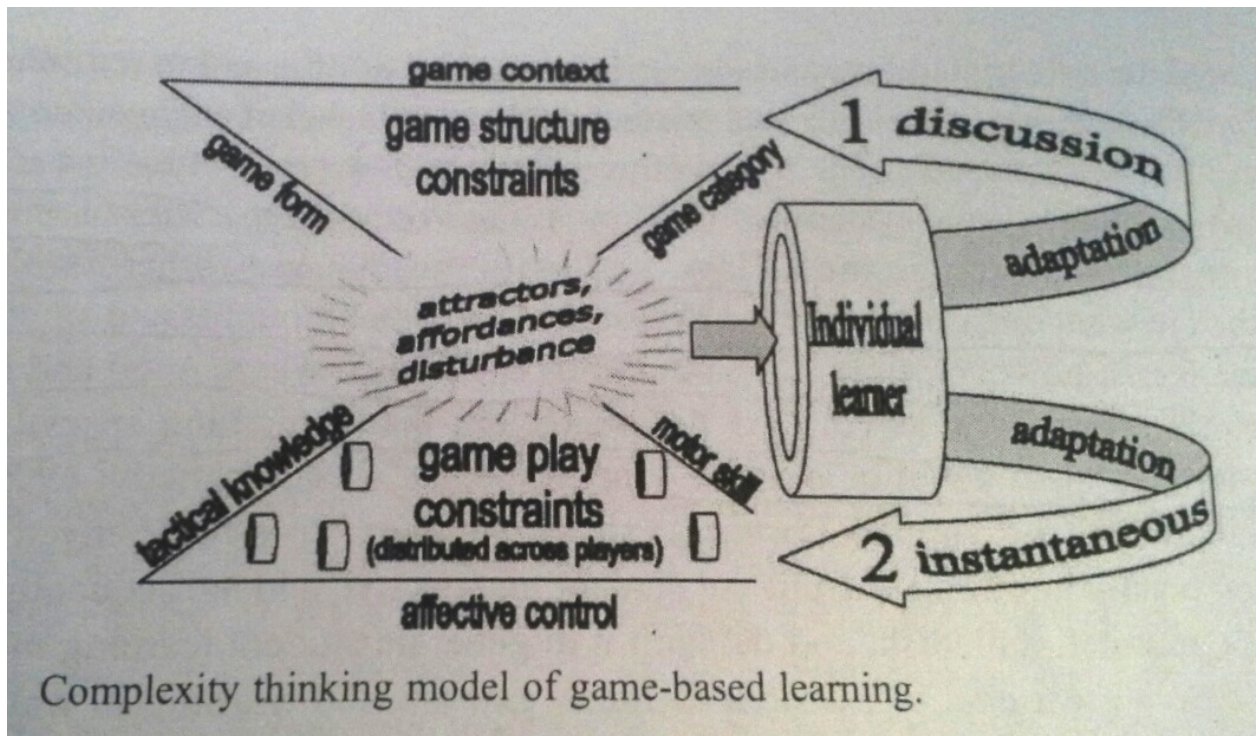


Figure 9: Complexity thinking model of game-based learning. (Storey & Butler, 2012)

### **Game-center Approach Research and Teaching in Physical Education (PE)**

Over the past thirty years, TGfU has become one of the recognizable teaching approaches in PE. Researchers and physical educators investigated the TGfU approach from many different aspects (Bell & Hopper, 2003; Oslin & Mitchell, 1996; Thompson, 1998; Thorpe, 1992; Thorpe & Bunker, 2010; Turner & Martinek, 1995). Based on the major research findings, TGfU helped to improve students' game performance as well as students' enjoyment/participation in games which leads to a healthier life style. In the comparison to the traditional approach (i.e., skill-focused approach), TGfU provided a more positive way of teaching strategic decision making for game players (Turner & Martinek, 1995). Additionally, TGfU intrinsically motivated students with the incentives of playing games and challenged them in a game-like situation (Thorpe, 1992). In the

early stage of the game-centered approach research, majority of qualitative data were compared with the traditional approach (i.e., skill-based approach) on various game components such as sport knowledge, game performance, skill development and motivation (Allison & Thorpe, 1997; Chatzopoulos, et al., 2006; French, et al., 1996; Lawton, 1989; Turner & Martinek, 1992; 1995). Lately, the game-centered approach research focuses more on the impacts of the approach to the learning aspects since the comparison (A versus B) research limited to describe the meaningful learning of game play.

### **Game Performance**

Game performance has been one of the most important components for the game-centered approach research since it emphasizes on tactical awareness, decision-making, and skill execution in a game situation (Bunker & Thorpe, 1982). Game performances were mainly assessed through observational procedures.

Majority of previous studies reported the stronger impacts of the game-centered approach to improve game performance in comparison to the traditional approach (French, & Thomas, 1987; Oslin, Mitchell, & Griffin, 1998). For example, field hockey performance based on the passing decision-making was higher with the game-centered approach group than the skill-based approach group (Turner & Martinek, 1995). With the 7<sup>th</sup> grade girls in a soccer class, students in the game-centered approach group showed the better results on decision-making and support components, assessed by Game Performance Assessment Instrument (GPAI), compared to the skill-based approach group (Chatzopoulos, et al., 2006). Similarly, students in the game-centered approach

group made more good decisions on and off the ball in basketball compared to students in the skill-focus group at a secondary school (Gray & Sproule, 2011).

On the other hand, some studies found no differences between the game-centered approach and the traditional approach (French, et al., 1996; Turner & Martinek, 1992). While students' ability to execute the field hockey skills in the games improved overtime with both the game-centered approach and the skill-based approach, there was no significant difference between two groups (Turner & Martinek, 1992). Similarly, French and others (1996) found no significant differences between the game-centered approach and the skill-based approach on the badminton game performance, which was measure by an observational instrument with the 9<sup>th</sup> graders. More research is needed to describe the relationship between the game-centered approach and game performance improvement.

### **Game Knowledge**

Henninger, et al. (2006) described that game knowledge is important, especially in a context of team sports, in order to build comprehensive understanding of game skills, tactics, and strategies (i.e., how to do, what to do, and when to do). Thus, game knowledge was often measured from written knowledge tests to describe cognitive understanding of the game. Most test scores were significantly higher with the game-centered approach compared to the traditional approach. For instance, game knowledge test scores were significantly higher with the game-centered approach group compared to the skill-based approach group with eight to nine years old students in basketball and field hockey (Allison & Thorpe, 1997) as well as sixth to seventh graders in badminton (Turner & Martinek, 1999). Gray and Sproule (2011) also reported the significant improvement of the basketball knowledge scores with the secondary students with the

game-centered approach. In the Lawton (1989) study, on the other hand, no significant difference was found between the game-centered approach group and the skill-based approach group for badminton knowledge with the 12 to 13 years old students.

Further, game knowledge has been suggested as an indicator for decision-making components in games (French & Thomas, 1987). With the constructivist perspective, expertise was developed by constructing new challenges and connecting with previous experiences (Grehaigne & Godbout, 1995). Previous studies have showed that experts have effectively utilized domain-specific knowledge while they faced to solve problems in games (French & McPherson, 2004; Griffin, et al., 2005). Students in a primary school in Spain had a difficult time using their tactical knowledge into soccer games in the early stage of game learning (Sa´nchez-Mora, Miguel Garcı´a, Sagrario Del Valle, Solera, 2011). There was also no significant correlation between declarative/procedural knowledge and game performance with the same primary school students (Sa´nchez-Mora, et al., 2011). Constructivist perspectives describe learning as constructing knowledge and integrating with existing knowledge. Therefore, assessing the learner’s development in sport knowledge (e.g., domain-specific knowledge) is helpful to understand the meaningful learning of game play with the game-centered approach.

### **Skill Development**

Ericsson (2001) explained that repetition over a long period of time was essential for developing the expert skill level. In that sense, the game-centered approach may face its challenge of the limited opportunity for repetitive practice to develop technical skills. The game-centered approach, however, does address the importance of skill practice in a similar circumstance where the skill is utilized during the game. The point is that skill,

which can be truly useful for the game, needs to be trained in a complex and fluid game environment where the players engage physically, emotionally, and intellectually (Light, 2005; Thorpe, & Bunker, 2010). Moreover, the sequence of the game-centered approach practice, which is ‘game - skill – game,’ related to the whole - part –whole motor learning concept (Swanson, & Law, 1993), helps to raise the game appreciation while players focus on skill development (Griffin, Oslin, & Mitchell, 1995). The comparison studies between the game-centered approach and the skill-focused approach have provided useful information to support this perspective (Allison & Thorpe, 1997; Gray & Sproule, 2011; Lawton, 1989; Turner & Martinek, 1992; 1995).

Previous studies have found no significant differences between the game-centered approach and the skill-focused approach. For example, there were no significant differences between the game-centered approach and the skill-based approach on badminton skill test (Lawton, 1989), field hockey skill test (Turner & Martinek, 1992, 1999), basketball skill execution (Gray & Sproule, 2011), as well as basketball and field hockey skill tests (Allison & Thorpe, 1997). Moreover, the game-centered approach group was better than the skill-based approach group on some of the skill variables (Allison & Thorpe, 1997). Thus, these results indicated that changing in emphasis from skill to tactics may not adversely affect in teaching games (Lawton, 1989).

### **Motivation**

Motivation is considered as one of the most important aspects in teaching PE and coaching SPA because it seems to be directly related to player’s performance and confidence. For example, when children in physical education were intrinsically motivated, they felt they could do it and it was worth doing (Thompson, 1998). Bunker

and Thorpe (1982) initially developed TGfU from their direct observation on strong desire to play among students in physical education. Therefore, the psychological impact of the game-centered approach in comparison to the skill-based approach is one of the critical components in order to determine the overall impacts of the game-centered approach in teaching/coaching games.

Previous studies supported positive impacts of the game-centered approach to improve the students' motivation (Allison & Thorpe, 1997; Chatzopoulos, et al., 2006). For example, the game-centered approach group improved all of Intrinsic Motivation Inventory (IMI) components while the skill-based approach group improved only on perceived component in the 7<sup>th</sup> grade soccer class (Chatzopoulos, et al., 2006). Likewise, the game-centered approach group showed high in enjoyment/effort, confidence, and perception about physical education with the 8 to 9 years old students in basketball and field hockey (Allison & Thorpe, 1997).

Teachers who applied the game-centered approach in their physical education classes also expressed the overall positive impacts on their students (Almond & Thorpe, 1988; Doolittle, 1983; Gubacs, Carney, Griffin, & Supapron, 1998; Turner, 1996). In the teachers' journal, TGfU enhanced the students' problem solving abilities and their enjoyments (Turner, 1996) as well as increased the students' benefits (Gubacs, et al., 1998), while the teachers observed the lack of students' enthusiasm during the technical approach. During the application of the game-centered approach, teachers experienced more learning about the game (Doolittle, 1983), reflecting their teaching, and creating new teaching ideas (Almond & Thorpe, 1988). The concerns from the teachers were; 1) disrupting teaching routine, 2) consuming more time, 3) lacking supports, and 4)



hesitating to newness (Almond & Thorpe, 1988; Doolittle, 1983; Gubacs, et al., 1998). Teachers suggested for implementing the game-centered approach; a) to start with small teaching group, b) to provide positive reinforcement to teachers, c) to consider teachers' comfort zone, and d) to discuss impacts of TGfU (Butler, 1996).

From students' perspectives, students in the game-centered approach classes experienced meaningful learning and expressed their preference of the approach (Gubacs, 2000; Tjeerdsma, Rink, & Graham, 1996). Students in badminton class indicated the improvement of their game performance and the fun aspects (Tjeerdsma, et al., 1996). The meaningful learning was capable to occur with; a) the combination of tactics and skills, b) the skills which were applied immediately in a game situation, as well as c) the fun and interesting game aspect (Gubacs, 2000).

#### **Game-centered Approach and Coaching in Sport and Physical Activities (SPA)**

There seems to be a slight gap between coaching research and practical coaching fields. Many coaches especially at the youth levels establish their own coaching theories and styles only from their own experiences and their observations. Reeves (1999) described these coaches' phenomenon as an invisible college. The invisible college in coach education develops personal coaching theory and creates knowledge, skills, and roles to deal with the problems within own context. According to the Reeves' coach education theory, successful coach education is a visible college in addition to the invisible college. The visible college develops the professional coaching theory and creates new knowledge that transfers to various situations. In order to help coaches to develop their coaching in the visible college, researchers need to conduct meaningful and useful studies for coaches. Although there are recently more and more studies in

coaching, academic research related to the game-centered approach on coaching in SPA is still underdeveloped (Oslin & Mitchell, 2006).

### **Players' Perception on the Game-centered Approach**

In Australia, Game Sense concept was introduced by Thorpe, R. and Australian Sports Commission as a systematic coaching approach (Australian Sport Commission, 1991). Kidman (2005) determined the significant impacts of Game Sense (i.e., the game-centered approach) with the Australian rugby and the netball national teams. Game Sense was able to not only develop the successful national teams but also empower the athletes (Kidman, 2005).

Similarly, Kidman (2001) reported the players' perspectives in a group interview from Daryl Gibson who was a professional rugby player in New Zealand and Anna Veronese who played for the New Zealand netball team. Both players preferred Game Sense, which they called the empowerment approach, more than the conventional ways of coaching. Daryl enjoyed the approach because "it also gives the players an opportunity to have input into the team and what they are doing (Kidman, 2001, p. 97)." Anna expressed her reason by stating "you also get a chance to say why you thought you should move to that position. It might not necessarily be the right place to go, but at least you can work through it (Kidman, 2001, p. 97)." Daryl and Anna also mentioned about the resistance from other teammates toward Game Sense if they were not used to the new approach (Kidman, 2001). Similarly, female college soccer players in the game-centered approach group demonstrated higher interest/enjoyment of participating, assessed by IMI, compared to the skill-focused approach (Haneishi, et al., 2009). The positive impact of the game-centered approach in motivation was critical because motivation was a critical

variable in an athlete's willingness to practice and stick with an activity for long periods of time (Ericsson, 2001).

### **Coaches' Perception on the Game-centered Approach**

Coaches, on the other hand, indicated more complex social process in coaching than ones that the coaching literature determined (Light, 2004). With the complexity, coaches experienced difficulties and expressed hesitation to apply the game-centered approach (Harvey, et al., 2010; Roberts, 2011). For example, England cricket coaches described various types of dilemmas, including pedagogical, cultural, and political dilemmas when they applied the game-centered approach into their coaching practices (Roberts, 2011). Although many coaches understand the benefits of the game-centered approach, some yet cannot neglect the skill (technical) portion of the game and modifying the game-centered approach in their own ways. For example, Jane, who coaches netball at the Victorian Coaching Centre in Australia, was guided by the Game Sense approach but retains a considerable amount of work on coaching technique (Light, 2006). Adopting the Game Sense involves coaching in a way that promotes development for both understanding and skill within game-like contexts (Turner & Martinek, 1992). Moreover, comparison research (i.e., the game-centered approach versus the skill-focused approach) showed no difference in soccer skill test after 8 week of soccer training (Haneishi, et al., 2009). Thus, it seems more efficient for coaches to improve the skill aspects of the game in a game situation. Coaches can also stop the game when a lack of techniques is holding up progression and work in a more technique-focused way to improve the skills until the skills are sufficient to play the game (Bunker & Thorpe, 1982; Griffin, et al., 1995).

Although coaches expressed their hesitation and the dilemmas about implementing the game-centered approach (Harvey, et al., 2010; Robert, 2011), coaches also recognized the benefits of the approach. For instance, coach indicated that Game Sense provided the opportunity to develop more complete players (Light, 2004). Naomi, who holds a senior position in the Sport Education section at the Australian Sports Commission, suggested that Game Sense “encourage coaches to teach rather than just tell (Light, 2006, p. 17).” Games Sense has also interpreted in different ways depending on their coaching philosophy and the approaches. Coaches adopt a more varied range of approaches across a spectrum of approaches from traditional technique-focused to purely game-centered approach (Light, 2006). Light (2004) suggested that given the complexity in coaching the wide range of research that seeks to provide different insights into the nature of coaching is necessary. Further, the use of qualitative research methods and a theoretically eclectic approach were suggested to analyze coaching beyond the instructional components (Cushion, Armour, & Jones, 2003).

### **Conceptualization of Game Play and Analysis of Team Play in an Inversion Game**

Grehaigne and his colleagues (Grehaigne, & Godbout, 1995; Grehaigne, et al., 1997; Grehaigne, et al., 2001; Grehaigne, et al., 2005) introduced the comprehensive analysis of game play and concept of team play. Particularly, Grehaigne and others (2005) provided the comprehensive explanation of their game analysis and team play as well as proposed Tactical Decision Learning model (TDLM). The information is helpful for coaches to analyze their games and conduct effective practices. When coaches plan a game-centered approach practice, modification of the practice games is one of the most important aspects. With the effective modified games during practices, intended practice

goals can be efficiently accomplished. Moreover, deeper analyses of team sports helped to determine how the game-centered approach impacted to the different levels of plays (i.e., one on one, group vs. group, and team vs. team) on the field (Grehaigne, et al., 2005). The following sections introduce the conceptualization of game play and analysis of team play especially in an inversion game like soccer.

### **Game Analysis Models**

Force ratio, a choice of motor skills, as well as individual and collective strategies indicated the main characteristics of the team sport while defining team sports (Grehaigne, et al., 2005). A group of players, called a team, confronts with another group of players, called opponent (team), during game play. Two teams compete over an object (i.e., ball and frisbee) in order to gain points and win the game (i.e., force ratio). Certain skill sets (i.e., motor skills) are necessary to perform (i.e., a choice of motor skills). There are strategies existed individually and as a team, so the team can move the object in effective ways (i.e., individual and collective strategies). These three characteristics are further analyzed in a relation to 1) space and time, 2) information during the game, and 3) organization in the game (Grehaigne, et al., 2005).

There are three levels of game play analysis (i.e., analytical model, structuralist model, and systemic model). In the individual scale, the game components are analyzed individually and then associated with each player (analytical model). This model analyzes technical skills in an isolation situation (not a game situation). It is based on a behavioral teaching approach as well as emphasizes imitation and repetition; however lacks with creative and critical thinking (Grehaigne, et al., 2005). Structuralist model considers a team as a collective group of individuals who work toward to a common goal.

The model aims to organize team strategies and tactics through practice situations. The practices focus on ball circulation and player movement in game situations. This game behavior helps to be flexible and creative during the game and provide the wider range of performance (Grehaigne, et al., 2005). Lastly, systemic model focuses on the game play from the oppositional relationship. The model aims to develop better understanding of the game and execute effective performance in the game. During the game, two teams need to organize their team play for recover, conserve, and move the ball so they can score goals and win the competition (Grehaigne, et al., 2005). This oppositional relationship game analysis helps to develop the preparation of response (i.e., anticipation) before the arrival of the ball.

### **Analysis of Inversion Game Play**

Internal log of play is called the rapport of strength and refers “antagonist links existing between several players or groups of plays confronted by virtue of certain rules of a game that determine a pattern of interaction (Grehaigne, et al., 1997, p. 516).” It is strongly connected with the opposition relationship (i.e., force ratio) during each sequence of play (Grehaigne, et al., 2001). Each segment is examined at the different levels based on the rapport of strength. For example, figure 10 showed two levels of game analysis in an inversion game. The primary opposition relationship is at the one-to-one level, where the ball carrier makes two essential decisions (i.e., penetration or possession). The penetration is the decision to go directly to the target in order to shoot or to move the ball closer to the goal (Grehaigne, et al., 2001). The possession is the decision to move the ball to create the better position for the next penetration play (i.e., changing the point of attack). The initiatives of the primary level is affecting to the

partial level (i.e., attacking group vs. opponent's defense group) as well as the match level (i.e., team vs. team).

The game-centered approach could help to train players in the various opposition relationships, so they can make effective decisions in the relation to what happens at the primary level and the partial opposition relationship. It is also important for researchers to assess the game performance at the all analysis levels, so how the game-centered approach impacts to the different oppositional relationships can be determined.

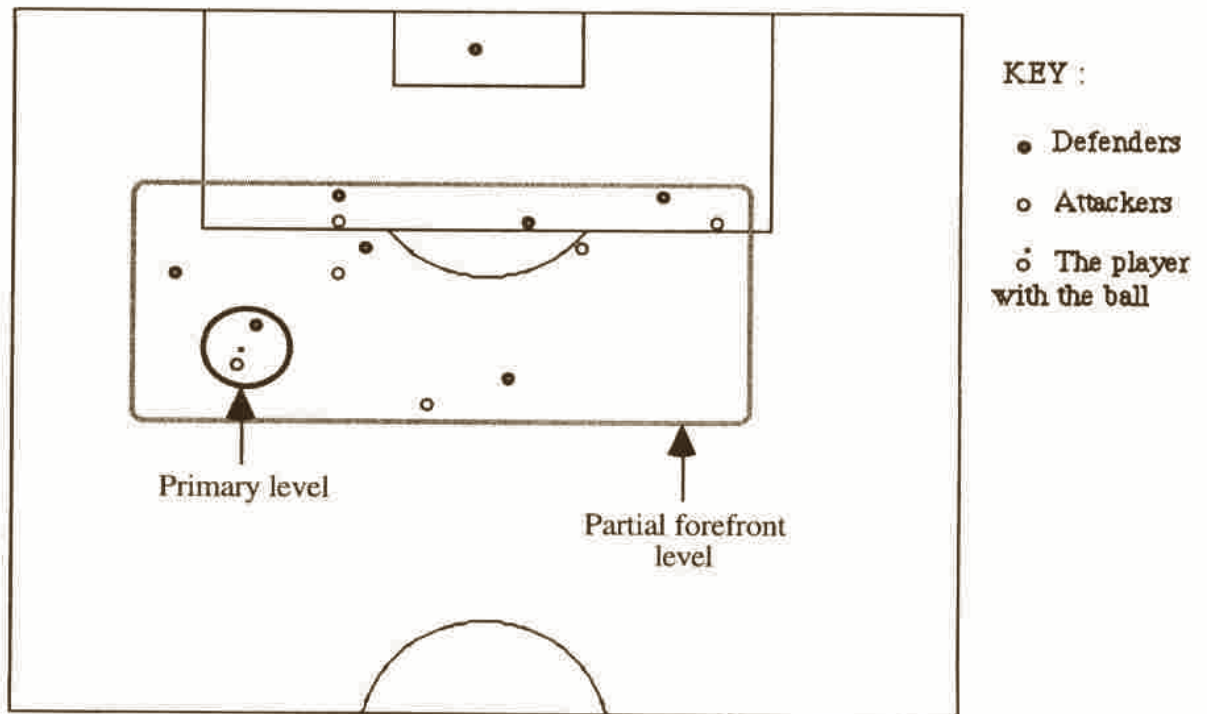


Figure 10: Partial forefront and primary organizational levels. (Grehaigine, et al., 2005)

### **Developing Individual and Team Tactics**

In the team play, strategy refers to formation of play, play plans, as well as guidelines for team play (Grehaigine, et al., 2005). They are determined prior to a

competition as a team in order to organize the individual players and the team during the competition (see figure 11). Tactics involve orientation and actions voluntarily executed during the game by players in order to adapt the immediate requirements from consistent changing opposition, opponent's spontaneous actions, or their game strategy (Grehaigne, et al., 2005).

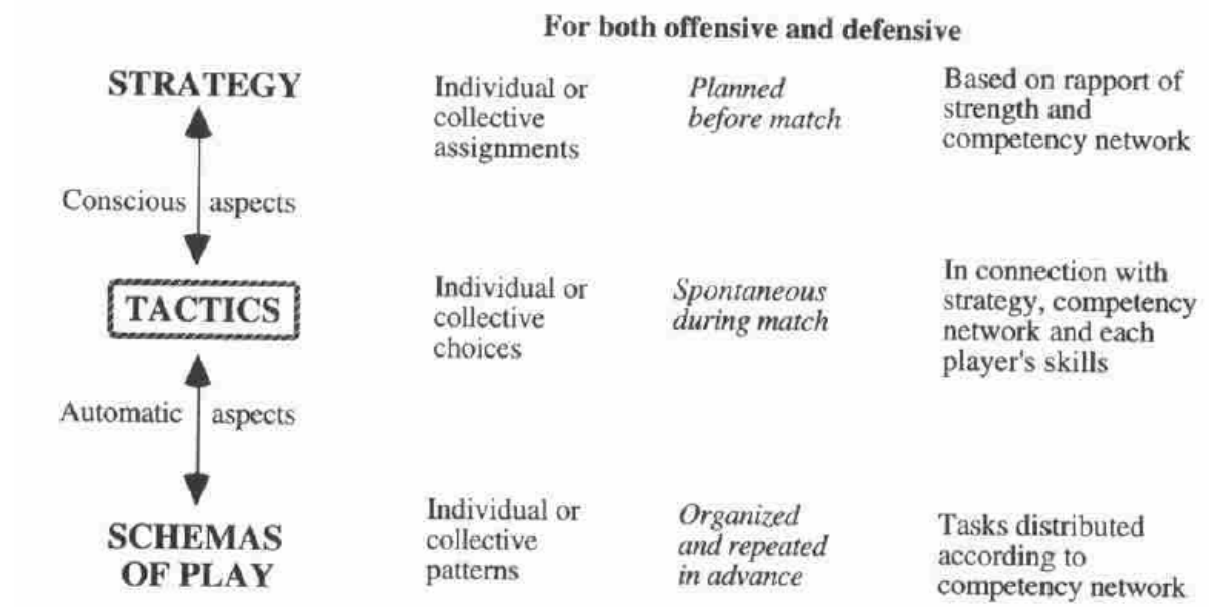


Figure 11: Main features of strategy, tactics, and schema of play (Grehaigne, et al., 2005)

According to Grehaigne and other colleagues (2005), success of team performance is determined by the most appropriate choices (i.e., decision-making) among various solutions at the players' levels and by the speed of those decision-making (i.e., anticipation). In that sense, the primary purpose of practicing game play is to improve individuals as well as team tactics. In other words, coaches need to develop a group of players who can make decisions based on their perceived information during the game



and execute efficient performance for the team advantage (i.e., scoring goals and winning the game).

The tactical efficiency implies the capacity of deciding in a timely manner (i.e., fast), and this capacity depends on the ability to formulate solutions (Grehaigne, et al., 2005). Figure 12 shows the various elements which influence the one's the decision-making process on the field. Decision making is influenced by the inter-relationship between attackers and defenders as well as the space around them (i.e., behind, between and in front of them). This inter-relationship can be compared with past experience of similar situations and learning materials (i.e., experience and knowledge). Based on that comparison, a decision of what action to take can be made (Grehaigne, et al., 2005). Players also need take into account their own abilities (i.e., the abilities of the opposition) the physical conditions of the field, the score at that particular moment, and the area of the field in which the action is taking place (Grehaigne, et al., 2005).

Configuration of play refers to the relative positioning of players on both teams. It is related to the possession and the location of the projectile ball as well as to the various players' movements (Grehaigne, et al., 2005). During the game, players need to be able to adjust their movements from one configuration of play to another in order to understand the progression of the game play (Grehaigne, et al., 2001). In connection with perceptual and decision-making skills, the construct of configuration of play is crucial because it allows the players to optimize their activity during play (Grehaigne, et al., 2005). The tactical decision- making requires knowledge (i.e., knowledge of the game, knowledge of opponents, knowledge of own ability), which uses constancy to recognize and solve the unexpected configuration of play in the game (Grehaigne, et al., 2005).



Figure 12: Some elements of the decision-making process in team sport. (Grehaigine, et al., 2005)

In addition to the decision-making, another important aspect of game performance is anticipation (Grehaigine, et al., 2001; 2005). Grahaigine and others (2001) reported that experts in team sports tend to have a speed rather than an accuracy advantage in their decision-making. With their superior knowledge (i.e., both declarative and procedural knowledge), experts are able to collect proper information in the game and predict the upcoming play faster than others (Grehaigine, et al., 2001). As a result, the experts are capable to make quick decisions, initiate the action timely, and win over opponents. Sources of the anticipation are indicated at individual level and collective level. Individual strategy, player's cognitive map or knowledge base, tactical knowledge, and player's resources are the key elements for individual decision making. Decision making at the collective level is influenced by three primary factors, such as 1) the collective strategy, 2) the rapport of strength (force ratio), and 3) the competency network (Grehaigine, et al., 2001).

Furthermore, to conceive game efficiency in these decision-making and anticipation manners, a player's game behaviors or responses must be considered as use and adaptation of the potential in a given situation not as application of fixed plan (Grehaigne, et al., 2005). Therefore, coaches' job is to help players adequately assess the variables in a given configuration of play and lead to positive game responses. These variables are often unexpected in unique situations that require game-related intelligence (Grehaigne, et al., 2005).

### **Tactical Decision Learning Model (TDLM)**

Combining the tactical game teaching models along with the constructivist and cognitivist perspectives, Grehaigne and his colleagues (Grehaigne, & Godbout, 1995; Grehaigne, et al., 1997; Grehaigne, et al., 2001; Grehaigne, et al., 2005) proposed the Tactical Decision Learning Model (TGLM). This model focuses on the players' exploration of the various possibilities of game play and on the construction of adequate responses in small-sided games (see figure 13). Grehaigne et al. (2005) also emphasized to consider the usefulness of the knowledge and competencies that need to be developed in learning game play. Consequently, players can make sense out of the learning activities that are presented to them. With the consideration, players will refer to his/her formulation of the task, observable behavior, and cues before actually engaging in the task (Grehaigne, et al., 2005).

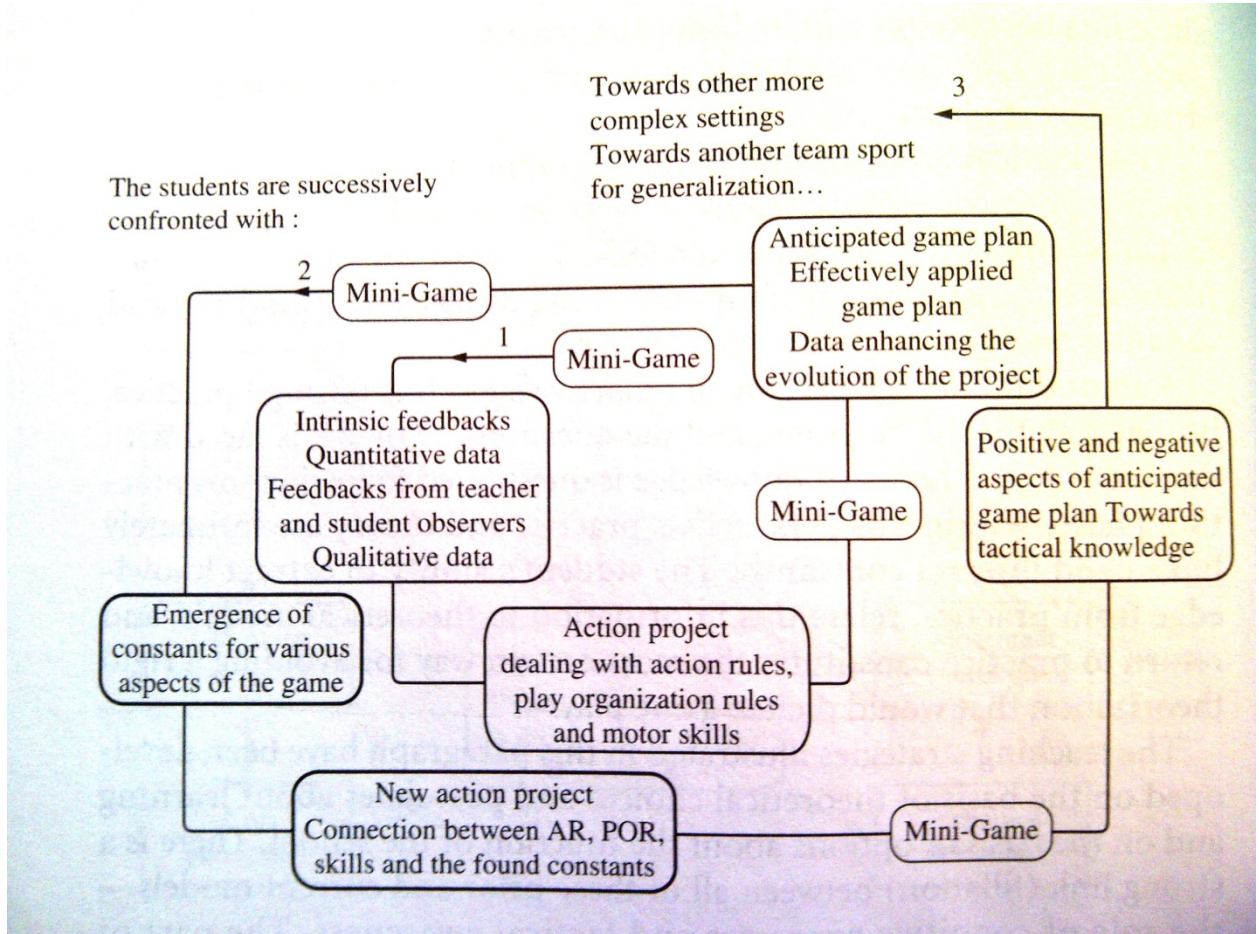


Figure 13: A model for students' construction of knowledge in team sports. (Grehaigne, et al., 2005)

### **Game Performance Assessment for the Game-centered Approach Research**

Ultimate goal for many coaches is to improve individuals' and team's game performance in the competitions. The game-centered approaches (i.e., TGfU and TGM) place the components of game performance and decision-making as the central parts of the approaches (Bunker & Thorpe, 1982; Oslin & Mitchell, 2006). Thus, as previously mentioned, game performance during actual game play is one of the critical aspects to

assess during investigating the impacts of the game-centered approach (Gutierrez, Gonzalez, Garcia-Lopez, & Mitchell, 2011; Gutierrez, & Garcia-Lopez, 2012a). Game performance is defined as “a complex product of cognitive knowledge about the current situation and past events, combined with a player’s ability to produce the sport skill (s) required (Thomas, French, & Humphries, 1986, p. 259).” Game performance usually consists of complex and fast-paced movements, so assessing the components of game performance (i.e., decision-making, support, game involvement and marking) could be challenging. While independent observation protocols were utilized for some studies (French, & Thomas, 1987; Turner & Martinek, 1999), GPAI (Oslin, Mitchell, & Griffin, 1998) and Team Sport Assessment Procedure: TSAP (Grehaigne, et al., 1997) are two most common assessment tools for game performance. Additionally, Gutierrez (2008) introduced Game Performance Evaluation Tool (GPET) to assess decision-making and the execution of technical-tactical actions in invasion games. The assessment protocol is useful for invasion games like soccer because it adopts the situated principle (i.e., tactical context/problem) as well as application principle (i.e., tactical adaptation of individual player).

### **Game Performance Assessment Instrument (GPAI)**

Conventional skills tests fail to assess players’ ability to make appropriate decisions about what to do, or the ability to execute skills under game conditions. Thus, Mitchell, et al. (2006) developed the Game Performance Assessment Instrument (GPAI), which observes players when they are not in possession of the ball as well as their decisions with the ball. It also helps assess the ability to solve tactical problems in games

by making decisions, moving appropriately, and executing skills. Figure 14 shows the components of game performance in the GPAI analysis. Researchers can select some of the critical components depending on their focuses rather than analyzing all of them. For example, a researcher can choose to focus on the components of support, decision-making, and skill execution if the research focus is about maintaining possession of the ball and attacking toward the goal.

### **Game Performance Assessment Instrument (GPAI)**

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. Decision making—Making appropriate choices about what to do with the ball (or projectile) during a game
4. Skill execution—Efficient performance of selected skills
5. Support—Off-the-ball movement to a position to receive a pass when player's team has possession
6. Cover—Providing defensive help for player making a play on the ball or moving to the ball (or projectile)
7. Guard or mark—Defending against an opponent who may or may not have the ball (or projectile)

Figure 14: Components of game performance. (Mitchell, et al., 2006)

By using this system, a researcher can measure the number of appropriate or efficient and inappropriate or inefficient actions. Scores in the GPAI analysis are relative to each other and there is no maximum score (Mitchell, et al., 2006). An example of a GPAI sheet is provided in figure 15.

Component of game performance Criteria for appropriate or efficient rating (to include all restarts—throw-ins, goal kicks, corners)

1. Decision made Criteria Player attempts to pass to an open teammate  
Player attempts to shoot when appropriate
2. Skill execution Criteria  
Reception—Control of pass and setup of the ball  
Passing—Ball reaches target  
Shooting—Ball stays below head height and is on target
3. Support Criteria The player appeared to support the ball carrier by being in or moving to an appropriate position to receive a pass

Name	Decision made		Skill execution		Support	
	A	IA	E	IE	A	IA
Matthew	xxxxxx	x	xxxxxx	x	xxxxxxx	xxxx
Bryan					xxx	xxx
Katie	xxxxx	x	xxxxx	x	xxxx	x
Kelly	xx	x	xxx	x	xxxxx	xx
Peter	xxx	xx	xx	xxx	xx	x
Alison	x	xx	x	xx	xxxxxxx	x

Key A = appropriate  
E = efficient IA = inappropriate  
IE = inefficient

Figure 15: Observation of soccer performance. (Mitchell, et al., 2006)

Oslin, et al. (1998) determined the reliability and the validity of GPAI across three games, including two games from the invasion category (i.e., soccer and basketball) and one game from the net/wall category (i.e., volleyball). While they did not find significant differences between high and low ability performers on the decision-making and the support indexes in basketball, the overall results suggested that GPAI was able to differentiate between high and low ability performers for each of the game components in soccer and volleyball (see Table 2). The reliability test was also high (range from 73% to 97%) in all three sports (Table 3). Hence, these findings suggested that GPAI was demonstrated as a reliable and valid method for assessing game performance. Moreover, this measurement is more authentic than conventional skill's tests because performance occurs within the context of the game (Oslin, et al., 1998). Hopper (2003) also suggested

that GPAI was useful in reinforcing and diagnosing tactical plays that create a foundation for skill practice.

Table 2: Comparison of GPAI components with students ranked high or low in game play performance: a test of construct validity. (Mitchell, et al., 2006)

	Soccer		<i>t</i>	<i>ES</i>	Basketball		<i>t</i>	<i>ES</i>	Volleyball		<i>t</i>	<i>ES</i>
	High ( <i>n</i> = 10)	Low ( <i>n</i> = 22)			High ( <i>n</i> = 7)	Low ( <i>n</i> = 18)			High ( <i>n</i> = 12)	Low ( <i>n</i> = 19)		
	<i>M</i>	<i>M</i>			<i>M</i>	<i>M</i>			<i>M</i>	<i>M</i>		
Decisions made	2.92 (3.00)	0.76 (0.94)	2.19*	1.19	3.51 (1.69)	2.54 (1.45)	1.44	0.64	2.33 (1.42)	0.75 (0.74)	3.58**	1.50
Skill execution	3.09 (2.10)	0.52 (0.79)	3.66**	1.93	6.58 (2.78)	3.04 (1.89)	3.69***	1.64	1.50 (1.13)	0.28 (0.42)	3.56**	1.58
Support	5.21 (4.98)	1.40 (1.17)	2.36*	1.31	3.23 (2.70)	2.14 (1.99)	1.09	0.50	—	—	—	—
Adjust	—	—	—	—	—	—	—	—	0.33	0.21	0.65	0.23

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

Table 3: Stability-reliability coefficients for GPAI components. (Mitchell, et al., 2006)

	Decisions made	Skill execution	Support	Ad
Soccer	.847	.971	.865	—
Basketball	.848	.844	.993	—
Volleyball	.896	.850	—	.972

### Team Sport Assessment Procedure (TSAP)

Gregainne et al. (1997) proposed a game-oriented authentic assessment protocol (i.e., Team Sport Assessment Procedure: TSAP), which assess individual performance



especially in team sports. This assessment tool was based on the observation of players' actions during competitions. It determines the efficiency of play, the volume of play as well as the overall performance score. Table 4 shows the definition of each measurement (Gregaingne, et al., 1997). The TSAP analysis determines an individual's overall offensive performance in selected invasion games (i.e., basketball, European handball, soccer) and net team sports (i.e., volleyball). A major feature of the TSAP protocol is its adaptability to different teaching/coaching scenarios. The assessment also reflects both technical and tactical aspects of game play. Using the integral version of TSAP was recommended when teaching more complex tactical problems at a higher grade level (Richard & Griffin, 2003).

Table 4: The relationships between items and types of information collected. (Gregaingne, et al., 1997)

Observation items	Information collected
Received balls (RB)	Involvement of the player in the team's play
Conquered balls (CB)	Defensive capacities of the player
Offensive balls (OB)	Player's capacity of making significant passes to his or her partners (offensive capacities)
Successful shots (SS)	Player's offensive capacities
Volume of play (PB)	General involvement of the player in the game
Lost balls (LB)	A small number reflects in good adaptation to the game

### **Game Performance Evaluation Tool (GPET)**

Recently, Gutierrez (2008) developed the Game Performance Evaluation Tool (GPET) to assess game performance in invasion games from a tactical view, coding decisions and executions according to the tactical problems. It offers a comprehensive perspective of attacking game as it assesses the behavior of both on-the-ball and off-the-ball. The GPET analysis was utilized to assess game performance in soccer and team handball (Gutierrez, et al., 2011), as well as modified invasion games (Gutierrez, & Garcia-Lopez, 2012a; 2012b).

GPET determines game performance at two different levels, such as the adaptation of actions to tactical problems/contexts and cognitive decision-making relative to motor skill execution. The adaptation of action is defined as “the efficiency during the game in adapting the actions to the tactical context (Gutierrez, et al., 2011, p. 878).” Game action is first analyzed in situation principle, which is the player’s capacity to identify tactical problems (i.e., maintain ball possession, penetrating, and scoring) during the game. Then, individual actions of play determine the application principle, which is the player’s choice of action according to one of the tactical principles (Gutierrez, 2008). At the second level, GPET separates the cognitive decision-making components and the motor skill-execution component (French, & Thomas, 1987). Control-decision-execution was considered as a usual sequence for on-the- ball attackers. Decision-making for support and execution for support were assessed as game performance for off-the ball attackers. Decision-making for marking, block, tackle, clearance, and exchange as well as its execution are assessed for off-the-ball defenders. Decision-making for marking, intercept, clearance, and double teaming as well as its execution are assessed for on-the-

ball defenders. One of the features in this GPET analysis is to measure the exceptional situations of invasion games, such as 50-50 balls and watcher-player. The watcher player refers a player who does not show tactical intention nor involvement in the game. Figure 16 show the complete data sheet for the GPET game performance analysis.

Team (t-shirt colour): \_\_\_\_\_ Number: \_\_\_\_\_

Game action/time		Principle		On-the-ball attacker					Off-the-ball attacker		On-the-ball defender						Off-the-ball defender				Exceptional situations					
N°	Min-sec.	SP	AP	C	Ex	DM			TD	Ex	DM						Ex	DM				WP	50-50 balls			
						P	M/D/P	Sh			Mc	Bl	Tc	Cl	Ex	DT		Mc	In	Cl	DT					
1.																										
2.																										
3.																										
4.																										
5.																										
6.																										
7.																										
8.																										
9.																										
10.																										
11.																										
12.																										
13.																										
14.																										
15.																										
16.																										
17.																										
18.																										
19.																										
20.																										

SP: situation principle  
 AP: application principle  
 DM: decision making  
 Ex: execution  
 C Ex: control execution  
 P: pass  
 M/D/P: moving with the ball/ dribbling/ protect the ball  
 S: shoot  
 GF: get free  
 Ex: fix  
 M: mark  
 Bl: block

Tc: tackle  
 Cl: clearance  
 Ex: exchange  
 In: interception  
 DT: double teaming

**Exceptional situations:**  
 - Watcher player / spectator player: Watcher-player: A player is coded as "watcher-player" when he does not show tactical intention nor involvement in the game. When an action is coded as watcher player, the application principle does not exist (and is coded as incorrect); and the DM or Execution are incorrect.  
 - 50-50 ball: and action is coded as 50-50 ball when it is not clear which player has the control of the ball, and which team is defender or attacker. In a 50-50 ball no other data is coded.

Figure 16: GPET data sheet. (Gutierrez, 2008)

## CHAPTER 3

### METHODS AND PROCEDURE

Learning game play, especially invasion games, involves in complex processes, such as defensive and offensive movements, opponents performance, player's previous experience, as well as social aspects (Light, 2004). In order to describe its complexity of game learning, a mix-methods protocol combining interviews and practice journal with GPAI was chosen for this study. Strauss and Corbin (1998) proposed that both quantitative and qualitative data had roles in describing a circumstance or theorize results, and both types of data can supplement one another. Figure 17 shows the conceptual picture of the present study. This study intends to describe the impacts of the game-centered approach from perspectives of cognitive learning of game play (i.e., cognitive and constructive knowledge) as well as actual game performance.

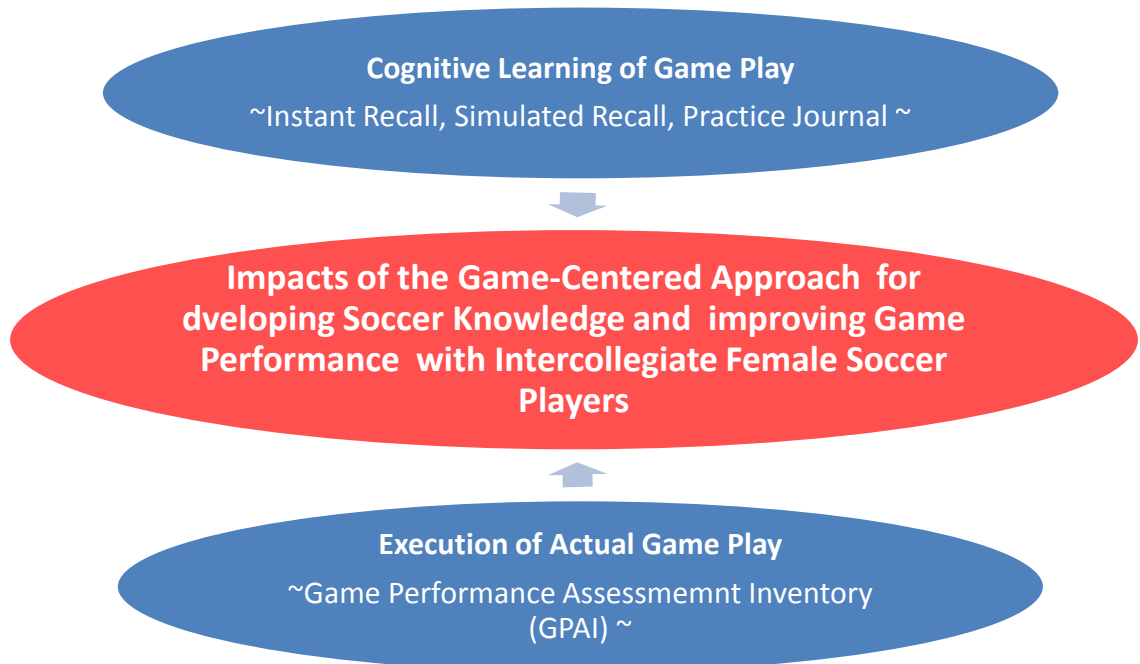


Figure 17: Conceptual picture of the present study.

## **Settings and Participants**

This study was conducted with a soccer team at a highly selective all women's college in New England. The intercollegiate sport team competes in the National Collegiate Athletic Association (NCAA) Division III as well as the New England Women's and Men's Athletic Conference (NEWMAC).

### **Team**

Seventeen female soccer players on this soccer team (age 18-21) participated in this study. All individuals completed a questionnaire (Appendix A) that included information about their demographics and previous experience with soccer.

All participants were free of any previous physical problems or pain and any previous other health problems before the study. Each participant was asked for both written and oral consent before engaging in the experiment. The study protocol was approved by the University's Institutional Review Board: IRB (Appendix D). All of the personal names were removed in order to maintain confidentiality and privacy.

### **Target Players**

Three target players from different positions, a defender (Jen), a midfielder (Ali), and a forward (Ann), participated in the simulated recall session. All three target players are in their first year with this college team. The target players sat down with the investigator after each game recording (i.e., beginning, mid, and end of spring season).

### **Coaches**

Three coaches (i.e., one head coach and two assistant coaches) participated in this study. The head coach (Kate) is a female coach who has ten years of coaching experience at the collegiate level. She is also the main investigator of this study who has

been involved in research of the game-centered approach for approximately eight years. She was taking the role of the investigator when assistant coaches were leading the practices (i.e., two third of practices).

The two assistant coaches (Molly and Lori) were briefed on the game-centered approach prior to the study. The assistant coaches led the two thirds of practices with the game-centered approach while the head coach was in charge for one third of the practices to demonstrate the game-centered approach coaching. Since the game-centered approach had been regularly applied the team practices for past years, both assistant coaches were familiar with the approach.

### **Procedure**

Traditionally, practices were built up with repeated drills where players were waiting their turns in lines and the skills were trained in an isolated situation often without any defenders. On the other hand, the game-centered approach develops the skills and the tactical understanding through playing in modified games. Coaches adjust the games (i.e., size of the field and number of the players) depending on the objectives of the practice. When the coach recognizes the coaching moment in the modified games, she/he stops the game, asks questions to the players, discusses the tactical/technical points, simulates the ideal play, and restarts the game.

The game-centered approach was used as a primarily coaching approach at all practice sessions in this study. More than 70-80% of practice time involved the soccer trainings with the game-centered approach while rest of the practice time was utilized for warm up, cool down, and walk-through. All three coaches reviewed the practice plan prior to each practice in order to verify the game-centered approach plan. Each practice

plan was saved as well as more than 80% of practice sessions were video-recorded for the verification of the game-centered approach.

During the 15-days of spring soccer season, the team basically had practices three times a week (i.e., Mondays, Wednesday, and Fridays) for five weeks. The team played an alumnae game after the 12<sup>th</sup> practice and participated in an 11 versus 11 tournament (i.e., three 60 minutes games) after the last practice. Each practice lasted between 1.5 hours to 2 hours of duration, which varied depending on the objectives of the day.

### **Continuous Model of the Game-Centered Approach**

Figure 18 explains the continuous model for the game-centered approach (Haneishi, et al., 2009). Throughout the present study, degree of the game-centered approach (i.e., how close to the right end of this spectrum is) during each practice was modified depending on the objectives of the day. In other words, the structure of each practice was shifted sideways on this spectrum while all practices were intended to keep as close to the right end of spectrum as possible.

The degree of the game-centered approach is mainly determined by the number of decision-making opportunities as well as the number of opportunities for a player to be involved in a specific game situation. For example, when shooting in soccer is practiced with an isolated shooting drill without a defender, the drill is categorized more to the left side of the spectrum. On the other hand, if a player develops shooting skills in a shooting game with her/his teammates and some defenders (i.e., 2 vs. 2 shooting game), the shooting exercise is aligned more with the right side of the spectrum. Table 5 provides an example of shooting exercises for each category. It is important to remember the continuum aspect so there is no clear cut between categories.

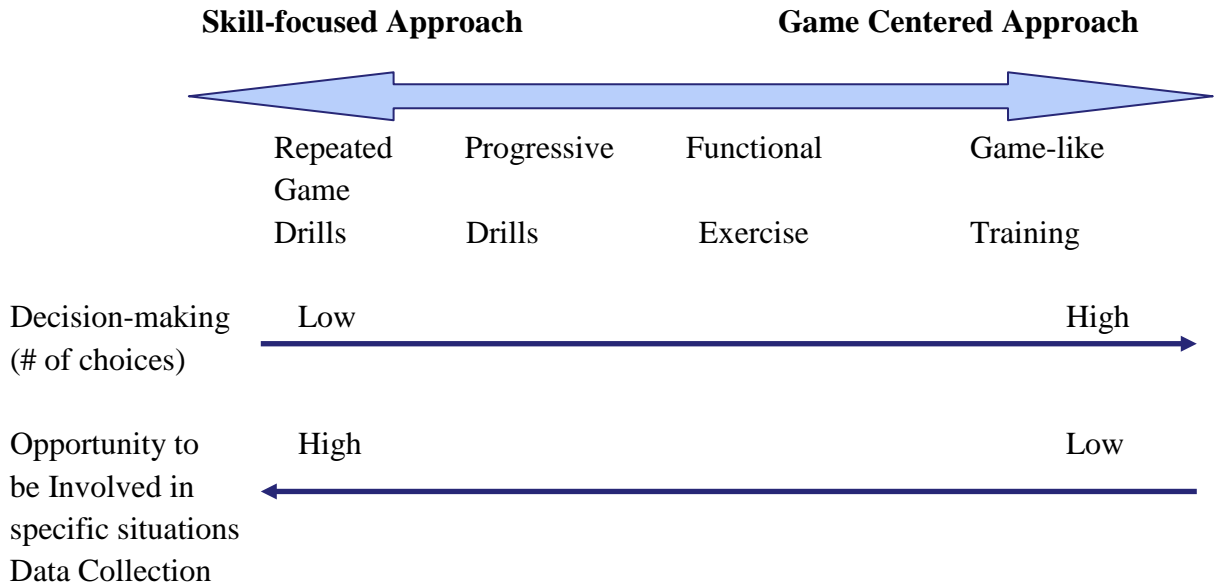


Figure 18: Continuous model for the game-centered approach. (Haneishi, et al., 2009)

Table 5: Example of shooting exercises in the continuous model for the game centered approach.

Continuous Model	Repeated Drills	Progressive Drills	Functional Exercise	Game-like Training	Game
Shooting Exercises	Shooting drill. Pass to a target player, receive the ball back, and take a shot	Shooting drill (a) with a stationary defense or a cone.	2 vs. 1 with one goal. Two offenses face to one defense. (one-way)	2 versus 2 shooting game with two goals each side (two-ways)	Small side game (i.e., 6 vs. 6) or full 11 vs. 11 game



## **Data Collection**

Game performance as well as cognitive learning of game play with the participants was examined through this study. Game performance during scrimmages was video-recorded at the beginning, middle, and end of the spring season. Three target players reviewed the video clips after each recording session and reflected on their thinking process. All participants also recorded their practice journals after each practice session and reflected on their game learning. During the practice sessions, the investigator randomly asked quick questions about their cognitive processing to the players who were just involved in a play. Research memo was kept throughout the study to support the collected data.

**Game Performance.** Three 20 minutes scrimmages at the beginning, middle, and end of the spring season were video-taped for the GPAI analysis. The following GPAI components were coded for the game performance analysis:

1. Decision-making WITH the ball,
2. On – the – ball movement (skill execution)
3. Off – the – ball movement (offensive support and defensive cover)

The definition and criteria of each component were defined prior to the study (Appendix B). Light (2005) mentioned that it is important to include on-the-ball movements and off-the-ball movements when researchers investigate game performance in an inversion game, like soccer and rugby. That is because players in the inversion games spend most of their game time without handling the ball. Thus, the player's off-the-ball movement

has significant influence to the team's success (Light, 2005). Therefore, off-the-ball movements (i.e., offensive support and defensive cover) were intentionally included in this GPAI data collection.

**Simulated Recall.** Target players watched the 20-minute of recorded video after playing each scrimmage. During the session, the target players were asked to recall their thinking process. Examples of the questions during the simulated recall interview were “what were you thinking about during this play?” or “what would you do differently?” The simulated recall sessions were recorded on a digital recorder and transcribed manually by the investigator. The research memo was taken during the simulated recall session to support the data.

**Practice Journal.** All participants kept practice journals to reflect their cognitive learning during each practice. They were asked to fill out the practice journal form (Appendix C) after each practice.

**Instant Recall.** Cognitive processing of players during the practices was recorded by the investigator when she was not leading the practice session. The players who were just involved in a certain play were randomly selected and was asked to recall their thinking process (i.e., what were you thinking just now?). The instant recall session were recorded on a digital recorder and transcribed manually by the investigator.

### **Data Analysis**

Game performance was analyzed by the GPAI analysis. Grounded theory method (Strauss & Corbin, 1998) was applied to analyze the simulated recalls, the practice journal, and the instant recalls. The following section explained the details of each data analysis.

**Game Performance.** GPAI (Mitchell, et al., 2006) was applied to determine the game performances during the each scrimmage. Each component of the game performances was determined using the following formula (Table 6).

Table 6: GPAI components and the formula.

1	Decision-making with the ball index (DMI)	Number of appropriate decisions made ÷ number of inappropriate decision made
2	Skill execution index (SEI)	Number of efficient skill executions ÷ number of inefficient skill executions
3	Offensive support index (SI)	Number of appropriate supporting movements ÷ number of inappropriate support movements
4	Defensive cover index (CI)	Number of efficient mark movements ÷ number of inefficient mark movements
5	Game performance	$[DMI + SEI + SI + CI] \div 4$

**Inter-observer agreement.** To insure objectivity in rating GPAI scales, inter-observer agreement was calculated using Pearson correlations. A volunteer who is also a soccer coach for a middle school boys' team was briefed on the GPAI, its scale structure, and strategy for classifying behaviors into categories. He then assessed 30% of the main investigator's GPAI evaluations. Significant correlations ( $p \leq 0.05$ ) with Rs at or above 0.6 (and hopefully higher) were required to demonstrate adequate inter-observer agreement.

**Statistical Analysis.** Multivariate analysis of variance (MANOVA) was conducted to determine the relationship between combined five dependent variables (i.e., five GPAI components) and scrimmages. Wilks' Lambda test was applied to determine the significance on MANOVA. Following MANOVA, one-way repeated measures of ANOVA was utilized to determine the mean differences among three scrimmages (i.e., beginning vs. middle vs. end) separately on the GPAI data. Independent variables were three recording points (i.e., three scrimmages). Dependent variables were the means of the 17 participants on each GPAI component. Fisher's least significant different (LSD) test was utilized for Post Hoc tests. In all cases, the level of significance was  $p \leq 0.05$  for the first analyses and further  $p \leq 0.35$  was utilized to report the significance on the different alpha level.

**Simulated Recalls, Practice Journal, and Instant Recalls.** Grounded theory method (Strauss & Corbin, 1998) was utilized to analyze the transcripts from the simulated recall sessions, the practice journals, and the instant recalls. Through the open-axial coding, main categories were established with properties and dimensions. After the interview data was transcribed, all transcription was coded openly until core categories were established through the process. This process intended to describe overall features of the stories from the interviews and the journal writings. The core categories that were developed through the open coding were then analyzed with relationships between the categories (axial coding) in order to establish the main categories. Key parts of the recalls and the journal were further analyzed in depth as selective coding. Through the selective coding the story lines were explicated, so it helps to understand the influence of the game-centered approach on the game learning process.

Additionally, data from simulated recall interviews were analyzed with a verbal response protocol to identify condition, action, and goal concepts (Henningher, et al., 2006; McPerson, 1993; 1999). The results from the condition/action/goal analyses were further combined with individual GPAI scores. This protocol helps to develop profiles for each target player. Table 7 indicates the quality and characteristic of condition, action, and goal concepts. Some possible condition, action, and goal concept categories are indicated in Table 8. To ensure the coding reliability, a second coder who is familiar with the domain (i.e, a soccer coach) conducted the same verbal response protocol on the 30% of the main investigator's coding. Reliability was estimated by  $\# \text{ of agreements} / (\# \text{ of agreements} + \# \text{ of disagreements}) \times 100 = \% \text{ for each category}$  (McPerson, 1993).

Table 7: Quality and characteristic of concept.

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Condition Concept Quality

0 = inappropriate or weak

1 = general condition without any characteristics

2 = appropriate and has one characteristics

3 = appropriate and has two or more characteristics

Action Concept Quality

0 = general action, weak

1 = appropriate (no forceful quality, only action stated)

2 = appropriate and has one forceful quality

3 = appropriate and has two or more forceful qualities

Goal Concept Quality

0 = skill and herself (execution, getting into a position)

1 = herself, teammates and opponent (penetration toward the goal, protect the goal)

2 = win (scoring goals, denying an opponent's goal, winning game)

---

Table 8: Some possible condition, action, and goal concept categories.

<u>Condition</u>	<u>Action</u>	<u>Goal</u>
Player's position	Passing/dribbling (skill)	Executing skill
Opponent's position	Visual -marking	Scoring a goal
Location of the field	Clearing the ball	Protecting an goal
<u>Team's position/shape</u>	<u>Stop an opponent (as a defender)</u>	<u>Winning game</u>

## **Research Profile**

The research focus of the main investigator was to explore the game-centered approach in coaching physical activities, especially in coaching competitive sports. She had 10 years of coaching experiences at college levels and had been involved in the game-centered approach research for eight years. From her involvement in the game-centered approach as a soccer coach and a researcher, the investigator was interested in further examining the game-centered approach at the intercollegiate level.

## **Limitation**

There were two limitations expected in this study. First, the main investigator of this study was also the head coach of the team. Although it was made clear prior to the study that any comments and any responses were completely separated from the team business, some degree of influences from the investigator-participants relationship was somewhat expected. For example, a player might have manipulated her response because she was concerned about her impression to the coach or worried about her playing time. Secondly, as with any practical research in a coaching field, injuries and sickness were expected to occur. Therefore, the number of the practices that each participant performs was influenced by the injuries, sickness, and other unexpected factors.

## **Trustworthiness**

All research needs to be concerned with producing valid and reliable knowledge in an ethical manner (Merriam, 2009). Therefore, the followings procedures were applied to support trustworthiness of this study.

**Internal Validity/ Credibility.** Critical friend as well as triangulation protocols was utilized as one of the tools to verify internal validity and credibility of the study. A

professor who focuses on the game-centered approach at a university served as a critical friend. She monitored the protocol of this study to verify internal validity and credibility of the study. A semi-structured interview procedure was combined with a quantitative method (i.e., GPAI). In addition, multiple theories and concepts (i.e., information processing theory) as well as results from previous studies were associated with the data from the present study.

The games-centered approach had been used regularly with this team for a while. Thus, all of the participants were familiar with the game-centered approach (adequate engagement). The research procedure was also reviewed consistently with the university's dissertation committee in order to receive subjective feedback.

**External Validity/ Transferability.** The background of the research setting and the participants was clearly described (i.e., collegiate level, females, and soccer players) to support transferability. The findings from this research were associated with previous findings in similar settings.



## CHAPTER 4

### RESULTS

The game-centered approach was examined from the perspectives of both cognitive learning of game play and actual execution of game performance on the field. GPAI scores showed no significant improvements at the significant level .05 while simulated recalls indicated the important cognitive process during the scrimmages. Instant recalls and practice journal seemed to demonstrate the cognitive learning of game play during the game-centered approach practices. The following sections provide the results from the GPAI analysis and the simulated recall for game performance, as well as the results from the instant recall and the practice journal for cognitive learning of game play.

#### **Game Performance**

Game performance of all participants from three scrimmages (i.e., beginning, mid, and end of the season) was analyzed by GPAI. Results from the inter-observer agreement analysis as well as the one – way repeated measures of ANOVA for each GPAI categories were explained in the followings.

#### **Inter-Observer Agreement**

To assess the objectivity of coding GPAI data, the inter-observer agreement was calculated (using Pearson's R) between observations made by the main investigator and the second observer. As seen in Tables 9, all correlations were significant at .05 or less between two observers, which ranged from .62 to .85. Since the sample size was relatively large (N= 53) and all GPAI categories showed significant correlation ( $p \leq$

0.01), the average correlations across categories were judged to be acceptable (mean for  $R = .67$ ) for the main objectives of this study.

Table 9: Correlation between the main investigator and the second observer.

GPAI Categories	Correlation
Appropriate Decision Making	.63*
Inappropriate Decision Making	.65*
Efficient Skill Execution	.62*
Inefficient Skill Execution	.65*
Appropriate Offensive Support	.62*
Inappropriate Offensive Support	.85*
Appropriate Defensive Cover	.64*
Inappropriate Defensive Cover	.73*
Overall Mean	.67*

\* Correlation is significant at the 0.01 level

### GPAI

MANOVA indicated that the combined dependent variable (five GPAI components) was not dependent on scrimmages (Wilks' Lambda = .834,  $F(10,94) = .894$ ,  $p = .543$ ). One – way repeated measures of ANOVA were conducted to test differences in game performance among the beginning vs. middle vs. end of the spring season on each GPAI index as well as overall game performance (Table 10). The tests for homogeneity of variances showed that this assumption for each ANOVA analyses was met on each

variable ( $F(2, 50) = .21$ ;  $p > .05$  for DMI,  $F(2, 50) = .70$ ;  $p > .05$  for SEI,  $F(2, 50) = .62$ ;  $p > .05$  for SI,  $F(2, 50) = .12$ ;  $p > .05$  for CI,  $F(2, 50) = .47$ ;  $p > .05$  for overall game performance). The results indicated that there was no statistical differences among three scrimmages at the significant level = .05 ( $F(2, 50) = .34$ ;  $p > .05$  for DMI,  $F(2, 50) = .37$ ;  $p > .05$  for SEI,  $F(2, 50) = .53$ ;  $p > .05$  for SI,  $F(2, 50) = .29$ ;  $p > .05$  for CI,  $F(2, 50) = .34$ ;  $p > .05$  for overall game performance). When the significant level = .35 ( $p = .35$ ) was further applied for the purposed of reporting the data, results of ANOVA showed that there were significant differences among three scrimmages on DMI, SEI, SI, CI, and overall game performance. LSD Post Hoc tests indicated that there were significant differences between scrimmage 1 and 3 on DMI, scrimmage 1 and 2 as well as 2 and 3 on SEI, scrimmage 1 and 3 on SI, scrimmage 1 and 3 as well as 2 and 3 on CI, scrimmage 1 and 3 on game performance.

Table 10: GPAI index and overall game performance. (Mean  $\pm$  Standard Deviation)

	Beginning	Middle	End
DMI	4.17 $\pm$ 3.95	5.03 $\pm$ 4.16	6.42 $\pm$ 5.29*
SEI	1.82 $\pm$ 1.25	2.45 $\pm$ 1.52*	1.90 $\pm$ 1.47
SI	3.69 $\pm$ 4.17	4.76 $\pm$ 3.40	5.06 $\pm$ 3.68*
CI	3.03 $\pm$ 3.14	2.70 $\pm$ 2.32	4.29 $\pm$ 3.70*
Game Performance	3.18 $\pm$ 2.43	3.74 $\pm$ 2.10	4.43 $\pm$ 2.81*

\* Significant level = .35

### **Simulated Recall**

Five main categories were developed from three simulated recall sessions of each target players using open-axial coding analysis (Strauss & Corbin, 1998). The four categories were 1) tactical decision making without the ball, 2) tactical decision making with the ball, 3) positional relationship with opponents and teammates, and 4) motor skill execution. Additionally, profile of each target player was developed and different domain specific knowledge was identified from the verbal response protocol to identify condition, action, and goal concepts (McPerson, 1993). The estimated coding reliabilities for condition, action, and goal categories were 81.25%, 90.16%, and 78.57%, respectively. Finally, since this study was interested in the cognitive learning of game play with the game-centered approach throughout the spring season, changes among three simulated recall sessions (i.e., three target players) were also evaluated.

### **Tactical Decision Making without the Ball**

Cognitive information processing and decision making without the ball were categorized as tactical decision making without the ball. As Light (2005) mentioned, players in games like soccer spend most of their game time without contacting the ball. Thus, majority of their simulated recalls were related to their off-the-ball movements. Players were making decision without the ball in two different game situations, such as in offense and defense (i.e., properties of grounded theory protocol). When her team was possessing the ball (i.e., offensive situation), the player was making a decision how to support her teammates. On the other hand, when the opponent was possessing the ball (defensive situation), the player was making decision for defensive pressuring and covering. For example, when Jen observed her teammate who was dribbling the ball, she

was “trying to give Andrea (the teammate) a passing option” offensively. Ann remembered that she “decided to make a diagonal run to outside because the side line was open and Hannah (her teammate) was running toward the middle.” These decisions can be also active to passive (i.e., dimension of grounded theory protocol). For instance, Jen recalled one of the defensive situations and said “I was covering Dian (her teammate) just in case she gets beat while I was watching (marking) Ann.” In this case, Jen was more actively making a decision based on the game situation. On the other hand, Ali said “I did not know where to go right there when Tori was dribbling toward me.” Her decision making process in this situation was more passive so she could not make any decision in the situation. With both properties with various dimensions, it was demonstrated that players were constantly processing the game information and making tactical decisions even when they did not have the ball.

### **Tactical Decision Making with the Ball**

Players were making tactical decisions what to do with the ball, and the recalled cognitive process with the ball was categorized as tactical decision making with the ball. Like previous category, the priorities of grounded theory protocol were established decisions in offense or in defense. The dimension of grounded theory protocol was from more accurate to less accurate. For example, Ann made an offensive decision what to do with the ball when she realized that a defender was marking her. She recalled the situation “Machaela (an opponent defender) was right on me so I decided to play one touch pass to Hannah (a teammate).” Similarly, Ali recalled her thinking process of what to do with the ball and described “when I received the ball there, I held the ball for a moment for her (her teammate) to have more space.” Players were utilizing the

information they obtained from the game situation and making tactical decisions what to do with the ball.

### **Positional Relationship with Teammates and Opponents**

Similar to the tactical decision without the ball, players were particularly making certain decisions in the relation to the other players' (either teammates or opponents) positioning. Any cognitive process related to the position between teammates and opponents was categorized as positional relationship with teammates and opponents. It can be also offensively and defensively (i.e., priorities). The dimension for these priorities was from a smaller scale to a larger scale. Most of the positional relationships that were described from the recall sessions were about their relationships with opponents. For example, Ann (who is a forward) described her defensive pressure to the opponent's defender. She stated "I was cutting off Jess so she could not pass to the other side." Jen also recalled her thinking in her defensive movement and described "I was trying to move to inside and prevent her (an opponent) to dribble up to the field." Players made their defensive decisions based on the opponent's positioning.

In the offensive side, Ann made a decision to take a shot to the far side of the goal in the relation to her defense's positioning. She recalled the situation and said "I knew that Machaela (an opponent defender) was coming from my right side so I kicked to the far side." In a smaller scale (involving one or two other players), Ann recognized two of her teammates' positioning before she made a decision where to move. Ann described "I saw that Cassidy (a teammate) was looking at Dain (a teammate) and was gonna play her, so I went outside." In a larger scale, Jen recognized her team positional relationship and

stated “there, I was thinking about switching over since we (her team) were all on that side.” Ali also explained her team positioning in one situation “there, I intentionally switched the ball to the other field because this side was too crowded.” These decisions were made based on the opponent’s defensive positioning.

When players were making certain decision with or without the ball, positional relationship with surrounded players (both teammates and opponents) became one of the critical factors in the decision making process. This category also emphasized that game performance in a game like soccer was depending on the complex positional relationships with the teammates and the opponents (Grehaigne, et al., 2005).

### **Motor Skill Execution**

Next category was established as motor skill execution for thinking process when a player tried to simply execute a certain skill. The followings were the examples of this category. Jen remembered her thinking process in a defensive situation and recalled “I was just trying to kick the ball away.” Ali also described one situation “I was just going to clear and make sort of pass out of it.” Ann explained her thinking when she was crossing the ball. She said “when I crossed the ball, I did not think any. I just hit toward people.” Some of the skill executions were led to inaccurate skill execution. For example, Ann commented “right there, I was like oh no I just right passed to her (an opponent).” She unintentionally passed to an opponent in the situation. Sometime in the game situation, players were not processing any tactical information and just thinking about execution a certain action (motor skill) to react the game situations.

### **Player Profile from Condition, Action, Goal Concepts**

Condition, action, and goal concepts provided richer analyses on game performance and cognitive processing. Table 11 indicated the scores of each category (i.e., condition, action, and goal) of the target players. Profiling each target player helped to describe the domain specific knowledge (Dodds, et al., 2001) during game play and connect between different domains of knowledge.

The defender Jen was able to demonstrate more procedural domain of knowledge (i.e., action concept); however she showed her limited ability to connect different domains of knowledge (i.e., most linkages were single or double). There was also minimal improvement of Jen's cognitive processing during the scrimmages while qualities of each category showed some improvement. Jen's GPAI scores among three scrimmages (i.e., beginning, mid, and end of season) changed 5.33, 3.67, and 1.2 on DMI, 1, 3, and 0.67 on SEI, 12, 8, and 2.25 on SI, 13, 5, and 1.16 on CI as well as 7.83, 4.91, and 1.32 on game performance index, respectively (Table 12). Combining the results from the condition/action/goal analyses and GPAI, the defender Jen showed little improvement (some declined) on her cognitive learning as well as game performance execution.

The midfielder Ali, on the other hand, demonstrated consistent improvements from beginning to mid and from mid to end of the season. At the beginning of season (beginning and mid), Ali described more procedural and conditional domains of knowledge. Those cognitive processing were also more isolated and were not connected to any outcome goals (i.e. goal statement), which may have indicated the lack of strategic domain of knowledge. However, at the end of the season, Ali's scores and qualities of



each category increased, and the score of the double linkages was improved. The increase on information quality means that she was able to obtain information with more characteristics in each situation. At this point, she was able to express her strategic domain of knowledge from her goal statements. She was also able to connect more different domains of knowledge (i.e., more linkages). GPAI results showed that Ali's scores improved from scrimmage 1 (beginning of the season) to scrimmage 2 (mid of season), and then declined at the scrimmage 3 (end of season). Each score at each scrimmage was 1.2, 8, and 4.5 on DMI, 1.75, 2.4, and 1 on SEI, 0.73, 7.6, and 3.5 on SI, 3, 6.33, and 2.75 on CI as well as 1.67, 6.08, and 2.94 on game performance, respectively (Table 12). The GPAI results somewhat conflicted with the results from condition/action/goal analyses; however it is fair to say that Ali's cognitive processing and actual game performance reasonably improved throughout the season.

The forward Ann demonstrated her stronger cognitive processing and her richer game knowledge compared to Jen and Ali. Overall, her scores and qualities of each category as well as the numbers of linkages were very high. The results indicated that she was able to obtain more information during the game and process with different domains of game knowledge. Moreover, Ann showed the improvement on most of categories as well as the numbers of double linkage throughout the season. Further, the results from GPAI on Ann supported her cognitive learning of game play. Ann's GPAI scores at the beginning, mid, and end of the season were 3, 12, and 10 on DMI, 1, 1.6, and 4 on SEI, 5.5, 11, and 11 on SI, 2, 3.75, and 11 on CI as well as 2.87, 7.08, and 9 on game performance, respectively (Table 12). Ann who had stronger cognitive processing and game knowledge at the beginning was able to obtain even more information during

the game, process different domain specific knowledge, and develop more game knowledge through the season while she was able to demonstrate her improvements on actual game performance on the field.

Table 11: Condition, action, and goal concept profiles of target players: category/variety (average quality).

	Beginning (Scrimmage 1)	Middle (Scrimmage 2)	End (Scrimmage 3)
<u>Jen (DF)</u>			
Condition (Quality)	8/3 (1.57)	3/1 (2.0)	2/2 (2)
Action (Quality)	22/6 (0.64)	14/4 (1.21)	14/5 (1.07)
Goal (Quality)	6/3 (0.5)	1/1 (1)	5/2 (1.6)
Single Linkage	12	7	8
Double Linkage	9	5	5
Triple+ Linkage	2	0	1
<u>Ali (MF)</u>			
Condition (Quality)	4/2 (1.25)	6/3 (2.0)	9/3 (2.44)
Action (Quality)	10/4 (1.3)	20/7 (1.74)	12/6 (1.75)

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Goal (Quality)	0/0 (0)	0/0 (0)	2/2 (1.0)
Single Linkage	4	11	6
Double Linkage	2	4	8
Triple+ Linkage	2	2	0
<u>Ann (FW)</u>			
Condition (Quality)	13/6 (1.75)	10/4 (2.4)	14/5 (2.14)
Action (Quality)	11/5 (1.27)	12/3 (1.83)	26/8 (1.46)
Goal (Quality)	2/2 (0.5)	1/1 (0)	5/4 (0.8)
Single Linkage	3	1	2
Double Linkage	4	3	12
Triple+ Linkage	5	5	5

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Table 12. GPAI scores of target players

	DMI			SEI		
	1	2	3	1	2	3
Scrimmage	1	2	3	1	2	3
Jen	5.33	3.67	1.2	1	3	0.67
Ali	1.2	8	4.5	1.75	2.4	1
Ann	3	12	10	1	1.6	4

SI	Game								
	CI			Performance					
	1	2	3	1	2	3	1	2	3
12	8	2.25	13	5	1.16	7.83	4.91	1.32	
0.73	7.6	3.5	3	6.33	2.75	1.67	6.08	2.94	
5.5	11	11	2	3.75	11	2.87	7.08	9	

### Changes in Thinking Process through the Season

Since this study intended to examine the cognitive learning of game play with the game-centered approach practices, changes from beginning, mid, and end of the season in players' thinking process were further analyzed from the simulated recall sessions. Two main findings from the analysis were that as the season progressed 1) players were able to obtain more quality information and make decisions in larger scales, and 2) there were more connections between game information players obtained and their decision making.

Players were observing the game more in an isolated and a small scale during the first scrimmage (i.e., beginning of the season) compared to the second and third

scrimmages (mid and end of the season). At the beginning, most recalls were about one player to one player situations which is called primary level (Grehaigne, et al., 1999). For example, Jen described her decision to support one of her teammates, and stated “I was trying to give Andrea an option.” When Ann was in a break-away situation (i.e., facing a goal keeper in front of the goal), she explained her situation with her defender “Jess was really close to me so I was just trying to kick it.” In these situations, the number of characteristics which were obtained in the information processing was one (player herself) or two (herself and one other player) in a small scale. Similarly, the average qualities of each condition, action, and goal concept were relatively small (0 ~ 1.75) at the first scrimmage. On the other hand, players were able to include more information in a larger scale during second and third scrimmages. Correspondingly, the average qualities of the condition, action, and goal concepts increased up to around 2 (the highest score was 2.44). For instance, Jen recalled “there, I was trying to shift over with the team while watching Ali (an opponent) at the same time.” Ali explained one offensive situation “when Tori got the ball, she passed to Hannah so I decided to drop (taking deeper position) a little so I can receive the ball and switch the field.” At one situation, Ann was able to recognize her mark’s as well as her teammate’s movements before she made a decision to pass. She recalled the situation “I saw Cassidy (her teammate) was running outside and I had my mark behind of me, so I stretched (my leg) to touch the ball with one touch (pass to Cassidy).”

Moreover, players were able to connect different game information with their decision making during the second and third scrimmages compared to the first scrimmage. During the first scrimmage, obtained game information was more segregated and there

was little detail. For example, Ali recalled her thinking when she was receiving a crossing pass in front of the attacking goal. The comment was “I was trying to run in for the cross.” Similarly, Jen explained her offensive support simply like “I was trying to support Andrea.” However, during the second and third scrimmages, the players’ thinking process was more detailed and the decisions were more connected with the obtained information. Examples of these recalls were “there, I was trying to run into the box (penalty box) to receive the cross. Since I was the first one to run into the box from my team, I went toward the near post (Ann).” “I knew where Cassidy was so I tried to pass the ball and move to the open space (Ali).” Consequently, the number of double and triple linkages increased while single linkage might have decreased from the condition, action, and goal concept analysis for the second and third scrimmages.

### **Instant Recall**

When the main investigator was not leading the practices, instant recall interviews were conducted during the game-centered approach practices. Immediately after a certain play, a player who was just involved in the play was asked to recall their thinking process. Using open-axial coding analysis (Strauss & Corbin, 1998), three categories (i.e., tactical thinking, action thinking, and no thinking) were developed from the grounded theory analyses.

### **Tactical Thinking**

Any instant cognitive thinking which was strategic and was related to game tactics was categorized as tactical thinking. As the game-centered approach intended to raise the tactical awareness (Bunker and Thorpe, 1982), various tactical thinking was included in many of instant recalls. The tactical thinking recalls were either in offense or

in defense (i.e., properties of the grounded theory protocol), and the dimension was from less details to more details. An example of defensive tactical thinking with less detail was when Kara was facing one on one situation as a defender. She said “I was trying to push her to the outside.” She tactically decided to move the offensive player toward outside which was away from the goal; however she did not think about any other information in the game situation (i.e., her teammate or other opponents). On the other hand, Cassidy knew where other offensive players were when she was facing two offensive players as a defender. She said “I was forcing her to my defense and making sure that I can cut off the angle. So she (an opponent) cannot get the pass off (to other offensive player).” This was an example of defensive tactical thinking with more details. Similarly, Emily was able to observe the goal keeper (GK) when she took a shot. She described the situation “when I cut in, I saw Mackenzie (GK) was over to the right so I shot to the left.” When Ann took a shot, she recalled the play “I was thinking not to kick it too hard because I was really close to the goal and I tired placing to the corner of the goal.” This instant recall interviews showed that practicing in a game-like situation encouraged the players to obtain the information, process it tactically, and make decisions. Further, the cognitive processes in this category involved in either conditional or strategic domain of knowledge (Dodds, et al., 2001).

### **Action Thinking**

When a player is in a moment of game play, she sometimes does not think a lot and just instantly reacts the situation. This category of action thinking was established for the cognitive process which was simply thinking about what to do. Most of instant recalls for this category were described as less detail since the player had limited time to

think in the moment of play. For example, after Cassidy blocked the opponent's shot, her instant recall was "to get in front of the ball." Similarly, right after Kara made a cross in front of the goal, she recalled her thinking as "to do just quickly so the defender does not have a time to come." When Ali took a shot, she recalled her cognitive thinking and said "to shoot the ball as hard as possible and keep it low." These comments were more directly about the action which the players just performed. In these situations, procedural domain specific knowledge (Dodds, et al., 2001) was mainly processed in the players' cognitive learning.

### **No Thinking**

Just like the action thinking, there were moments in the game-like practice when players had very little time to think. Cognitive thinking related to the condition was categorized as no thinking. In the situation, it seemed that the players tend to think about the action itself (i.e., the category of action thinking) or had no thinking in their mind. Examples of no thinking comments were like "no, I was not thinking any (Lily)," and "no, no thinking (Patricia)." The reasons for this no thinking were mainly little time for the player to process information or so called muscle memory which the body automatically reacts in a certain way without any cognitive thinking involved (Schmidt & Wrisberg, 2004). Or the player had limited ability to obtain information, processing it, and make decision in a short amount of time.

### **Practice Journal**

Each player was asked to keep the practice journal after every practice and record what they learned from the practices. This journal helped to further determine the player's cognitive learning of game play during the game-centered approach practices.



While players learned the various parts of game play in different situations, five main categories were established using grounded theory method. The five categories were 1) off- the-ball movement, 2) quick decision, 3) communication, 4) possession, and 5) individual technical skill. These five categories were the main components of game play which the players learned most throughout the spring season. The followings are the definitions of each category as well as the examples from the practice journal.

### **Off the Ball Movement**

As previously mentioned, off – the – ball movement is one of the critical parts of game play since players spend most of their game time without contacting the ball (Light, 2005). Many players described in their journal how the game-centered approach practices helped them to learn the importance of it. Any comments related to off-the-ball movements were included in this category. Priorities of this category were established as in defense and in offense with less detail to more details (i.e., dimension of grounded theory method). For example, some players just wrote “I learned off the ball movement” without any description. On the other hand, some players included how to do and why it is important. Andrea said “I learned movement off the ball to open up the field and provide more options.” Similarly, Emily and Ash explained about off the ball movement and what it is for, such as “I learned movement off the ball to give a player options (Emily),” and “I learned to spread the field and moving off the ball to find through passes (Ash).” Katie was able to describe how to make effective off the ball movement, and she said “to change speed of run to beat defender and be open.” Since the game-centered approach provides the opportunity for players to be in the game situation without the ball,

it helped players to learn about different game tactics for off the ball movement (i.e., why it is important and how it is performed).

### **Quick Decision Making**

Quick decision making was another component of game play which many players described in their journal, and it was established as one of the main categories. Grehaigne and other colleagues (2005) suggested that the success of team performance is determined by the most appropriate choice (i.e., decision making) and the speed of the decision. The practice journal indicated that the game-centered approach raised the awareness of quick decision making and helped them to realize how to make decisions quickly in a game situation. Many players pointed out the importance of looking around and making decision beforehand for quick decision making. Examples of these comments were “I learned to look up before receiving the ball to know where players are (Emily).” And “I learned to look up and decide where you are going to put and move the ball before you receive (Lily).” More specifically, Ash learned when the good time to take a quick shot was and said “it’s important to take shots quickly and I do when a window appears to take a shot.” Jess also described how quick decision making helped the team and stated “I learned to use one or two touches to effectively transition as a team.” All of these game tactics (i.e., observing game situations and having less touch on the ball) were critical aspects of game play when player tries to make quick decisions. Thus, it seemed that the game-centered approach helped players to learn how to make the quick decision and become more successful on the field.

## **Communication**

Players also recognized the importance of communication with their teammates for the team success, especially when the team worked on defensive tactics. Any comments which were related to field communication were included in this category. Examples of the defensive communication were “I learned to force the offense one way or another and communicate specially to the first defender (Katie),” and “1<sup>st</sup> defender should call for the ball and the 2<sup>nd</sup> covers them and tells them where to force the ball (Ash).” Offensively, Kara described the importance of working together and communicating with her teammates “I learned to move in relation to the people around you and talk to them.” Since soccer is a sport which involves various combination plays especially in partial forefront level (Grehaigne, et al., 1999), working together through close communication is one of the important aspects for team success. The game-centered approach was able to emphasize the communication component during the practices.

## **Possession**

Journal also indicated that the game-centered approach practices helped players to learn how to maintain the possession of the ball as a team. There were several points of game play in order for a team to maintain their possession. Players were able to describe those components in their journal, and they were established as the category of possession. For example, it is important to switch the field so the team can avoid the opponent’s defense. Katie explained “it is important to change the point of attack where the field is less crowded and pass to the space.” Emily also said “I learned the movement across the field to switch the field.” Secondly, when the team is maintaining the

possession, it is important to spread out as a team so it makes harder for the opponent to pressure the ball. This tactical aspect was also indicated in the journal, such as “I learned to switch the field and provide depth/width as a team (Kara),” “I have learned how to work on width and deepness (Pam),” as well as “using lateral and back passes allow the forwards for quick transition but more open to defending (Lily).” Another component which was related to team possession was to support each other and the supporting angle. Examples of the comments were “it’s important to provide proper angles for your teammates to easily play you the ball behind them or behind a defender (Katie),” “it is important as a defender to support out wide on attack (Kate),” as well as “always be at angle with an open player (Pat).” The game-centered approach was clearly able to encourage the tactical game learning for possession, so the team can successfully maintain the possession of the ball.

### **Individual Technical Skill**

Lastly, the game-centered approach practices encouraged players to also focus on their technical skills in the game. The journal indicated that the players were able to develop the skills which were effectively utilized in a game situation. Players’ comments which indicated the individual skills were categorized as individual technical skill. For example, Kate and Cassidy learned how to shield the ball and said “to shield with arm out (Kate)” and “shielding with your body (Cassidy).” Some players learned the importance of their first touch; such as “I learned to focus on planning first touch to move yourself towards goal (Kate),” and “I learned to take first touch in opposite direction of defender (Tori).” Other examples about technical skills were “quick turns to set up for shot (Katie),” and “keeping the ball low for shooting (Ali).” These comments also indicated that the

game-centered approach practices helped cognitive learning about not only game tactics but also technical skill.

### **Summary of Results**

Game performance showed no significant improvement throughout the spring season (i.e., beginning, mid and end of season) at the significant level .05 while significant improvements were recognized on all GPAI indexes when the significant level was increased to .35. Tactical decision making with/without the ball was indicated during the scrimmages with the target players while they were also processing the specific game information, such as positional relationship with the teammates and the opponents as well as motor skill execution. Throughout the season, players (i.e., target players) were able to process more quality game information and make tactical decisions in larger scale as well as connect the obtained information better with their decisions.

Profile of the three target players indicated that the defender Jen mostly processed procedural domain specific knowledge with limited connection with other types of domains of game knowledge. She also showed very little (some decreased) improvement on her cognitive processing of game play while her actual game performance on the field also showed very little (some declined) improvement throughout the season. The midfielder Ali started with lower on her ability to recognize more quality game information and showed limited connection between obtained information; however she was able to recognize more complex game information (i.e., strategic domain of knowledge) and connect the obtained information. At the same time, Ali improved her actual game performance on the field from the beginning to the mid of the season (but not to the end of the season). The forward Ann demonstrated her strong ability to recognize

more quality game information (i.e., various domain specific knowledge) and connect that information to construct decisions. Throughout the season, Ann's cognitive processing during the game continued to improve its quality while she also showed her large improvement on her actual game performance on the field.

At the moments of the game-centered approach practices, players were processing information related to tactical movements and action itself while some players executed certain movements as their reaction without any thinking. After the game-centered approach practices, players reflected their cognitive learning especially on off-the-ball movement, quick decision making, communication, possession as well as individual technical skills.

Overall results showed that players were able to process more quality game information in larger scale on the field during the scrimmages while cognitive learning of game play with and without the ball seemed to occur during the game-centered approach practices. Player profile of the target players indicated the relationship between cognitive learning of game play and improvement of actual game performance on the field. Jen who showed very little improvement on her cognitive processing of game information showed no improvement on her game performance while Ali and Anne demonstrated their learning of game play and improved their game performance.

## CHAPTER 5

### DISCUSSION

It is reported that more research is necessary to find out how the game-centered approach can help developing players in coaching SPA (Light, 2006; Oslin & Mitchell, 2006). Results from this descriptive study indicated that the game-centered approach practices seemed to reinforce cognitive learning of game play and potentially improve the actual game performance on the field. Figure 19 presents the overview of the impacts that seemed to happen during the 5-week game-centered approach practices with the intercollegiate female soccer players. Focuses of the study were mainly on their actual game performance on the field as well as their cognitive learning of game play. Although there was no statistical improvement on the game performance (i.e., at the significant level of .05), the outcomes from GPAI at increased level of significance ( $p=.03$ ) and profile of the target players indicated the potential to improve the players' game performance through coaching with this approach. As the positive relationship between game knowledge and expertise in game play has been reported previously (French & McPherson, 2004; Grehaigne & Godbout, 1995; Griffin, et al., 2005; O'Donnell, 2012), this potential improvement of game performance can be supported by the cognitive game learning appear to be occurred (i.e., tactical game learning and technical skill learning) in this study. It is important to indicate that this was a descriptive study (not a cause-effect study) which various other components could have influenced on the game performance and cognitive learning of game play in this study.

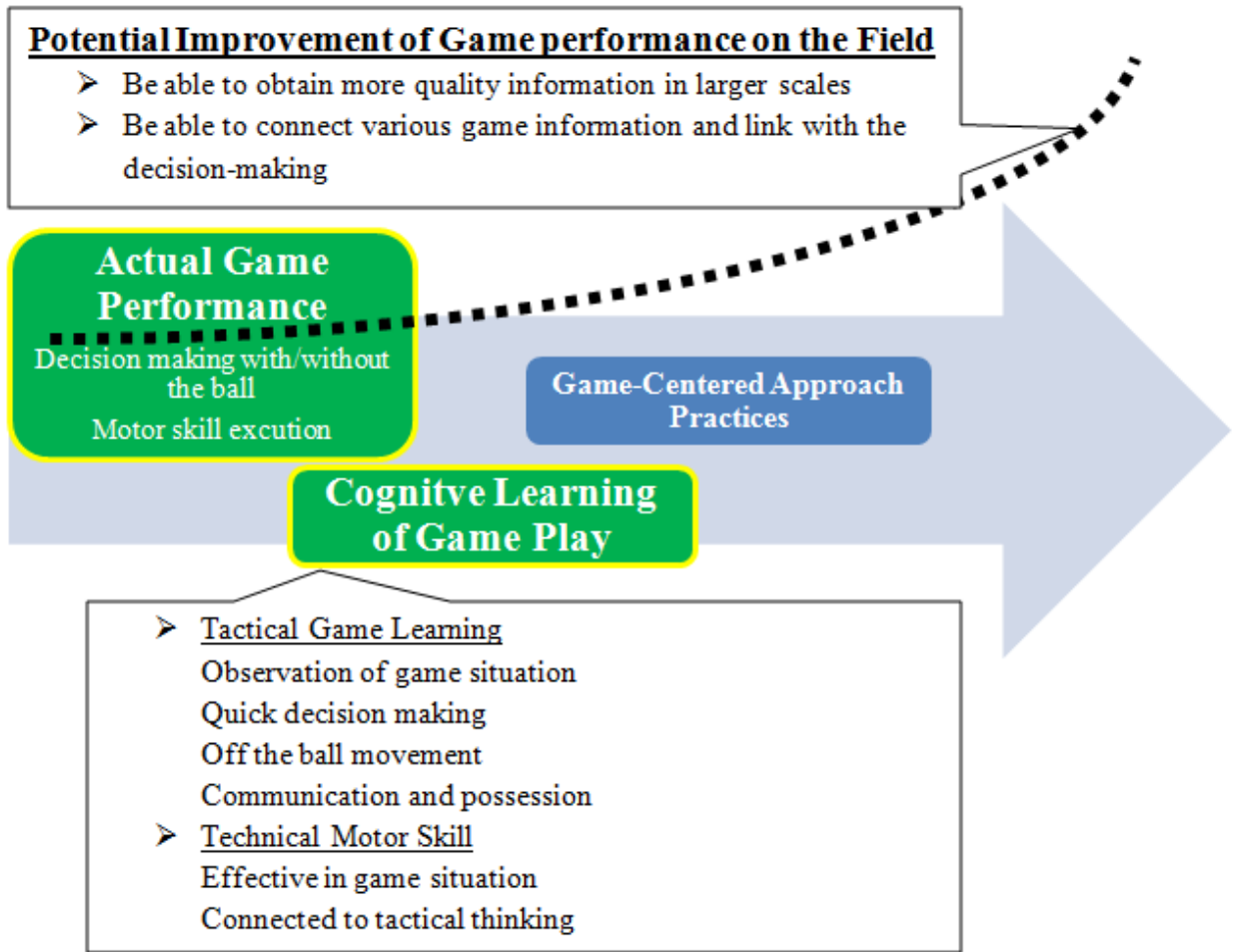


Figure 19: Overview of impacts of the game-centered approach practices on game performance and cognitive learning of game play.

Light (2008), in his complex learning theory, suggested that learning was a dynamic, multifaceted, and continuous process where mind and body were connected and collaborating with each other. Results of this study determined the cognitive changes (i.e., learning) within the activity of game play. Seemingly, players in this study were able to think tactically and technically, and then applied the cognitive reproduction into the action. The players demonstrated their learning by increasing the condition/action/goal concept scores (i.e., higher scores and linkage) and being able to



identify the key tactical/technical components of the soccer game (i.e., observation, quick decision, off the ball movement, communication, possession, and skill execution).

As the complex learning theory perceives learning as more spontaneous, more unpredictable, and more alive, games in the game-centered approach were also seen as complex, dynamic, and unpredictable (Light, 2008). Through game structure and game play constraints, players were (i.e., individual learners) making adaptations either instantaneously in play or from discussion with coaches and teammates. This learning process guides to game learning such as change in perception of attractors (i.e., open space, the net, and the ball), recognition of affordance (i.e., opportunities to challenge the capacity), and motor skills in action (Storey & Butler, 2012). For example, Ann explained her decision to make a run to the outside open space in related to her teammate's movement and said "(I) decided to make a diagonal run to outside because the side line was open and Hannah (her teammate) was running toward the middle." In this situation, Ann recognized the game play constraint (i.e., Hannah was taking the middle space), made the instantaneous adaptation, and changed her attractors (i.e., from middle space to outside space) during the game play. By doing so, Ann was able to learn the concept of angle support (i.e., off the ball movement) and develop conditional domain-specific knowledge (Placek & Griffin, 2001). Similarly, Cassidy recognized her opportunity to double defense with her teammate (i.e., affordance) and explained "I was forcing her to my defense (her teammate) and making sure that I can cut off the angle. So she (an opponent) cannot get the pass off (to other offensive player)." Through this game situation, she learned the group defense concept of 1<sup>st</sup> and 2<sup>nd</sup> defender (i.e., strategic

knowledge). Therefore, this study supported the cognitive learning of game play by interacting mind and body as well as building different domains of game knowledge through the game-centered approach. Players in the approach used the game information to make adaptations through the complex game situation, and then constructed and built the cognitive representation which then became more meaningful knowledge in the game (Butler, 1997; Light, 2008; Light & Fawns, 2001; Light & Wallian, 2008; Mayer, 2012).

Additionally, the game-centered approach practice provided an opportunity for the players to adapt their motor skill during game play. For instance, because of her game constraint (i.e., her defender), Tori learned to take her first touch away from the defender. She described “I learned to take first touch in opposite direction of defender.” Cassidy also learned to shield the ball by positioning her body between the ball and a defender. These players developed procedural knowledge of domain specific knowledge (Placek & Griffin, 2001), and applied the cognitive learning into their play. These results encouraged that the game-centered approach can provide an opportunity to develop game skills which are truly useful to the game. This finding also supported that skills in the game-centered approach were trained in a complex and fluid game environment where the players engaged physically, emotionally, and intellectually (Light, 2005; Thorpe & Bunker, 2010).

Complex learning theory (Light, 2008) also argued that game learning is taken place through social component of game play (i.e., coconstructive and social constructivist approach) rather than simply computing knowledge. This aspect of game learning was explained with situated learning theory (Lave & Wenger, 1991) in

constructivism. In this perspective, cognition is seen not as an individual process but as a collective process spread across the individual's learning (Light, 2008). One of the critical game components found from this study was communication and possession during the game play. Players learned game play through communicating with their teammates, and they expressed the importance of the communication in order to work together (i.e., both defensively and offensively) and maintain the possession of the ball as a team. Katie, for instance, described her learning process about zonal defensive tactics "I learned to force the offense one way or another and communicate specially to the first defender." In this situation, she was able to construct her defensive knowledge by facing her opponent and interacting with her teammate. Moreover, the learning through social interaction was not limited to the verbal interaction but also with embodied dialogue in games (Light & Fawns, 2003). Ann's recall of her shooting action was a good example of how body interaction can help game learning. In the situation, Ann was learning to place her shot at a certain area of the goal because of the defender's positioning. Her comment was "I knew that Machaela (an opponent defender) was coming from my right side so I kicked to the far side." Findings from this study positively supported the game learning through social interaction. Players were encouraged to construct the tactical meaning of game play and reflected on their learning as they interacted with other players in the complex game situation (Piltz, 2003).

Although the statistical analyses did not show the significant improvement of actual game performance (i.e., GPAI) in this study, there were several components which indicated the strong potential for the game performance improvement with the game-centered approach practices. Grehaigne and other colleagues (2005) described that

success of team performance was determined by appropriate decision-making at individual players' levels and by speed of decision-making. During the game-centered approach practices, players in this study were able to observe and recognize more detailed game information in bigger scale as the season progressed. The players were also developing important tactical knowledge (i.e., decision-making with/without the ball and quick decision-making) in this process. At the beginning of the season, the target players were observing and analyzing the rapport of strength (i.e., relationship with other players) only at the analytical model (Grehaigne, et al., 1997), which was an individual scale in an isolated situation. For example, when Jen mentioned "I was trying to give Andrea an option," her antagonist link was only between one of her teammates and herself (i.e., single linkage in condition/action/goal concept). In the middle and end of the season, players were able to determine and analyze the game situation at the structuralist model, which is a collective group scale, or the systemic model, which is an oppositional relationship scale (Grehaigne, et al., 1997) by linking the different game information together (i.e., increased linkage in the condition/action/goal concept). Ali's comment was an example of the structuralist model, and it was "when Tori got the ball, she passed to Hannah so I decided to drop (taking deeper position) a little so I can receive the ball and switch the field." She recognized the movements by several of her teammates, analyzed the rapport of strength at the situation, and made the decision to take the certain positioning. Further, Ann was able to expand her game vision and analyzed the positional relationship with both her teammates and her opponents (the systemic model). She said "I saw Cassidy was running outside and I had my mark behind of me, so I stretched (my leg) to touch the ball with one touch (pass to Cassidy)." In this

situation, Ann recognized the relative positioning of players as well as the location of the projectile ball (i.e., configuration of play). She was able to adjust her play from one configuration of player to another, so her team can maintain the ball possession. Among three target players from this study (i.e., Jen, Ann, and Ali), Ann demonstrated her higher expertise of game play by processing more (i.e., higher scores on condition/action/goal concept) and detailed game information (more double and triple linkage). Three target players were also able to increase their most of condition/action/goal scores at the end of the season, which also indicated the effectiveness of the game-centered approach on their cognitive learning of game play.

In addition to the choices in game play (i.e., decision making), speed of decision was also identified as a key component of team success (Grehaigine, et al., 2005). Experts are able to collect proper information in games, quickly predict the upcoming play (i.e., anticipation), and initiate the play effectively. Sources of anticipation at the individual level were player's cognitive map, tactical knowledge, and player's resources (Grehaigine, et al., 2001). In this study, the game-centered approach helped the players to analyze the game tactically, create mental representation, and develop game knowledge. Through the process of this game learning, the players also noticed the importance of quick decision-making and learned the key aspects for quick making decision (i.e., looking around before receiving the ball). As Grehaigine, et al. (2005) described the importance of inter-relationship between teammates and opponents as well as the space around them for effective decision making; the game-centered approach encouraged the players to be always aware of their surroundings. Consequently, the players in the game-

centered approach were able to be mindful about quick decisions and make effective decisions during the game.

### **Conclusion**

To respond to the research questions of this study, players' cognitive process with and without the ball seemed to improve by being able to analyze the game information from less detail to more details as well as from smaller scale to larger scale throughout the spring season. The actual game performance on the field did not change statistically; however there were some positive components which could have indicated the potential improvement of game performance on the field. Additionally, players in this study were seemingly encouraged to carefully observe the game situation, analyze them, make tactical decisions, and construct game knowledge during the game-centered approach practices. Therefore, this descriptive study appeared to support the positive impacts of the game-centered approach in coaching SPA reported previously in Chatzopoulos, et al. (2006), Gray and Sproule (2011), Haneishi, et al, (2009), as well as Turner and Martinek (1999).

Further, it is important to continue examining how the game-centered approach can influence to the cognitive learning of game play and the actual game performance on the field, especially in the coaching fields. So there will be more meaningful and useful information for coaches to adjust their practices and their coaching approaches on the field. Suggestions for future study are to examine the game-centered approach in a longer term (i.e., one or two years span) and/or with different sports (i.e., basketball and rugby).

**APPENDIX A**

**Demographic Questionnaire**

Name \_\_\_\_\_ Date \_\_\_\_\_ Yr. \_\_\_\_\_

- Age: \_\_\_\_\_ Hometown: \_\_\_\_\_ Position: \_\_\_\_\_
- Soccer Experience: \_\_\_\_\_ years \_\_\_\_\_ months
- Which order is closer to the practice sequence that you experienced prior to this team?
  1. \_\_\_\_: warm up > various drills for skill developments > scrimmage > cool down
  2. \_\_\_\_: warm up > modified games (i.e., keep away) > skill execution > scrimmage > cool down
  3. \_\_\_\_: other \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_ > \_\_\_\_\_
- Please write the numbers of objectives that your previous coaches focused on during the practices? (1 – most focused: 4 – least focused)
  - \_\_\_\_: Individual tactics (i.e., individual positioning and decision-making)
  - \_\_\_\_: Team tactics (i.e., team formation and strategies/movements)
  - \_\_\_\_: Individual skills (i.e., shooting, passing, and dribbling)
  - \_\_\_\_: Fun and excitement (i.e., playing World Cup and relay)
- Please describe about the differences between college practices and your high school/club team practices.

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**APPENDIX B**  
**Game Performance Assessment Instrument: GPAI (Soccer)**

The following aspects of the game performance with the definition are assessed. The GPAI coding is conducted with the following criteria;

1. Decision-making with the ball

Definition: An ability to analyze the game situation and an intension to move the ball in an appropriate way

Criteria:        1) Possession / Loss of the ball  
                     2) Existence of intension

2. Skill execution

Definition: An ability to execute her decision into an actual performance

Criteria:        1) Selection of the skill to execute her decision  
                     2) Technical skill to perform her intension

3. Offensive Support

Definition: An ability to move without the ball in order to support the team's offense during the possession of the ball as a team

Criteria        1) Support position  
                     2) Timing of the movement

4. Defensive Cover

Definition: An ability to take position in defense without the ball especially in relation to the team defensive tactics. An ability to defense against the opponents.

Criteria        1) Appropriate/inappropriate defensive position  
                     2) Defensive pressure  
                     3) Steal the ball from the opponent



**APPENDIX C**

**Practice Journal**

**NAME:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

- **What were the objectives of today's practice?**

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- **What components of game play have you learned from today's session?**

**Please provide specific examples.**

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- **What did you do well or what part of your game play do you think you improved from today's practice?**

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- **Which aspects of game play do you want to improve in the future? Please be specific.**

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**APPENDIX D**

**IRB**

**MOUNT HOLYOKE COLLEGE**

**INSTITUTIONAL REVIEW BOARD FOR THE OVERSIGHT OF RESEARCH**

**INVOLVING HUMAN SUBJECTS**

**PROPOSAL FOR RESEARCH INVOLVING HUMAN SUBJECTS**

Date submitted: , 2013

Title of Proposed Research Project: **Impacts of the Game-Centered Approach with Intercollegiate Female Soccer Players during a 15-day of spring Season**

Proposed starting date of project: **March, 2013 immediately after approval**

Proposed ending date of project: **April, 2013**

Principal Investigator(s) name: **Kanae Haneishi**

Department: **Physical Education and Athletics Department**

Electronic mail: **khaneish@mtholyoke.edu**

Phone: **(413) 538 - 2112**

Signature(s): **Kanaehaneishi**

Has this proposal been subject to departmental review or review by another IRB?

Yes: University of Massachusetts Amherst – School of Education

No

1. Briefly describe the purpose of this study (attach additional pages if necessary):

While several information process view and situated learning theory seems to support the game-centered approach concept, previous studies in physical education indicated positive effects of the game-centered approach on learning game play. At the same time, there was limited research about the game-centered approach in coaching. Therefore, the purpose of this study is to describe the impacts of the game-centered approach in coaching female collegiate soccer players during a 15-day of spring season. This study is especially intended to assess two major components of game play, which are game performance as well as cognitive processing for constructive knowledge of game play.

2. Participants: Describe the number and type of participants, the source from which they will be recruited, the method of recruitment. [Human subjects under age 18, with the exception of college students, require written permission from a parent or legal guardian. ATTACH A COPY OF YOUR PARENT PERMISSION LETTER, if appropriate]

Soccer players on the Mount Holyoke varsity team will be voluntarily participating in this study. Three of them (i.e., one freshman, one sophomore, and one junior) will be randomly selected for simulated recall interviews.

All individuals will be free of any previous physical problems or pain and any previous other health problems before the season. The participants will be informed about the purpose of the present study. Each subject will be given both written and oral

consent before engaging in the experiment. The study protocol will be approved by Institutional Review Board (IRB).

3. Describe the research procedures to be used (what participants will be asked to do, or what treatments will be applied to each subject) in detail. [ATTACH COPIES OR DESCRIPTIONS OF PROCEDURES]

Design: The game-centered approach will be primarily applied to all practice sessions throughout the 15-day of spring soccer season. During the season, the team will basically practice three times a week (i.e., Mondays, Wednesday, and Fridays) for five weeks. The team will be playing an alumnae game after the 12th practice and an 11 versus 11 tournament (i.e., three 60 minutes games) after the last practice. Each practice will be between 1.5 hours to 2 hours of duration, which varies depending on the objectives of the day.

All three coaches will review the practice plan prior to each practice in order to verify the game-centered approach practice. The head coach will lead one third of practices (i.e., 5 days) while other two third of practices (i.e., 10 days) will be conducted by the assistant coaches. Each practice plans will be saved as well as all practice sessions will be video recorded for the vilification of the game-centered approach.

Data Collection: Game performance as well as cognitive knowledge and information processing of the participants will be measured through this study. Game performance during scrimmages will be video-recorded at beginning, middle, and end of the spring season. Three target players will review the video clips after each recording session and

reflect their thinking process. All participants will record their practice journals after each practice session and reflect their game learning. During the practice sessions, the investigator will randomly ask quick questions about their cognitive processing to the players who are just involved in a play. Research memo will be kept throughout the study to support the collected data.

### *Game Performance*

Three 20 minutes scrimmages at beginning, middle, and end of the spring season will be video-taped for the Game Performance Assessment Inventory: GPAI (Griffin, et al., 1997) analysis. The following GPAI components will be coded for the game performance analysis:

1. Decision-making WITH the ball,
2. On – the – ball movement (skill execution)
3. Off – the – ball movement (offensive support and defensive cover)

The definition and criteria of each component are defined prior to the study. When researchers investigate game performance in an inversion game, like soccer and rugby, it is important to include on-the-ball movements and off-the-ball movements (Light 2005). Players in the inversion games spend most of their game time without handling the ball, so the player's off-the-ball movement has significant influence to the team's success (Light, 2005). Therefore, off-the-ball movements (i.e., offensive support and defensive cover) will be included in this GPAI data collection.

### *Simulated Recall*

Targeted players will watch the 20-minute of recorded video after playing each scrimmage. During the session, the targeted players will be asked to recall about their

thinking process. Examples of the questions during the simulated recall interview will be “what were you thinking about during this play?” or “what would you do differently?” The simulated recall sessions will be recorded in a digital recorder and transcribed manually by the investigator. The research memo will be taken during the simulated recall session to support the data.

### *Practice Journal*

All participants will keep a practice journal to reflect their cognitive learning during each practice. They will be asked to fill out the practice journal form after each practice.

### *Instant Recall*

Cognitive processing of players during the practices will be recorded by the investigator when she is not leading the practice session. The players who were just involved in a certain play will be randomly selected and will be asked to recall their thinking process (i.e., what were you thinking just now?). The instant recalls will be recorded in a digital recorder and transcribed manually by the investigator.

4. Risk to participants: Given the fact that in any study it is possible for participants to experience some degree of discomfort, anxiety, concern about failure, etc., what will you do to minimize the possibility that this will occur, and how will you address or reduce it if it does occur?

Since the investigator is also the head coach for the soccer team, some degree of discomfort and anxiety will be expected from the participants during the study. Therefore, the following aspects will be strongly emphasized throughout the study:

- The purpose of the study will be explained to the participants before the study begins. Any questions and concerns will be asked to ensure that all participants are comfortable about the procedure of the study.
- The participation in this study is completely volunteer- basis and all individuals are free to withdraw from the study anytime during the study.
- It will be clear to the participants prior to the study that their performance, comments, and responses will NOT influence to their status on the team and their playing time during competitions.
- All of the names and any signs that could identify an individual will be removed and replaced with alternatives.

5. How will you obtain informed consent? [DESCRIBE PROCEDURES AND ATTACH COPIES OF INFORMED CONSENT FORMS]

Each subject will be given both written and oral consent before engaging in the experiment. The informed consent is attached.

6. If necessary, how will you debrief participants? [DESCRIBE PROCEDURES AND ATTACH COPIES OF DEBRIEFING LETTER, IF APPROPRIATE]

Upon to the participants' request, the results of the study will be debriefed with the participants after the study.

7. Participants' rights:

A. How will confidentiality or anonymity (whichever is appropriate) be guaranteed?

(Include a description of how data will be handled to insure confidentiality or anonymity)

All of the names and any signs that could identify an individual will be removed and replaced with alternatives. All of the data, the videotapes and the research memo will be appropriately demolished after the study.

B. How will participants' right to terminate or refuse participation be guaranteed?

All participants are free to refuse and withdraw from this study anytime during the study.

8. For Principal Investigators (faculty and students) whose research is supported by

Federal grants: N/A

9. For students and other researchers without previous experience conducting research with human subjects:

Please provide additional background information and qualifications illustrating that you have received training in the ethical conduct of research conduct (include names of relevant courses):

The main investigator, Kanae Haneishi, has completed the training in the ethical conduct of research on Group 2 Social and Behavioral Research Investigators and Key Personnel from CITI (Collaborative Institutional Training Initiative) on 9/23/09. (Course completion is attached.) In addition, Kanae Haneishi has conducted researches with human subjects previously and two of them have been published.



Haneishi, K., Fry, A. C., More, C. A., Schilling, B. K., Li, Yuhua, and Fry, M. D. (2007). Cortisol and stress responses during a game and practice in female collegiate soccer players. *Journal of Strength and Conditioning Research*, 21 (2), 583-588.

Haneishi, K., Griffin, L. Siegel, D., & Shelton, C. (2009). Effects of games approach on female soccer players. Hopper, T. (Eds.), *New-Teaching Games for Understanding – Simply Good Pedagogy: Understanding a Complex Challenge* (pp. 131-143). Vancouver, Canada: Physical and Health Education Canada.

**INFORMED CONSENT DOCUMENT**  
**Department of Physical Education and Athletics**  
**Mount Holyoke College**

**Title of Investigation:**

*Principal Investigator:*

Kanae Haneishi, MS  
Lecturer and Head Soccer Coach  
Department of Physical Education and Athletics  
Mount Holyoke College  
Phone: (413) 538-2112 (office)  
[khaneish@mtholyoke.edu](mailto:khaneish@mtholyoke.edu)

*Adviser:*

Linda L. Griffin, Ph.D.  
Associate Dean  
School of Education  
University of Massachusetts Amherst  
Phone: (413) 545-0236 (office)  
[lgriffin@educ.umass.edu](mailto:lgriffin@educ.umass.edu)

**Explanation of the Research Study**

**Purpose:**

While several information process view and situated learning theory seems to support the game-centered approach concept, previous studies in physical education indicated positive effects of the game-centered approach on learning game play. At the same time, there was limited research about the game-centered approach in coaching. Therefore, the purpose of this study is to describe the impacts of the game-centered approach in coaching female collegiate soccer players during a 15-day of spring season. This study is especially intended to assess two major components of game play, which are game performance as well as cognitive processing for constructive knowledge of game play.

**Procedures:**

**Design:** The game-centered approach will be primarily applied to all practice sessions throughout the 15-day of spring soccer season. During the spring season, the team will basically practice three times a week (i.e., Mondays, Wednesday, and Fridays) for five weeks. The team will be playing an alumnae game after the 12th practice and an 11 versus 11 tournament (i.e., three 60 minutes games) after the last practice. Each practice will be between 1.5 hours to 2 hours of duration, which varied depending on the objectives of the day.

All three coaches will review the practice plan prior to each practice in order to verify the game-centered approach practice. The head coach will lead one third of practices (i.e., 5 days) while other two third of practices (i.e., 10 days) will be conducted by the assistant coaches. Each practice plans will be saved as well as all practice sessions will be recorded for the vilification of the game-centered approach.

**Data Collection:** Game performance as well as cognitive knowledge and information processing of the participants will be measured through this study. Game performance during scrimmages will be video-recorded at beginning, middle, and end of the spring season. Three target players will review the video after each recording session and reflect their thinking process. You will record their practice journal after each practice session and reflect their learning game play. During the practice sessions, the investigator will randomly ask quick questions to the players who were just involved in a play about their cognitive processing. Research memo will be kept throughout the study to support the collected data.

*Game Performance*

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### *Practice Journal*

You will keep a practice journal to reflect their cognitive learning during each practice. You will be asked to fill out the practice journal form after each practice.

### *Instant Recall*

Cognitive processing of players during the practices will be recorded by the investigator when she is not leading the session. The players who were just involved in a certain play will be randomly selected and will be asked to recall their thinking process (i.e., what were you thinking just now?). The instant recalls will be recorded in a digital recorder and transcribed manually by the investigator.

### **Discomforts and Risks:**

Since the investigator will be your coach, some degree of discomfort and anxiety will be expected from you during the study. Therefore, the following aspects will be strongly emphasized throughout the study:

- The purpose of the study will be explained to you before the study begins. You will have opportunities to ask any questions and indicate any concerns throughout the study to ensure that you are comfortable about the procedure of the study.
- The participation in this study is completely volunteer- basis and all you are free to withdraw from the study anytime during the study.
- Your performance, comments, and responses will NOT influence to your status on the team and your playing time during competitions.
- All of the names and any signs that could identify your participation will be removed and replaced with alternatives.

### **Potential Benefits:**

Upon to your request, you will have opportunities to review the results of this study to improve your game performance for the future. This participation potentially helps to improve your tactical knowledge of the game and enhance your overall game performance.

### **Confidentiality/Privacy:**

All of the names and any signs that could identify your participation will be removed and replaced with alternatives. All of the data, the videotapes and the research memo will be appropriately demolished after the study.

**Questions Answered:** If there is any problem following any of the test procedures described, or if you have any questions, please contact Kanae Haneishi at Kendall 115, 50 College Street, South Hadley, MA 01075 and/or (413) 320-3665 (cell)/ (413) 538-2112 (office). These phone numbers may be called at any time, 24 hours a day. If you have any questions about your rights as a subject, contact the institutional review board for the oversight of research involving human subjects, Mount Holyoke College, 50 College Street, South Hadley, MA 01075 or e-mail to [institutional-review-board@mtholyoke.edu](mailto:institutional-review-board@mtholyoke.edu).

**Right to Withdraw:** Your participation in this study is voluntary, and you have the right to withdraw your participation at any time. Such a decision will not affect your care at this institution or cause a loss of benefits to which you might otherwise be entitled.

**Contact People:** Kanae Haneishi, MS  
Kendall Hall 115  
Mount Holyoke College  
50 College Street  
South Hadley, MA 01075  
[khaneish@mtholyoke.edu](mailto:khaneish@mtholyoke.edu)  
413-538-2112/office  
413-320-3665/cell

This is to certify that I, \_\_\_\_\_, hereby agree to participate as a volunteer in a educational investigation as an authorized part of the research program of Mount Holyoke College under the supervision of Kanae Haneishi, MS.

The investigation has been described and fully explained to me, and I fully understand the explanation. A copy of the procedures of this investigation and a description of any risks and discomforts has been provided to me and has been explained in detail to me.

I have been given an opportunity to ask whatever questions I may have, and all such questions have been answered to my satisfaction.

I understand that I am free to deny any information or answers to specific items or questions in interviews or questionnaires.

**I understand that any data or answers to questions will remain confidential to the extent provided by law with regard to my identity. All data will be kept in a locked secure area, and will be available only to members of the research team, and that any subsequent publication of the results of this study will no identify individual subjects.**

I understand that in the event of injury resulting from this investigation neither financial compensation nor free medical treatment has been budgeted to provide for such an injury.

I certify that to the best of my knowledge and belief, I have no physical or medical illness or weakness that would increase the risk to me of participation in this investigation.

**I CERTIFY THAT I HAVE READ AND FULLY UNDERSTAND THE STATEMENT OF PROCEDURES AND AGREE TO PARTICIPATE AS A SUBJECT IN THE RESEARCH DESCRIBED HEREIN. MY PARTICIPATION IS GIVEN VOLUNTARILY, AND I HAVE NOT BEEN COERCED OR UNDULY INFLUENCED TO PARTICIPATE. I UNDERSTAND THAT I MAY DISCONTINUE PARTICIPATION AT ANY TIME WITHOUT PENALTY OR LOSS OF ANY BENEFITS TO WHICH I MAY OTHERWISE BE ENTITLED.**

---

Subject's Name (print)

Subject's Signature

Date

---

Parent/Guardian Name (print), Signature, and Date (if subject is under 18 years of age)

I, the undersigned, have described and fully explained the investigation to the above subject.


---

Investigator Name (print)

Investigator's Signature

Date

**Completion of Training for ethical conduct of research  
on Group 2 Social and Behavioral Research Investigators and Key Personnel from  
CITI (Collaborative Institutional Training Initiative)**

 ~~Kanae Haneishi~~ (Member ID: 1417894)

**CITI** Collaborative Institutional Training Initiative

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**Institution: University of Massachusetts Amherst**  
**Group: Group 2 Social and Behavioral Research Investigators and Key Personnel**  
**Stage: 1. Basic Course (Ref #: 3564022)**

Required Modules	Date Completed	Score
Introduction	09/23/09	No quiz
History and Ethical Principles - SBR	09/23/09	4/4 (100%)
Defining Research with Human Subjects - SBR	09/23/09	5/5 (100%)
The Regulations and The Social and Behavioral Sciences - SBR	09/23/09	5/5 (100%)
Assessing Risk in Social and Behavioral Sciences - SBR	09/23/09	5/5 (100%)
Informed Consent - SBR	09/23/09	4/4 (100%)
Privacy and Confidentiality - SBR	09/23/09	3/3 (100%)
Conflicts of Interest in Research Involving Human Subjects	09/23/09	2/2 (100%)
University of Massachusetts Amherst	09/23/09	No quiz

[Course Completion History](#)

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