Original Article

Development of game performance by novice learners participating in a sport education physical education unit

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Abstract:

The purpose of the study was to determine whether fourth grade students participating in a Sport Education unit for the first time can exhibit an improvement in their game play capabilities. Repeated measures analysis of variance was used to compare the efficiency index (an overall indication of game performance) of 12 randomly selected students across three phases of the season. A qualitative analysis was also provided by three experts who made comments about the quality of play and whether they believed there was a substantive difference in performance across the three games that were observed. There was a statistically significant effect of time on the efficiency index of the observed players. Post hoc tests revealed that by the end of the season, the index reached a score of .75 (SD =.46), which was significantly greater than the scores for the first match ($.29 \pm .25$, $p = .002$) and the match observed at mid-season ($.25 \pm .19$, $p = .001$). In addition, the experts believed that the quality of game play in the final lesson was superior to the other two games. These findings suggest that students participating in a Sport Education unit for the first time can expect to experience an improvement in game performance, particularly as the extended length of season may provide the framework for students to develop improved skill competency.

Key words: primary students, game play, skill development

Introduction

For many years the idea of sport competition for young people was found in either interscholastic competition or in pickup games in someone's backyard. With regards to the latter, friends would get together and compete in games that either mimicked or closely compared to what was played in the competitive leagues. With the assistance of imagination, each game would consist of someone kicking the winning goal in the World Cup, winning Olympic gold in the team Badminton competition, or possibly catching the long pass to win the Super Bowl. Regardless of the situation, children often found enjoyment in playing the game.

Physical education teachers have always been in a unique position to exploit this student desire by creating an environment where participants could learn the skills of various games and apply these within developmentally appropriate competition. Nonetheless, as Gubacs-Collins (2007, p.106) states, many physical education teachers believe that the most appropriate progression lies in "first providing explanation or demonstration, followed by skill practice and culminating in game play". To Gubacs-Collins, these teachers have less interest in replicating the sport experience in which their students either take part or mimic once outside the classroom. As supporting evidence for this conclusion, Kirk (2010, p. 2) critiques this "physical education-as-sport-techniques", in which the practice of physical education has focused on the transmission of decontextualized sport-techniques to large classes of children who possess a range of interests and abilities, and where learning rarely moves beyond introductory levels.

As a response to this decontextualized presentation of sport, and in particular, to the absence of the attractive features of formal sport or imaginary play that produce the most meaning to young people, Siedentop (1994) introduced the concept of Sport Education, with its explicit goal of providing an authentic sport experience for boys and girls that was developmentally appropriate, and in which all participated equally. Siedentop, Hastie and van der Mars (2011) list six key features of Sport Education, including seasons, affiliation, formal competition, culminating events, record keeping and festivity. In Sport Education, which aims to produce the *complete sports player* by including participation in roles other than player, the goal is to help young people have a more defined understanding of sport, instead of one who has only developed sport skills.

For development of the complete sports player to occur, significant opportunities for practice need to be available. Not only does the student need extended and repeated successful repetitions (Silverman, 1985) but in terms of game play, as Rink, French, and Graham (1996, p. 497) simply state, "skill and strategy take time to

develop". This notion of time has been explicitly demonstrated in research on Sport Education (see the study by Hastie, Sinelnikov, & Guarino, 2009 as one specific example).

Given the desire to create an authentic sporting experience for young people, game play is a central component of Sport Education. Beginning research findings suggest that the model is capable of promoting both elements of effective game play, namely technical execution and tactical decision making. Studies by Hastie (1998a) and Hastie, Sinelnikov, and Guarino (2009) found that students who participated in a Sport Education season made gains in terms of skill competence. In addition, results reveal that gains can be made in tactical awareness and competence in game play. In the study by Hastie (1998a) students who participated in an ultimate Frisbee Sport Education season received significant gains in passing and receiving during game play. The study also revealed an increase in tactical decision making as students realized that shorter passes led to less turnovers. A study conducted by Pritchard, Hawkins, Wiegand, and Metzler (2008) found that students improved in game performance when compared to a traditional form of teaching. The belief was that improvement occurred due to the modified games played earlier in the season and that through affiliation, students competed with their teammates over a period of time which led to greater outcomes.

To date, the studies examining game performance during seasons of Sport Education have been limited to those focusing on middle and high school students (Browne, Carlson, & Hastie, 2004; Hastie, 1998a; Hastie, et al., 2009; Pritchard, et al., 2008). To our knowledge, there has not been any investigation of game play performance by children in elementary school settings. By consequence, the purpose of this study was to examine the development of game play capabilities in a group of fourth grade (9-10 years old) students. In essence, the guiding question was to determine whether fourth grade students participating in a Sport Education unit for the first time can exhibit an improvement in their game play capabilities.

Method

Participants and Setting

The study took place in a public elementary school located in a small rural town in the southeastern United States. The school enrolled 472 students from grades one through five, and all students had 30 minutes of physical education five days a week. The participants in the study consisted of 12 students (6 boys and 6 girls) from two randomly selected teams from two classes of 40 fourth grade students (18 girls, 22 boys; average age 9.72). The students did not have any prior experience with Sport Education. Further, the game that was played (Swirl Ball) was created by a previous class during a unit of student-designed games. Therefore, all students were novice players due to their minimal understanding and experience of the game being played. However, before the season, the teacher classified each student as higher, medium, or lower skilled based on their knowledge of student performance in physical education.

The teacher had been at the school for over 10 years and had extensive experience planning and teaching a number of Sport Education seasons. Those seasons included both team sports (handball, volleyball, hockey) as well as individual sports (track and field athletics, gymnastics, bowling) and involved a number of different competition formats and culminating events. In addition, the teacher has completed Sport Education seasons in collaboration with international schools.

Informed consent and assent was obtained from all participants and their parents prior to the beginning of data collection, and the research protocol was approved by the university's Institutional Review Board for Human Subjects Research.

Season plan

The season of Swirl Ball took place over 13, 30 minute lessons. The season consisted of three phases. In the first phase (called the pre-season) which lasted from lessons 1-6, students were introduced to Sport Education, game roles, and protocols, placed onto teams, and participated in individual and team skill practices designed to improve their swirl ball game performance. In the second phase (called the formal competition) which lasted from lessons 7-11, students were involved in competitive matches against other teams from the class. During each lesson of this phase, four teams would compete in two games being played at the same time while two teams would perform officiating and record keeping roles. At the end of the first two games, teams would rotate positions and another round of games would take place. In the third phase (called the culminating event), which took place during lessons 12 and 13, the semifinal and final matches and awards ceremony took place. Following typical Sport Education protocols, students were placed on heterogeneous, mixed-sex teams at the beginning of the season. In this particular season, the teacher allocated students to teams based on his knowledge of their skill competence and interpersonal skills. Students stayed with their respective teams for the duration of the season, and served in nonplaying roles such as officials, statisticians, equipment managers, trainers, and captains.

The game selected for the season, Swirl Ball, was an invasion game created by a previous fourth-grade class from the same school. In Swirl Ball, students attempt to throw a soft foam ball (the size of a softball) into a small goal (2m x 1m). Each team is composed of four players and one goal keeper. Students can pass the ball from player to player and can move three steps with the ball. However, if they are tagged by an opposing player while holding the ball, they must immediately drop the ball and the opposing team obtains possession. Teams are not penalized for incomplete passes, and hence the ball may touch the floor during any possession.

Another component of Swirl Ball is the free shot hoop. One hula hoop is placed between 3 and 4 meters diagonally from the goal at each end. If a player catches a pass from a teammate while standing in either of these hoops, they can take a free shot (i.e., with no defender or goal keeper) at their opponent's goal. The game of Swirl Ball is continuous, meaning that when a goal is made, the goalkeeper collects the ball and passes it to a teammate to resume play.

Instruction and treatment validity

When examining the outcomes of any instructional intervention, it is critical to validate that the instruction was indeed consistent within the accepted standards for the model under study. Metzler (2001) suggests that in order to demonstrate acceptable fidelity, the researcher must (1) fully explain the model under study, noting all of its relevant features, (2) document that those features were in fact present in the instructional units, and (3) demonstrate that the necessary contextual and operational requirements for the model were met.

With respect to the teacher's instruction according to Sport Education, a 10 item checklist with benchmarks that typifies instructional features of the model was developed. Based upon the version of Pritchard, et al. (2008) the checklist asks a trained observer to make decisions as to whether an item is representative of the lesson (see Table 1). In this case, two investigators who had a significant research and publication record relating to Sport Education viewed four randomly selected lessons from each of the school sites. These observers reached a 100% agreement with regard to the instructional approach used in each lesson.

Table 1. Instructional Checklist

1. ☐ Groups of students go to a designated home area and begin warming-up with that group.
2. ☐ Students warm-up as a whole class under the direction of the teacher.
3. ☐ Students practice together with their group/team under the direction of a peer leader.
4. ☐ Students practice individually or in small groups under the direction of the teacher.
5. ☐ Students remain a part of easily identifiable groups throughout the lesson and throughout different tasks.
6. ☐ Student grouping throughout the lesson is variable across tasks.
7. ☐ Performance records are kept by students.
8. ☐ Students perform specialized tasks within their group/team.
9. ☐ Student performance scores count towards a formal and public scoring system.
10. ☐ Student performance scores are not recorded or recorded in private.

Note. Items 1, 3, 5, 7, 8, 9 indicate Sport Education while items 2, 4, 6, 10 represent a traditional lesson. In this study, only those Sport Education items should be checked.

Data collection

All lessons of the season were recorded on a Canon digital video recorder mounted on a tripod. The camera was located in the corner of the gym so that it did not interfere with the activity. The lessons were then transferred to a personal computer for observation to take place.

Game play (quantitative analysis). As an overall indication of playing performance, an efficiency index was calculated based on the formula developed by Gréhaigne, Godbout, and Bouthier (1997) for assessing game play. Efficiency was established from the following data: (a) the number of catches from one's own team as well as interceptions, known as recovered throws (RT); (b) the number of jeopardizing passes (JP) consisting of the total of successful passes and scoring shots of goal; (c) the number of lost passes (LP), which is the sum of uncatchable passes and intercepted passes; and (d) passes from a team mate which were dropped (D). The efficiency index then is calculated as follows: Efficiency Index = $RT + JP / (10 + LP + D)$.

Efficiency data were collected by recording the elements listed above for all 12 students during three lessons throughout the season. These lessons represented the first time the students played a competitive match (lesson 7), their fifth match (lesson 10), and their tenth match (lesson 13).

Validity data for this formula are available in the research of Gréhaigne, et al. (1997). Furthermore, Gréhaigne (1996) noted that play without the ball is excluded, "for it seems to us that a student whose non-ball play is efficient is practically certain to obtain a pass especially in the case of small teams" (p. 5). This would also apply to the game used in this study, as players who are more active in getting open will likely receive more passes, while players who are more skillful in reading the play and moving to disrupt their opponents are likely to make interceptions.

A two-step process was used to ensure these data were reliable. First, an observer was trained to reach a greater than .90 agreement criterion with the primary investigator during simultaneous viewing of 15 minutes of game tape from two different preseason matches. Discrepancies were discussed and resolved. Second, an inter-rater reliability check was conducted on simultaneous observations of videotape twice throughout the study. Kazdin's (1982) agreements/agreements + disagreements formula was used in assessing reliability with this agreement was exceeding recommended levels of .85 agreement suggested by van der Mars (1989).

Game play (qualitative evaluation). In order to provide a more descriptive account of the quality of game play, three, three minute clips were made of game play during lessons 7, 10, and 13 of the season. These were then uploaded separately to the YouTube website with a random title given to each clip for the purpose of

anonymity. Three experts in basketball or handball were invited to make an analysis of the video clips by first making a comment about the quality of play (listing strengths if any, and weaknesses), and second, making a statement as to whether they believed there was a substantive difference in the quality of play across the three games. These experts were blind to the stage of season in which the games were played, and hence were not aware of the order in which they were played.

Data analysis

Repeated measures analysis of variance (ANOVA) was used to compare the efficiency index scores of the 12 players to determine if there was a difference between them over the three stages of game play.

The expert data were analyzed using a constant comparison method (Lincoln & Guba, 1985). Firstly, the answers were read and then transcribed verbatim into a transcript for each expert. Then, key words were selected and common themes were generated for each clip which related to the game being played. Next, themes were then compared and contrasted to determine the level of consistency across the experts. Finally, the experts' rankings of the game play were compared with the chronological order of the matches.

Results

Game play (quantitative analysis)

Figure 1 provides a visual presentation of mean efficiency index scores for the 12 students across the season. Mauchly's Test of Sphericity indicated that the assumption of sphericity had not been violated, $\chi^2(2) = 5.15, p = .076$. By consequence, there was a statistically significant effect of time on the efficiency index of the observed players ($F(2, 10) = 20.09, p < .001, \eta^2 = .691$). Post hoc tests using the Bonferroni correction revealed that by the end of the season, the index reached a score of .75 ($SD = .46$), which was significantly greater than the scores for the first match ($.29 \pm .25, p = .002$) and the match observed at mid-season ($.25 \pm .19, p = .001$). The difference between the first match and that observed at mid-season was not significant ($p = .438$).

Fig. 1. Efficiency index across three selected matches

Inspection of fig. 2 shows that this trend toward improvement during the latter parts of the season was consistent across skill levels. While the higher skilled students outperformed their peers at all stages of the season, they too only made significant improvement following repeated opportunities to play.

Fig 2. Comparison of efficiency index scores according to students' skill levels

Game play (qualitative analysis)

Table 2 provides a collection of the comments made about the quality of game play for lessons 7, 10, and 13. This table includes comments on the strengths and weaknesses of skill ability, tactical decision making, and other facets of the game. With respect to their rankings, the evaluators suggested they could discriminate that the quality of game play in lesson 13 was superior to the other two games. They did, however, suggest there was little difference between those games played in lesson 7 and 10.

Table 2. Evaluation of Game Play

Match 1 - Strengths		
Skill Ability	Tactical Decision Making	Other
They passed the ball very well	Students were moving with the purpose of trying to score.	Game play was continuous
Match 1 - Weaknesses		
Skill Ability	Tactical Decision Making	Other
Few were able to throw the ball.	A lot of long uncontrolled passes.	Very stationary with movement.
Not a lot of possibilities for catching	Did not move well without the ball	Stood around a lot more compared to the other clips.
	Did not utilize the free shot hoops	Players were not working together; slow game play.
	Indecisive on where to throw the ball	
Match 5 - Strengths		
Skill Ability	Tactical Decision Making	Other
They were in a basketball stance moving their feet.	They were in the passing lanes of the offensive team.	Communicated well with teammates.
Offensive play and passing game was much better than (Lesson 7).	Once they understood how to move and pass...more goals were scored.	
Defensive play was good with solid positioning.	Better utilization of free shot hoops.	
	Players tried to move to open areas to receive the pass	
Match 5 - Weaknesses		
Skill Ability	Tactical Decision Making	Other
Passing and catching wasn't as high as other (Lesson 13).	Students were tentative in their actions during the game.	The game seemed to be a little too fast for them.
	Spacing a little better but some players still making long uncontrolled passes.	
Match 10 - Strengths		
Skill Ability	Tactical Decision Making	Other
Passed the ball around quickly	Seemed to spread the floor well	Worked together as a team
Their ability to throw and catch was good.	They took advantage of the other team's mistakes by playing aggressive defense and forcing several turnovers.	
They were better aware of their opponents. They returned nicely back to own court. I think they tried to play man to man defense.	Took advantage of the free shot hoop.	
Forced turnovers which led to fast breaks and quick scoring.	Moved well without the ball	
Match 10 - Weaknesses		
Skill Ability	Tactical Decision Making	Other
None	None	None

Discussion

Results from both quantitative and qualitative data support the conclusion that given time, students participating in a season of Sport Education for the first time were able to make improvements in overall game performance. This finding is consistent with previous research of Sport Education that shows significant improvement in game performance, and also reinforces the extended length of seasons of Sport Education as producing a number of positive benefits to students (Hastie, 2000; Hastie, et al., 2009; Pritchard, et al., 2009). The experts noted that while the game play seemed chaotic in the beginning (stationary, long uncontrolled passes, no use of free shot hoop, etc.), it did resemble improved skill ability (throw and catch quickly, forced turnovers, etc.) and improved tactical decision making (good spacing, use of free shot hoop, etc.) by the end of the season.

The experts believed that the passing ability of the students did improve over time, and this provides support for the empirical data collected from the analysis of game play. The experts commented that students exhibited long uncontrolled passes as well as indecisiveness in their pass decisions at the beginning of game play, but as the season progressed to the final lesson they all wrote about how quickly and effectively passes were made. These outcomes match Hastie (1998b) who discussed how throws made in the beginning of the season “continually hit the ground, flew out of bounds, or was thrown without any control” (p. 377). Yet, as the season progressed the students were better able to select their pass options and did exhibit an increase in completed passes.

There are two postulates as to why this may have occurred. First, as the season progressed, the expert reviewers noted that students became more aware of their tactical decisions. For example, at the beginning of the study, students, when receiving the ball, would become frantic and throw the ball to no one in particular because of their fear of being tagged. This led to many turnovers and little ball control by the offensive team. Towards the end of the season students became more conscious of the free throw (occurs after tagging someone from the opposing team with the ball) and the free shot hoop. With regards to the free shot hoop, players in the beginning of game play were more concerned with occupying the ball and attempting the unnecessary long passes. Over time, the players began to realize that the free shot hoop was an effective way to score and thus provide an advantage for their team. These data are consistent with Hastie, et al. (2009) who found that eighth grade students improved on their skill development, game competence and tactical knowledge after completing a Sport Education season in badminton for the first time. Using a pre-and-post test design, students in that study displayed improvement in all three categories following a season of Sport Education.

The second reason for the increased quality of game performance was that students took advantage of shorter passes and passing to students who were open. In the beginning, students were intrigued by the possibility of completing a long pass to a teammate. Eventually, one may realize that long passes do not always lead to success. Therefore, it is possible that success increased because of this change. These outcomes match exactly the study of Hastie (1998b) in which students learning Frisbee would change the way they performed without any intervention from the teacher. Through playing, students would acquire better tactics which resulted in shorter attempts being completed.

Another important facet of invasion games is the idea of space. With invasion games students typically will congregate around the ball causing limited space and the inability to be effective with moving the ball. The concept of space can be difficult to teach with technical skill exercises. In the game of Swirl Ball, players would react to the positioning of their opponents and their defensive decision making. Therefore, one would believe that the best teaching scenario would be actual game play. The experts believed that students were mostly stationary in the beginning lesson, yet took advantage of open space and moved well without the ball in the final lesson. These results support Pritchard, et al. (2008) who examined how Sport Education and a traditional style of teaching would impact skill development, knowledge, and game performance for volleyball at the secondary level. Pritchard believed that the increase may have occurred due to earlier opportunities to play modified games when using Sport Education. These results suggest that game play can improve these components of play thus improving the overall quality of play.

Conclusions

Even with the limitation of using a small sample size from two classes, this study contributes to our understanding of the capabilities of young students participating in a Sport Education physical education unit in the following ways: First, the study provided evidence that game performance increased only after an extended interaction with the content. Due to the consistency of skill opportunities, over the course of time students may see an improvement of overall game play ability. Ultimately, the length of season may provide the framework for students to develop improved skill competency. Second, the study revealed that the development of game performance can occur for novice learners. Regardless of experience with using Sport Education, students participating in a Sport Education unit for the first time can expect to experience an improvement in game performance.

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