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ARTICLE

Effects of Student Skill Level on Knowledge, Decision Making, Skill Execution and Game Performance in a Mini-Volleyball Sport Education Season

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The purpose of the paper was to examine the effects of student skill level on knowledge, decision making, skill execution and game performance in a mini-volleyball Sport Education season. Forty-eight secondary school students from two classes participated in a 12 lesson season. Knowledge, decision-making and skill execution (components of game play) were evaluated prior to and on completion of the season. Paired *t* test analysis showed that the game performance components of decision making and game play achieved significant gains. Further, results of the regression analyses detected that the sigmoidal model was indeed superior to the linear model for (a) skill execution, (b) game play, and (c) knowledge, by explaining 4.0, 2.8, and 3.25 times more of the variance respectively. That is, improvements of the highest and lowest skilled students were less significant than

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those of more moderate levels. This outcome, accompanied by a lack of general improvement in skill execution, suggests that future research should examine in more detail the progressive development of the tasks and learning experiences incorporated during seasons of Sport Education.

Keywords: physical education, sport education, skill level, knowledge, game performance

In order to expose students to a wide variety of sports and movement activities, many physical education curriculum documents propose a series of units across an academic year (EACEA, 2013).To achieve the demands of these curricula, many teachers resort to implementing a series of short, 8–10 lesson units in which they tend to focus on discrete, and non-game-like skills (Siedentop, Doutis, Tsangaridou, Ward, & Rauschenbach, 1994; Siedentop & Tannehill, 2000) in a pedagogy that Kirk (2010, p. 41) critiques as "physical education as sport techniques." While the underlying intent of these units is to provide young people with greater opportunities to find an activity to which they are attracted, an unintended consequence seems to be low levels of student commitment, intensity of engagement and enthusiasm (Casey, 2006; Hastie & Curtner-Smith, 2006; Perlman, 2010, 2012; Shen, Wingert, Li, Sun, & Rukavina, 2010). Kirk argues that the technical aspects of games and sports are given prominence over the performance of the games and sports themselves. Siedentop (1994, p. 7) has also criticized this presentation of "decontextualized physical education", in which games and sports are taught in ways which rarely resemble the authentic sport experience, and in which there is infrequent use of modified games that promote student decision making, and a better understanding of game play. Further, in physical education as sport techniques, it is the teacher who controls almost all aspects of the learning process, leading to minimal levels of student autonomy, perceptions of competency and relatedness (Hastie, 2012). These are all critical features of motivational climates that have been shown to promote student engagement and enjoyment (see Hastie, Rudisill & Wadsworth, 2013).

As a result of Siedentop's dissatisfaction with the way in which sport was presented to students within physical education, Sport Education emerged as a pedagogical model based on constructivist theories (Metzler, 2011), whose priorities are teamwork and fostering autonomy, problem solving, accountability, competition, decision making and final recognition. Focusing around the six key concepts that mimic the authentic form of sport within the larger culture (seasons, affiliation, formal competition, record keeping, culminating events, and festivity), the main goal of Sport Education is to produce competent, literate and enthusiastic sports players (Siedentop, Hastie, & van der Mars, 2011).

Research since the early 1980s to the present has analyzed the extent to which Sport Education has been validated in achieving its three major goals, with reviews being conducted by Wallhead and O'Sullivan (2005), Kinchin (2006), and Hastie, Martínez de Ojeda, and Calderón (2011). Studies have also been conducted that compare Sport Education outcomes with other teaching models that follow more traditional, teacher-directed styles (Browne, Carlson, & Hastie, 2004; Parker & Curtner-Smith, 2005; Perlman, 2010; Pritchard, Hawkins,

Wiegand, & Metzler, 2008). Mostly, the research has focused on the effects that these models have on the enthusiastic participation of students (Browne, et al., 2004; Carlson, 1995; Hastie, 1996, 1998, 2000; Pope & Grant, 1996); learning to teach (Alexander & Luckman, 2001; Alexander, Taggart, & Thorpe, 1996; McCaughtry, Sofo, Rovegno, & Curtner-Smith, 2004; McMahon, & MacPhail, 2007); and perceived skill improvement (Alexander, 1994; Calderón, Hastie, & Martínez de Ojeda, 2010; Siedentop, et al., 2011). However, as Hastie et al. (2011) noted, there is a lack of empirical evidences to validate improvement on game performance and knowledge of students.

Within Sport Education, the first empirical study that provided quantitative data on game performance and students' knowledge was conducted by Hastie (1998), which students showed significant improvement from the initial phase of a 30-lesson Ultimate Frisbee season to the end. A second study (Pritchard, et al., 2008) showed that following two volleyball units (Sport Education and Traditional Style), students demonstrated no significant differences between models for technical skills and knowledge, but that Sport Education was superior in enhancing game performance. It was suggested that these differences could be attributed mainly due to the fact that students in Sport Education remain on the same teams throughout their units and by consequence attend more seriously to team practices and the resulting competitions. A third study, (Hastie, Sinelnikov, & Guarino, 2009) reported significant improvements in technical skills, game play, and tactical knowledge following a Sport Education badminton season of 18 lessons. These authors also showed improvements in shot selection and shot execution (i.e., which shot to make and the ability to complete that desired shot). Most recently, Pritchard, McCollum, Sundal, and Colquit (2014) showed improvements in game performance (and its subsets of decision making and skill execution) following an 18 day, 3 versus 3 basketball unit.

As research on student achievement in physical education shows, it is important to consider the initial skill level of the students, as this variable affects the experiences that students have in physical education (Rikard, 1991, 1992; Silverman, 1993). As Silverman, Woods, and Subramaniam (1998) have suggested, it is important to consider student skill level because it may mediate process variables such as student practice, task organization, feedback and achievement. Accordingly, it is recommended that classes in physical education are structured in ways that provide low skilled students equal opportunity to learn (Silverman, Woods, & Subramaniam, 1999) as well as optimizing the quantity and quality of practice opportunities for all students (Hastie, Calderón, Palao, & Ortega, 2011). As these authors have argued, if the effects of practice by students of different skill levels are understood, the process of learning and teaching will indeed be enhanced (Hastie, et al., 2011).

Given the relative importance of considering students' skill level when examining the impact of a pedagogical intervention (such as Sport Education), it is notable that only the study of Hastie (1998) took into account skill level to analyze the game performance enhancements and knowledge of students. In fact, in most of the research on Sport Education, skill level is not considered as a mediating variable. By consequence, the purpose of this paper was to evaluate the degree to which students' initial skill levels may result in differential student outcomes during a season of Sport Education.

Method

Design

This study followed a mixed-methods approach. Quantitative data on student performance were evaluated using a quasi-experimental pretest-posttest design. Pretests on game knowledge and game performance took place before the instruction began, while posttests took place following completion of instruction. In addition, player performance was evaluated using qualitative commentary from external experts. The students were also interviewed on completion of the study to record their perceptions of the season and their levels of improvement.

Participants

Two classes of 48 eight-grade students (23 boys and 25 girls) from a coeducational high school in southern Spain completed a 12 lesson season of mini-volleyball taught following the principles of Sport Education. While the 12 lesson number falls at the low end of recommended season lengths (see Siedentop et al., 2011), this was the longest possible intervention within the curricular constraints for physical education mandated by Spanish educational authorities. Nonetheless, the lessons were at least 55 minutes in duration.

While the teacher had participated in seasons of Sport Education with other classes prior to this study, the students in this study had no prior experience with the model. They did, however, have previous experience with volleyball, but following pedagogies more aligned with direct instruction and playing the full 6 versus 6 format of the game.

The study had the approval of the board of the school. Parents or legal guardians of each student signed the informed consent letter to allow their child to participate in the study which had the approval of the Ethics Committee of the researchers' university.

In order to produce more valid results and promote experimental control, only those students who attended at least ten of the twelve sessions of the season and who completed all assessment instruments were included in the analysis. Nonetheless, this criterion only reduced the final sample by four students (2 boys, 2 girls), leaving a final participant pool of 44 students.

Season Design and Lesson Content

The mini-volleyball season took place twice a week over a period of six weeks for a total of 12 lessons. Each lesson was scheduled for 55 minutes. The students in each class were divided into mixed-ability teams based upon their pretest scores. These teams (four to five students per team) remained constant throughout the season, with individual students on each team taking upon different team roles. Table 1 provides an example of how the essential features of Sport Education were incorporated during this particular season.

The season began with a series of lessons that focused on the skills and tactics of mini-volleyball. These four lessons, which were initially teacher directed, aimed at developing the students' competence to the point where they could play a game of 4 versus 4 mini-volleyball with a degree of ball continuity. In these early lessons,

Table 1 Features of the Sport Education Season

Lesson	Content	Teacher´s role	Student's role
1	Knowledge test	Class leader	Participant
	Introduction to teaching approach		
	Description of daily roles*		
2	Assigned team/	Class leader	Participant
	Pretest 4 vs 4		
3	Overhead pass	Head coach	Coaches, players, learn duty role, practice duty roles
	1 vs 1		
	2 vs 2	Referee advisor	
4	Forearm pass	Head coach	Coaches, players, learn duty role, practice duty roles
	2 vs 2	Referee advisor	
5	Underhand serve	Head coach	Coaches, players, learn duty role, practice duty roles
	3 vs 3	Referee advisor	
6	Spike/tip	Head coach	Coaches, players, duty team roles
	3 vs 3	Referee advisor	
7	Block	Head coach	Coaches, players, duty team roles
	Defending space	Referee advisor	
	3 vs 3		
8	4 vs 4	Class manager	Coaches, players, duty team roles
9	4 vs 4	Program manager	Duty team roles
10	Tournament 4 vs 4	Program manager	Duty team roles
11	Tournament Posttest 4 vs 4	Program manager	Duty team roles
12	Final Competition	Master of ceremonies	Participant
	Festivity Award ceremony		

Note. Individual roles: Physical trainer, captain and publicist; Team roles: Scorer and referee

students were also introduced to the rules and officiating procedures of the game. The next five lessons consisted of a formal competition phase in which each lesson began with team practice and concluded with small-sided games in teams' practice areas. During these small-sided games, nonplaying teams acted as officials and were responsible for refereeing, scorekeeping, and awarding fair play points.

The season concluded with a postseason tournament spanning three lessons. This postseason tournament took the form of a no elimination round-robin challenge. After the final games, a closing ceremony provided a formal end to the season and in which various awards were presented to students.

Instruction and Treatment Validity

As Metzler (2005) has noted, any instructional model needs to have in place essential contextual conditions such as teacher expertise and student readiness for the model to have any chance of working. In this particular study, the teacher received formal instruction and training in Sport Education following the directions of Dyson, Griffin, and Hastie (2004), and had previous experience teaching Sport Education. Further, an external review of the season plan developed by the teacher confirmed that all key aspects of Sport Education conformed to those listed in a validity check developed by Sinelnikov (2009).

Data Collection

Game Performance. Digital video records were made of student game performance at both pretest and posttest. Each student was recorded for at least eight minutes during these observations. Game performance was assessed using the Game Performance Assessment Instrument (GPAI) (Oslin, Mitchell, & Griffin, 1998). While the GPAI allows the evaluation of seven game components, for this study only the two most used and fundamental indexes of GPAI (decision making and skill execution) were assessed. From these data, the following indexes were calculated: Decision Making Index (DMI), Skill Execution Index (SEI), and Game Performance, which is calculated using the formula (GP=(DMI+SEI)/2).

To calculate DMI, the total number of appropriate decisions is divided by the sum of the number of appropriate and inappropriate decisions (DMI=DM/(DM+iDM)). An appropriate decision is defined as those actions in which the player tries to (a) pass the ball to their teammate (on the first and second contact); (b) send the ball across the net in a way that places a stress on the opposing team (on the third contact); or (c) block an opponent's attack.

To calculate SEI, the total number of correct executions is divided by the sum of the number of correct and incorrect executions (SEI=*SE*/(*SE*+iSE)). An execution was considered correct in the following cases: (a) when the player made a hand or forearm pass that rose above the net height was able to be controlled or attacked by a teammate; (b) the player successfully sent the ball into the opponent's court, or (c), the player blocked the ball so that it was returned to the opponent's side of the court.

To ensure the reliability of the GPAI data, three observers were trained for a minimum of ten hours viewing and analyzing video clips. During the first hours of training, the observers watched games other than those used during data collection. The observers were considered adequately reliable when they were able to achieve

a 90% accurate standard with respect to both obtain intra- and interobserver reliability. This "gold standard" was calculated by means of the intraclass correlation coefficient and percent agreement ((agreement/disagreement)*100) achieved following a 12 minute assessment of a single player at two intervals separated by two weeks. This protocol is consistent with recommendations of McGarry and Franks (1994) and O'Donoghue (2007).

Reliability of the pre and posttest data were measured through interobserver evaluation among the three coders. In these evaluations, the observers analyzed more than 15% of the players as suggested by the literature (Hopkins, 2000; Tallir, Lenoir, Valcke, & Musch, 2007). Reliability of the observation reached intraclass correlation values between .84 and .94, and percent agreement values between 80.6% and 92.7%.

Game Knowledge. Game knowledge was measured through the use of a written test. The test consisted of six questions concerning technique, five concerning rules, three concerning tactics, and a further three assessing the students' general knowledge about the game of volleyball. The specific items selected for assessment were confirmed by the teachers as being consistent with those knowledge items identified in the Spanish curriculum documents relating to physical education. The test was administered both before the season began and again on completion with an average time for completion being 25 minutes.

Expert Analysis of Game Performance. To provide a more qualitative dimension to the GPAI data, a number of experts in volleyball were asked to analyze sample video sequences of the participating students. Two men and two women, all with doctoral degrees in physical education and who had coached on the national level for over 10 years agreed to participate.

Using the methodology outlined by Hastie, Layne and Mesquita (2013), two video clips of every team (20 clips in total) were shared with these evaluators via a virtual folder. The two clips were from the initial games during pretest and from the final (posttest) game. It should be noted that file names of these video clips were labeled in a way that the evaluation team members were not aware of the temporal location of the matches.

The experts were asked to complete two tasks. The first was to make a comment on each of the following aspects of play: (a) attacking play, (b) defensive play, (c) technical quality of the players, and (d) tactical decisions made throughout the games. The second task asked of the experts was to judge whether they saw distinctive qualitative differences in the overall quality of each team's performance across their team games, and if so, to note which was superior.

Students' Perceptions. Individual interviews were held with three lower skilled and three higher skilled students to investigate their general perceptions of the season, but also about their opinions regarding their game involvement and performance improvement.

Data Analysis

Game Performance and Knowledge. Fitzmaurice, Laird, and Ware (2011) recommend the use of gain score analysis when the research question focuses on

improvement. Consequently, a series of paired-samples *t* tests were conducted using the IBM Statistical Package for the Social Sciences, Version 20. Rather than using the Bonferroni method for controlling Type I error inflation, the Holm's sequential Bonferroni method was applied as it is less conservative and has greater power (Maxwell & Delaney, 2000).

To determine if gain scores were affected by the individual student's ability at initial evaluation, both linear and sigmoidal regression analyses were conducted. While the assumption of a linear regression is the predictor has a constant effect on the outcome variable, the sigmoidal regression assumes that the predictor has a differential effect on the outcome variable. Specifically, the sigmoidal regression analysis is appropriate when there is the possibility that individuals with either low or high ability at pretest would demonstrate lower gains than those who were of more moderate ability at pretest.

Expert Commentary. It was hypothesized that if there was consistency across expert assessments indicating higher levels of game play that matched performances following instruction, then this would support the assertion that the students had indeed made improvements in their game play.

Interviews. All interviews were recorded and later transcribed. Interview data were analyzed inductively (Bogdan & Biklen, 1992). Repeated examinations summarized the text segments into preliminary categories (Merriam, 2009). Similar to the constant comparative method (Glaser & Strauss, 1967; Lincoln & Guba, 1985), the data were reviewed repeatedly and continually coded to identify similarities and differences, groupings, and patterns.

Results

Game Performance

Results of a series of paired *t* tests are presented in Table 2. Inspection of these data shows that of the GPAI components, only DMI and GP achieved significant gains. Results of the regression analyses detected that the sigmoidal model was indeed superior to the linear model for SEI and GP, by explaining 4.0, and 2.8 times more of the variance respectively. There were no model differences for DMI. The R^2, *p*-value, constant (b0) and the b-weight (b1) are presented in Table 3.

Knowledge

The students showed a group improvement on the knowledge test from a prescore of 5.50 (*SD* = 2.12) to one of 6.40 (*SD* = 1.66) at the end of the season (Cohen's d = 0.48, Table 2). Results of the regression analysis also detected that the sigmoidal model was indeed superior to the linear model, in this case explaining 3.25 times more of the variance.

Game Performance Experts

The quantitative results were also supported by the qualitative assessments made by the experts. First, all experts placed the clips in the order of lower to higher

Table 2 Changes in Decision Making, Skill Execution, Game Performance and Knowledge across Time

	Pre		Post				
	M	SD	M	SD	M dif	SD dif	Cohen's d
DMI	.60	.28	.78	.20	.18	.24	.75
SEI	.69	.29	.77	.22	.08	.25	.32
GP	.64	.24	.77	.19	.13	.22	.59
Knowledge	5.50	2.12	6.40	1.66	.90	1.89	.48

Note. Cohen's Index: 0.2 = small, 0.5 = medium, 0.8 = large

Table 3 Comparison of Linear and Logistic Regression

	Linear				Logistic			
Variable	R^2	p	b0	bi	R^2	p	b0	bi
DMI	.13	.02	.63	.25	.14	.02	3.58	.24
SEI	.03	.27	.68	.13	.12	.02	3.73	.28
GP	.06	.11	.65	.19	.17	.01	4.81	.17
Knowledge	.04	.21	5.48	.15	.13	<.01	-.82	1.99

quality in the chronological order in which the clips were filmed. This supports the first requirement for demonstrating improvement in game play over the season. Second, the experts all agreed that players showed significant improvements in attack, defense, technique and tactical concerns. Some of the comments can be summarized in the following statements: "There is more safety in the service, teams have a better spatial distribution, they try to make blocks, perform better reception, players assume certain functions trying to build an attack, there is greater collaboration and increased mobility, there is greater control directionality ball in the field to make three passes".

All three experts also commented that within the games that certain students promoted greater opportunities to respond by all team members. For example, Expert B noted that "every team has a player that is helping a lot to their teammates, I think that without him the game performance of the team would have been much worse," while Expert C commented that "there are some players that don't play really well, but there are others that encourage them to play better and give the best of themselves".

Interviews

Interviews with the higher skilled students resulted in the generation of three themes. In the first of these (individual improvement), the higher skilled players believe they did not make substantive improvements in their ability to play volleyball. The main instance here is that these players suggested they already had a good level of skill

in volleyball, and the quality of the competition was not of a standard that required them to extend their abilities. However, these students also believed their investment was directed more toward the second theme that is "self-sacrifice towards team improvement". They reported what they saw as "significant team improvement" and that they expedited this by "putting all my effort in the team and forgetting about myself". In addition, these students also recognized they made deliberate efforts to help their lower skilled peers. As one student noted, "when I see my teammate doing a bad execution, I try to help him or her, because it is better for the team". Still another student noted that "I wasn't used to playing with peers of lower skill and this made me to feel more capable of helping". She continued to suggest "that this feeling encouraged me to help my lower skilled teammates more and more."

It was, however, the third theme (positive team affiliation) that led to the realization of the first two themes. All the higher skilled students spoke about team affiliation as the key to team success. They noted that in cases where persisting teams do not exist (as in traditional games formats), there is "no need to help the lower skilled, because there is no meaning in their play to you as an individual". This theme of team affiliation was also relevant to the lower skilled students, who also mentioned it is as a "key for team success". They also recognized that they were "helped by my higher peers every time I needed it", and a factor which was appreciated in that these students suggested that "I really like to be helped".

The lower skilled students also made particular notes of the theme of "team roles". Many of them reported that taking a role "made me take things more seriously", and that "I was more motivated than in other classes where we had no responsibilities". This responsibility toward the functioning of the team helped encourage these lower skilled students "to be more engaged and motivated to learn as an individual and as a team".

Discussion

The purpose of this paper was to evaluate the degree to which students' initial skill levels may result in differential student outcomes during a season of Sport Education. The results obtained in game performance match and complement those found in Pritchard et al. (2008, 2014), whose GP scores became significantly higher from pre to post season. However, a deeper analysis of the results suggested that the gains in overall performance were strongly dictated by improvements in decision making rather than skill execution. These outcomes mirror those of their motor skill competence. Ormond, DeMarco, Smith, and Fischer (1995) where a panel of experts concluded that students in a Sport Education basketball season showed improvements in offensive and defensive tactics more than in their technical skills. This finding here is also consistent with research conducted in youth sport settings which shows improvement in decision-making well before improvements in skill execution (e.g., Gallagher, French, Thomas, & Thomas, 1996).

Given that game play is a function of decision making and skill execution [GP=(DMI+SEI)/2)], the following outcomes were observed for students of differing skill levels: (a) higher skilled students showed significant increases in decision making, but not in skill execution, leading to lower levels of overall game play improvement, (b) middle skilled students showed increases in both dimensions,

resulting in substantive improvements in game play, and (c) lower skilled students showed increases in understanding, but were perhaps unable to execute the appropriate skills, resulting in lower gains in game play.

Analysis of Highest Skilled Students

Aside from the potential of ceiling effects, the lower levels of game play improvement of the highest skilled students might be explained from an ecological perspective (Hastie, 2000). The social nature of the Sport Education season has been reported as a positive factor in promoting work in the instructional task system (Carlson & Hastie, 1997), and being together over the course of a number of lessons in which higher skilled students helped each teammate to develop an identity and achieve social goals. In the current study there was evidence of motivation to achieve the social goal of team success when students commented that they were more concerned with team success than with their own development.

Analysis of Lowest Skilled Students

In this study, despite their lesser gains in overall game performance, the lowest skilled students still claimed they did not feel marginalized within their teams and believed they had equal opportunities for improvement. Certainly there was evidence from the video experts of these students receiving assistance from their more able peers. As a model, Sport Education contains specific instructional features that should promote improved performance in game play. In Hastie et al. (2009), the analysis of the decision-making components of the GPAI data showed that the students had little tactical sophistication in their play until the end of the season. This supports a central idea of Sport Education with respect to the adoption of longer units of instruction in which students have more opportunities to practice and to improve the game play. It may well have been in this study that 12 lessons was insufficient for the lowest skilled students to gain similar benefits. This is particularly the case when the study of Cho et al. (2012, p. 386), while finding improvements in technical and movement to the ball in volleyball, were only able to show "a trend to toward significant change over time" in seasons lasting 15 lessons.

Indeed, it should be noted that even in mini volleyball contexts, many students struggle with the technical demands of the individual elements (Croitoru, Grigore, Badea, & Hantau, 2013). Further, given that the season plan implemented in this study consisted of a series of game challenges with the final form being 4 versus 4 volleyball, the students were not afforded the advantages of discrete practice of the technical skills. That is, since the performance in games was the primary formal accountability system in place during the season (i.e., winning equals points), the students' focus were on the demands of the game. These are essentially tactical (e.g., serve or hit to open spaces) demands, and by consequence, become explicit. In contrast, the performance of the technical components of volleyball becomes more implicit, as these are simply the means to the end. By having a series of games without perhaps specifically allocated time for technique practice, the students (of all skill levels) were not afforded the advantages that are derived when different kinds of motor tasks are sequence in a progressive way following the principles of continuity, complexity and gradual increment (Mesquita, Graça, Gomes, & Cruz, 2005).

Knowledge

The results obtained in this study on the knowledge test were consistent with those obtained by Hastie, Calderón, Rolim, & Guarino (2013) on the application of a track and field season, where students worked with Sport Education showed significant improvements in knowledge. However, they oppose the findings of Pritchard et al. (2008 in volleyball) and Ormond et al. (1995 in basketball) who found no significantly improved scores over time.

The fact that the students are required to officiate other teams' performances means they need to know the rules and the statistical measures of the sport. This serves to reinforce the importance of understanding game rules and match protocols. What might be more pertinent, however, would be a change in the focus on knowledge assessments in Sport Education. Rather than focus on rules and general game knowledge, perhaps it would be more appropriate to focus on knowledge of techniques and tactics, and in the case of Hastie et al. (2013) the ability to give feedback. It is these dimensions of knowledge would seem better associated with game performance, and the inclusion of these measures might allow for the testing of relationships between students' game knowledge and game performance.

Despite their logic, the statements in the above paragraph are still intuitive statements. There is a need for future research that specifically examines the pedagogical processes (by either the teacher or the student coaches) that promote game knowledge during seasons of Sport Education. Indeed, previous studies in competence in Sport Education have failed to provide substantive details of the pedagogies involved or of the progressive development of the tasks and learning experiences incorporated during the season. For example, there is a need to examine in detail the instructional agendas of student coaches, particularly with respect to the challenges they face during the teaching-learning process (see Wallhead & O'Sullivan, 2007). These include the student coach's ability to elaborate content through appropriate demonstration, error diagnosis and task modification. Further examination in this area would allow us to not only better understand the extent to which students are able to develop skill and knowledge during Sport Education, but also allow us to determine what specific gaps there are within these coaches' instructional abilities.

Implications for Practice and Future Research

As Silverman (1993) has noted, the skill level of the students is an important factor in studying achievement in physical education, and this very point is confirmed in this paper. For example, while previous studies have found significant main effects for time on game performance, their failure to account for the differential levels of students may overstate the previously held value of Sport Education in being equally effective for all students. As MacPhail, Kirk, and Griffin (2008, p. 112) have noted with respect to team games: "each individual's performance and opportunities to learn are crucially affected by the capacities and motivation of other players and their interpretations of and contributions to the game." They continue to suggest the idea of "grouping players according to experience and ability and matching task difficulty to ability groups" as ways to address these inequities. The findings from this study would certainly encourage teachers to do so. Within Sport

Education in particular, this is eminently possible, with Siedentop et al. (2011, p. 75) specifically stating that

> you should assign students with varying levels of experience to each team so that A- and B- levels of competition can be organized with games modified directly for the students with less and more experience…The B-level students, with less experience, would play in a 3v3 competition on smaller field with simpler rules, while the A-level might be 5v5 competition on a larger field with rules closer to regulation.

Still, none of the studies to date that have examined game performance have utilzed this differential system of team competition. From the findings of this study, the authors strongly encourage investigations into the outcomes for students in such settings.

More importantly however, is an examination of the length of seasons that result in significant gains across all levels of competence (a fundamental goal of Sport Education). Given Rink, French, and Graham's (1996, p. 494) maxim that "skillful game play takes time" and that the benefits of longer units of instruction are now irrefutable, the challenge is to find the threshold whereby seasons of Sport Education are sufficiently lengthy that students cannot only master the control of whatever objects are being used (e.g., badminton rackets, volleyballs, or hockey sticks), but can become truly competitive players. This is particularly relevant when we also consider Rink et al. (1996, p. 494) other contention that "game play is highly contextual", by which they contend that the tactics players use in games are somewhere dependent upon the skills and tactical abilities of their opponents. The response by those authors was to match players by ability as much as possible. These findings again emphasize the value of graded competition within Sport Education. It may well be that within specific seasons, the practice and competition phases may differ for students of differing entry skill levels.

References

Alexander, K. (1994). Developing sport education in Western Australia. *Aussie Sports Action, 5,* 8–9.

Alexander, K., & Luckman, J. (2001). Australian teachers' perceptions and uses of the sport education curriculum model. *European Physical Education Review, 7,* 243–267. doi:10.1177/1356336X010073002

Alexander, K., Taggart, A., & Thorpe, S. (1996). A spring in their steps? Possibilities for professional renewal through sport education in Australian schools. *Sport Education and Society, 1,* 23–46. doi:10.1080/1357332960010102

Bogdan, R.C., & Biklen, S.K. (1992). *Qualitative research for education: An introduction to theory and methods*. Boston, MA: Allyn & Bacon.

Browne, T.B., Carlson, T.B., & Hastie, P.A. (2004). A comparison of rugby seasons presented in traditional and sport education formats. *European Physical Education Review, 10,* 199–214. doi:10.1177/1356336X04044071

Calderón, A., Hastie, P.A., & Martínez de Ojeda, D. (2010). Aprendiendo a enseñar mediante el modelo de educación deportiva (Sport Education). Experiencia inicial en educación primaria. *Cultura, Ciencia y Deporte, 15,* 169–180. doi:10.12800/ccd.v5i15.103

Carlson, T. (1995). "Now I think I can." The reaction of eight low-skilled students to sport education. *ACHPER Healthy Lifestyles Journal, 42*(4), 6–8.

Carlson, T.B., & Hastie, P.A. (1997). The student social system within sport education. *Journal of Teaching in Physical Education, 16,* 176–195.

Casey, A. (2006, September). *From highwayman to highway patrol: A physical education teacher's journey towards student-centred instruction.* Paper presented at the British Education Research Association National Conference, Warwick, UK.

Cho, O., Richards, K.A., Blankenship, B.T., Smith, A.L., & Templin, T.J. (2012). Motor skill development of students enrolled in a sport education volleyball season delivered by in-service physical education teachers. *Physical Educator, 69,* 375–394.

Croitoru, D., Grigore, G., Badea, D., & Hantau, C. (2013). Training contributions at mini-volleyball level. *Procedia: Social and Behavioral Sciences, 93,* 724–726.

Dyson, B., Griffin, L., & Hastie, P.A. (2004). Theoretical and pedagogical considerations for implementing sport education, tactical games, and cooperative learning instructional models. *Quest, 56,* 225–239. doi:10.1080/00336297.2004.10491823

European Commission/EACEA/Eurydice. (2013). *Physical education and sport at school in Europe: Eurydice report*. Luxembourg: Publications Office of the European Union, doi:10.2797/49648

Fitzmaurice, G.M., Laird, N.M., & Ware, J.H. (2011). *Applied longitudinal analysis*. Hoboken, NJ: Wiley.

Gallagher, J.D., French, K.E., Thomas, K.T., & Thomas, J.R. (1996). Expertise in youth sport: relations between knowledge and skill. In F.L. Smoll (Ed.), *Children and youth in sport: A biopsychosocial perspective* (pp. 338–358). Madison, WI: Brown & Benchmark.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine Publishing Company.

Hastie, P.A. (1996). Student role involvement during a unit of sport education. *Journal of Teaching in Physical Education, 16,* 88–103.

Hastie, P.A. (1998). Skill and tactical development during a sport education season. *Research Quarterly for Exercise and Sport, 69,* 368–379. doi:10.1080/02701367.1998.10607711

Hastie, P.A. (2000). An ecological analysis of a sport education season. *Journal of Teaching in Physical Education, 19,* 355–373.

Hastie, P.A. (2012). The nature and purpose of sport education as an educational experience. In P. Hastie (Ed.), *Sport Education: International perspectives* (pp. 3–14). London: Routledge.

Hastie, P.A., & Curtner-Smith, M.D. (2006). Influence of a hybrid Sport Education-Teaching Games for understanding unit on one teacher and his students. *Physical Education and Sport Pedagogy, 11*, 1–27. doi:10.1080/17408980500466813

Hastie, P.A., Calderón, A., Palao, J.M., & Ortega, E. (2011). Quantity and quality of practice: Interrelationships between task organization and student skill level in physical education. *Research Quarterly for Exercise and Sport, 82,* 784–787. doi:10.1080/02701367.2011.10599815

Hastie, P.A., Calderón, A., Rolim, R.J., & Guarino, A.J. (2013). The development of skill and knowledge during a sport education season of track and field athletics. *Research Quarterly for Exercise and Sport, 84,* 336–344. doi:10.1080/02701367.2013.812001

Hastie, P.A., Layne, T.E., & Mesquita, I. (2013). Evaluating game performance from external experts in Sport Education. *Revista Portuguesa de Ciências do Desporto, 13,* 23–37.

Hastie, P.A., Martínez de Ojeda, D., & Calderón, A. (2011). A review of research on Sport Education: 2004 to the present. *Physical Education and Sport Pedagogy, 16,* 103–132. doi:10.1080/17408989.2010.535202

Hastie, P.A., Rudisill, M.E., & Wadsworth, D.D. (2013). Providing students with voice and choice: Lessons from intervention research in autonomy-supportive climates in physical education. *Sport Education and Society, 18,* 38–56. doi:10.1080/13573322.2012.701203

Hastie, P.A., Sinelnikov, O.A., & Guarino, A.J. (2009). The development of skill and tactical competencies during a season of badminton. *European Journal of Sport Science, 9,* 133–140. doi:10.1080/17461390802542564

Hopkins, W.G. (2000). Measures of reliability in sports medicine and science. *Sports Medicine (Auckland, N.Z.), 30,* 1–15. doi:10.2165/00007256-200030010-00001

Kinchin, G.D. (2006). Sport education: A review of the research.In D. Kirk, M. O'Sullivan, & Macdonald, (Eds.), *Handbook of research in physical education* (pp. 596-609). Thousand Oaks, CA: Sage.

Kirk, D. (2010). *Physical education futures*. London: Routledge.

Lincoln, M.F., & Guba, D. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications.

Maxwell, S.E., & Delaney, H.D. (2000). *Designing experiments and analyzing data*. Mahwah, NJ: Erlbaum.

McCaughtry, N., Sofo, S., Rovegno, I., & Curtner-Smith, M. (2004). Learning to teach Sport Education: Misunderstandings, pedagogical difficulties and resistance. *European Physical Education Review, 10,* 135–155. doi:10.1177/1356336X04044068

McGarry, T., & Franks, I.M. (1994). A stochastic approach to predicting competition squash match-play. *Journal of Sports Sciences, 12,* 573–584. doi:10.1080/02640419408732208

McMahon, E., & MacPhail, A. (2007). Learning to teach sport education: The experiences of a pre-service teacher. *European Physical Education Review, 13,* 229–246. doi:10.1177/1356336X07076878

MacPhail, A., Kirk, D., & Griffin, L.L. (2008). Throwing and catching as relational skills in game play: Situated learning in a modified game unit. *Journal of Teaching in Physical Education, 27,* 100–115.

Merriam, S.B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Mesquita, I., Graça, A., Gomes, A.R., & Cruz, C. (2005). Examining the impact of a step game approach to teaching volleyball on student tactical decision making and skill execution during game play. *Journal of Human Movement Studies, 48,* 469–492.

Metzler, M.W. (2005). Implications of models-based instruction for research on teaching: A focus on teaching games for understanding. In L.L. Griffin & J.I. Butler (Eds.), *Teaching games for understanding: Theory, research and practice* (pp. 183–199). Champaign, IL: Human Kinetics.

Metzler, M.W. (2011). *Instructional models for physical education* (2nd ed.). Scottsdale, AZ: Holcomb Hathaway Publishing.

O'Donoghue, P. (2007). Reliability issues in performance analysis. *International Journal of Performance Analysis in Sport, 7,* 35–48.

Ormond, T., DeMarco, G., Smith, R., & Fisher, K. (1995). Comparison of the sport education model and the traditional unit approach to teaching secondary school basketball. *Research Quarterly for Exercise and Sport, 66*(Suppl.), A-66.

Oslin, J.L., Mitchell, S.A., & Griffin, L.L. (1998). The game performance assessment instrument (GPAI): Development and preliminary validation. *Journal of Teaching in Physical Education, 17,* 231–243.

Parker, M.B., & Curtner-Smith, M. (2005). Health-related fitness in sport education and multi-activity teaching. *Physical Education and Sport Pedagogy, 10,* 1–18. doi:10.1080/1740898042000334872

Perlman, D.J. (2010). Change in affect and needs satisfaction for amotivated students within the sport education model. *Journal of Teaching in Physical Education, 29,* 433–445.

Perlman, D.J. (2012). The influence of the sport education model on amotivated students' in-class physical activity. *European Physical Education Review, 18,* 335–345. doi:10.1177/1356336X12450795

Pope, C.C., & Grant, B.C. (1996). Student experiences in sport education. *Waikato Journal of Education, 2,* 103–118.

Pritchard, T., Hawkins, A., Wiegand, R., & Metzler, J.N. (2008). Effects of two instructional approaches on skill development, knowledge, and game performance. *Measurement in Physical Education and Exercise Science, 12,* 219–236. doi:10.1080/10913670802349774

Pritchard, T., McCollum, S., Sundal, J., & Colquit, G. (2014). Effect of the sport education tactical model on coeducational and single gender game performance. *Physical Educator, 17,* 132–154.

Rikard, G.L. (1991). The short term relationship of teacher feedback and student practice. *Journal of Teaching in Physical Education, 10,* 275–285.

Rikard, G.L. (1992). The relationship of teacher's task refinement and feedback to student's practice success. *Journal of Teaching in Physical Education, 11,* 349–357.

Rink, J.E., French, K.E., & Graham, K.C. (1996). Implications for practice and research. *Journal of Teaching in Physical Education, 15,* 490–502.

Shen, B., Wingert, R.K., Li, W., Sun, H., & Rukavina, P.B. (2010). An amotivation model in physical education. *Journal of Teaching in Physical Education, 29,* 72–84.

Siedentop, D. (1994). *Sport education: Quality PE through positive sport experiences*. Champaign, IL: Human Kinetics.

Siedentop, D., Doutis, P., Tsangaridou, N., Ward, P., & Rauschenbach, J. (1994). Don't sweat gym! An analysis of curriculum and instruction. In M. O'Sullivan (Ed.), High school physical educators: Their world of work [Monograph]. *Journal of Teaching in Physical Education, 13*, 375-395.

Siedentop, D., Hastie, P.A., & van der Mars, H. (2011). *Complete guide to Sport Education*. Champaign, IL: Human Kinetics.

Siedentop, D., & Tannehill, D. (2000). *Developing teaching skills in physical education* (4th ed.). Mountain View, CA: Mayfield.

Silverman, S. (1993). Student characteristics, practice, and achievement in physical education. *The Journal of Educational Research, 87,* 54–61. doi:10.1080/00220671.1993.9941166

Silverman, S., Woods, A.M., & Subramaniam, P.R. (1998). Task structures, individual student feedback, and student skill level in physical education. *Research Quarterly for Exercise and Sport, 69,* 420–424. doi:10.1080/02701367.1998.10607718

Silverman, S., Woods, A.M., & Subramaniam, P.R. (1999). Feedback and practice in physical education: Interrelationships with task structures and student skill level. *Journal of Human Movement Studies, 36,* 203–224.

Sinelnikov, O.A. (2009). Sport education for teachers: Professional development when introducing a novel curriculum model. *European Physical Education Review, 15,* 91–114. doi:10.1177/1356336X09105213

Tallir, I.B., Lenoir, M., Valcke, M., & Musch, E. (2007). Do alternative instructional approaches result in different game performance learning outcomes? Authentic assessment in varying game conditions. *International Journal of Sport Psychology, 38,* 263–282.

Wallhead, T., & O'Sullivan, M. (2005). Sport education.Physical education for the new millennium? *Physical Education and Sport Pedagogy, 10,* 181–210. doi:10.1080/17408980500105098

Wallhead, T., & O'Sullivan, M. (2007). A didactic analysis of content development during the peer teaching tasks of a sport education season. *Physical Education and Sport Pedagogy, 12,* 225–243. doi:10.1080/17408980701610177