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SPORT EDUCATION

Enhancing Student Learning in Sport Education Through the Manipulation of Need-Supportive Instruction

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Abstract

Though motivationally nurturing instruction has been linked to numerous desirable outcomes, its presence and impact on student learning, particularly in models-based practice, is largely absent in the literature. Grounded in self-determination theory, this study examined the efficacy of an intervention aimed at increasing the provision of psychological need-supportive instruction and the associated impact on learning within Sport Education. This study included one preservice teacher, Jason, and the 58 students in his fifth-grade class. Jason first taught one season of floor hockey. During this season, Jason's need-supportive behaviors were coded and his students were tested in the cognitive (pre, post, retention) and psychomotor (pre and post) domains. Following a workshop seeking to increase his provision of need support, Jason then taught a season of pickleball to the same class, and identical data collection procedures were used. Relative to the preintervention season, Jason exhibited significantly more need-supportive behaviors in the form of autonomy support ($p = .006$), structure ($p < .001$), and relatedness support ($p = .004$) in the postintervention season.

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Analysis of variance tests revealed significant improvements in cognitive scores during both seasons from pre- to posttest; however, only during the postintervention season were scores significantly higher from posttest to retention, $t(53) = 2.20$, $p = .033$, $d = .22$. Though significant improvement in students' contextual skill performance was observed in both seasons, t-test results using change scores indicated significantly more progress was made during the postintervention season. Significant improvement in decontextualized skill performance was comparable across seasons. Collectively, these results suggest not only that preservice teachers' motivating styles are malleable, but also that increased provision of need support in physical education may facilitate improvements in student learning.

Congruent with the perspective that student motivation serves as a cornerstone to understanding and improving physical education (PE; Standage, Duda, & Ntoumanis, 2003), a significant body of research has focused on contextual motivational processes at play (e.g., Ntoumanis, 2005; Perlman, 2013; Sulz, Temple, & Gibbons, 2016). Largely, this inquiry has recruited self-determination theory (Deci & Ryan, 2008) as a mechanism for understanding the construct of motivation. This theory delineates motivational quality based on the extent to which the source of the catalyzing force for behavior is internalized (Ryan & Deci, 2000). Fundamental to self-determined behavior is satisfaction of the psychological needs for *autonomy* (volition), *competence* (efficacy), and *relatedness* (belonging).

The sentiments and behaviors physical educators exude during instruction constitute their interpersonal styles. These styles have been shown to influence the quality of student motivation in PE (Haerens et al., 2013). Teachers using a more autonomy-supportive interpersonal style facilitate the process of *internalization* (i.e., the transition from more controlled to more autonomous forms of motivation) in their students by supporting their students' psychological needs. For example, they support students' needs for autonomy *(autonomy support)* by affording choice on how to practice a skill, competence *(structure)* by allowing students to work at their own pace, and relatedness *(relatedness support)* by using students' names. Collectively, these strategies comprise need-supportive instruction (NSI; Haerens et al., 2013). Contrarily, teachers who recruit a more

controlling interpersonal style impede the process of internalization by thwarting their students' psychological needs. A teacher, for example, can thwart student autonomy by dictating the order and pace of practice tasks, competence by providing unclear instructions and expectations, and relatedness by dismissing student perspectives.

Relative to their counterparts taught by more controlling teachers, students taught by more autonomy-supportive teachers experience a host of benefits including, for example, more autonomous forms of motivation (Perlman, 2013), heightened engagement (Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009), admirable affective reactions (Vazou-Ekkekakis & Ekkekakis, 2009), and increased intent to engage in physical activity outside of class (Chatzisarantis & Hagger, 2009). Teachers feel the benefits of autonomy support as well. Teachers who increasingly support student autonomy have reported more autonomous forms of motivation for teaching, greater teaching skill, and teaching well-being (Cheon, Reeve, Yu, & Jang, 2014). Notwithstanding these benefits, many PE teachers continue to rely on controlling styles of instruction (Reeve, 2009). Fortunately, interpersonal styles appear to be malleable, as interventions aimed at cultivating more autonomy-supportive styles of instruction among inservice (Aelterman et al., 2013; Reeve & Cheon 2016; Tessier, Sarrazin, & Ntoumanis, 2010) and preservice (Perlman, 2011b) PE teachers have reported successful results.

In addition to the teacher's interpersonal style, implementation of the pedagogical model appears to influence student motivation in PE (Ennis et al., 1999; Metzler, 2011; Perlman, 2011a). Particularly, the goals and structure of Sport Education (SE; Siedentop, Hastie, & van der Mars, 2011) have been successful in helping teachers further support students' motivational capacities (Hastie, Sinelnikov, & Guarino, 2009; Perlman, 2011a; Perlman & Goc Karp, 2010; Sinelnikov, Hastie, & Prusak, 2007; Spittle & Byrne, 2009). In pursuit of the development of sporting competence, literacy, and enthusiasm, SE gradually shifts the decision-making process from teacher to student, allowing for greater student ownership of learning (Sinelnikov et al., 2007). The model resembles the progression of an authentic sport season and includes six distinguishable features: (a) a season format, (b) affiliation, (c) formal competition, (d) record keeping, (e) a culminating event, and (f) festivity (Siedentop

et al., 2011). Notwithstanding its mandated features, SE still affords the teacher a level of space for variation (Kirk, 2013). From a motivational perspective, this means that the teacher can still manipulate the class climate within the autonomy-supportive structure of SE (Sinelnikov & Hastie, 2010a). More autonomy-supportive teachers may, for example, provide students with a clear outline of the season plan, along with a rationale for each phase at the beginning of the season, thus providing structure to assist with students' need for competence. Also, students of a more autonomy-supportive teacher may be given a choice of format for the formal competition phase. Contrarily, controlling teachers using the SE model pick teams on their own or neglect to provide students with a rationale for the way points are awarded. Though principally absent from the interpersonal styles literature, autonomy-supportive interventions within models-based practice (e.g., the hybrid SE–Tactical Games Model; Pritchard & McCollum, 2009) can be successful (Perlman, 2015), as initial evidence suggests.

While teachers' provision of autonomy support in PE may have motivational and other benefits to them and their students, the ultimate measure of the utility of an interpersonal style may rest with its influence on student learning. However, this outcome variable, which conceivably is the most important, is generally absent from the literature on motivation in PE. Preliminary evidence indicates that a more autonomy-supportive interpersonal style among inservice teachers brings about higher levels of game performance and involvement among secondary students in a unit of volleyball taught via the traditional method (Perlman, 2014). Additional inquiry is needed to determine if this impact extends to the elementary level, different activities, discrete skill performance, and the cognitive domain. Moreover, beyond Perlman's (2015) insightful work with preservice teachers, little is known about the potential to enhance undergraduate PE majors' provision of autonomy support.

Therefore, the purpose of this study was to (1) determine the efficacy of an intervention in changing a preservice teacher's provision of autonomy support in SE and (2) examine the impact of that change on student learning. Specifically, we hypothesized that

the provision of autonomy support would increase postintervention (H1) and, as a result of increased autonomy support, greater student learning would occur (H2).

Method

The university institutional review board approved the study protocols. Additionally, the school district, school, and participants provided appropriate consent and assent.

Participants and Setting

The participants for this study included one Caucasian male preservice teacher, Jason (pseudonym), and the students in his intact fifth-grade PE class (N = 58). At the time of data collection, Jason was 21 years of age and completing the student teaching portion of his undergraduate PE teacher education (PETE) program. He was purposefully recruited for participation because of his exposure to what Curtner-Smith, Hastie, and Kinchin (2008) referred to as "high-quality PETE" (p. 111). That is, throughout his teacher education program, Jason received "plenty of exposure to and supervised practice of [Sport Education] during [early field experiences] and teaching practices" (p. 111). Further, Jason's assimilation of the values promoted by his program's faculty with regard to effective teaching and models-based practice led the research team to identify him as being more oriented toward teaching PE, as opposed to coaching extracurricular sport (Curtner-Smith et al., 2008). His experience in a PETE program of this nature coupled with his teaching orientation suggested he would implement the "full version" of SE (Curtner-Smith et al., 2008). Table 1 provides a brief descriptive account of SE seasons that Jason conducted prior to teaching the seasons in this study. As noted in the table, in addition to learning about the model in his PETE program, Jason had taught seven full seasons of SE with different students (fourth through eighth grades) and in different contexts over 2 years. His teaching responsibilities in each season had progressively increased to the point at which he was able to independently design and teach the seasons.

Table 1
Jason's Experience Teaching Sport Education

Class/season information	Soccer	Track and field	Ultimate	Soccer	Soccer	Volleyball	HRF
Grade	7/8 coed	6 coed	6 coed	7 coed	8 coed	7/8 coed	4 coed
Class size	50	37	45	30	35	54	72
Season length	650 min (13 × 50 min)	1070 min (17 × 60 min)	1200 min (20 × 60 min)	1200 min (20 × 60 min)	1080 min (18 × 60 min)	1080 min (18 × 60 min)	480 min (16 × 30 min)
Team selection	CT	CT	Student-driven	Student-driven	Student-driven	CT	CT
Number of teams	5	6	5	5	5	5	10
FC	Round robin	Event	Round robin	Round robin	Round robin & Single Elim.	Round robin & Single Elim.	Event
Constant teams?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Season phases	TC PSGs FC CE	TC NCEs Olympics/CE	TC PSGs FC CE	TC PSGs FC CE	TC PSGs FC CE	TC PSGs FC CE	HRF training NCEs FC CE
Team roles	Coach Warm-up leader Manager Statistician	Coach Warm-up leader Equipment manager Recorder	Coach Warm-up leader Manager Statistician BLM commissioner	Coach Warm-up leader Manager Statistician BLM commissioner	Coach Warm-up leader Manager Statistician BLM commissioner	Coach Warm-up leader Manager Statistician Publicist	Coach Warm-up leader Manager
Duty team roles	Official Scorer	Announcer Judge Timer Measuring judge	Official Scorer	Official Scorer	Official Scorer	Head judge Lane judge	Routine judge
Fair play?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Responsibilities	Co-teach a designed season	Co-teach a designed season	Teach a designed season	Design and co-teach with preservice teacher	Design and co-teach with preservice teacher	Self-design and teach	Self-design and teach
Supervision	PETE faculty	PETE faculty	PETE faculty	CT & partial PETE faculty	CT & partial PETE faculty	PETE faculty	PETE faculty

Note. CT = cooperating teacher; Single Elim. = single elimination; TC = training camp; PSGs = preseason games; FC = formal competition; CE = culminating event; NCEs = nonconsequence events; HRF = health-related fitness; BLM = board league member.

The students in Jason's class ranged between 9 and 11 years of age and primarily identified as Caucasian (n = 30, 51.7%) or African American (n = 15, 25.9%). Some students identified as Asian (n = 5, 8.6%), Mixed (n = 4, 6.9%), Other (n = 3, 5.2%), and Hispanic (n = 1, 1.7%).

Data collection took place at a public elementary school in the southeastern United States serving students in Grades 1 to 5 who were selected from other schools in the district for their academic achievement. Thirty-nine percent of the school's students are eligible for the free or reduced lunch program. The school's student population is 50% Black, 42% White, 5% Asian, 2% Hispanic, and 2% of other ethnicities. PE facilities include a large gymnasium with a stage, a large field surrounded by a walking/running track, and a concrete basketball court. SE was the primary instructional model in place in the school's PE program, likely preventing Jason from experiencing a lack of support, which has been observed to be one contextual barrier to SE implementation (Ko, Wallhead, & Ward, 2006).

Research Design

In this quasi-experimental study, Jason taught one SE season of floor hockey. Following the season, Jason participated in a self-determination theory–based workshop designed to increase his provision of NSI. Subsequent to the workshop, Jason then taught an SE season of pickleball to the same class. We assessed students' learning gains through pre- and posttest sport-specific cognitive, decontextualized, and contextualized skill assessments. Per the recommendations of Mesquita, Farias, and Hastie (2012), the students completed a third iteration of the cognitive exam approximately one month after the conclusion of each season, which we used to investigate any effect of time. For each of his videotaped lessons, Jason wore a wireless lapel microphone. Using these tapes, the lead researcher coded all of his teaching for provision of NSI.

Model Fidelity

Considering the focus (i.e., increasing NSI in SE) of this study and the possible misalignment between teachers' planning and implementation in SE (Ko et al. 2006), it was crucial that Jason was, in fact, implementing SE as it was intended to be implemented. Adhering to Hastie and Casey's (2014) guidelines for ensuring model fidelity in

reporting research on a pedagogical model, we provide (a) a description of curricular elements of the unit, (b) a detailed validation of model implementation, and (c) a description of the program context.

Table 2 displays the content as well as Jason's and his students' roles throughout both SE seasons and describes the curricular elements of the season (Hastie, 1996). Lessons took place on Monday, Wednesday, and Friday and were 45 min in length. Two researchers who are experts in models-based instruction completed validation of both SE seasons. To ensure implementation validation, we routinely compared Jason's instruction to the checklist of Sport Education Specific Pedagogical Behaviors (Ko et al., 2006; Sinelnikov, 2009). The validation procedure included experts reviewing the lesson plans and videotaped lessons of both SE seasons. Upon observation of a particular teacher or student behavior that corresponded with categories outlined in the Sport Education Specific Pedagogical Behaviors instrument, the film was paused and experts discussed the observed behavior. Upon 100% agreement relative to the nature of the behavior and its applicability to one of the categories in the instrument, a check mark was placed in the instrument data sheet, indicating the presence of the category.

Of the 23 behaviors comprising the SE model, Jason demonstrated 20 (87%) during the floor hockey season and 21 (91%) during the pickleball season, indicating high fidelity to the model. Specifically, during the floor hockey season, Jason did not (1) establish a level of accountability for student performance in nonplaying roles; (2) provide the team captains with task sheets during practices; and (3) promote clear team identification (while each team did have a name, they were not easily recognizable, because they did not wear common t-shirts or colors). During the pickleball season, he satisfied the same 20 criteria as he did in the floor hockey season and also provided team captains with task sheets. Considering Jason's relatively high level of the model fidelity during the first season, he was not provided feedback prompting him to exhibit SE-specific behaviors after each lesson or after a season.

Table 2
Content and Teacher and Student Roles for the Floor Hockey and Pickleball Seasons

Lesson	Content	Teacher role	Student role
		Floor Hockey Season	
1	Team selection/skills testing		Skill development
2	Training camp/skills testing		Skill development
3	Training camp/skills testing		Skill development
4	Team practice/posters	Assisted coaches	Coach-led practice
5	Team practice/nonplayer roles	Nonplayer role instruction	Practice
6	Scrimmage	Assisted coaches	Playing & nonplaying
7	Regular season	Monitored/assisted duty teams	Playing & nonplaying
8	Regular season	Monitored/assisted duty teams	Playing & nonplaying
9	Regular season	Monitored/assisted duty teams	Playing & nonplaying
10	Playoffs	Announced teams/assisted duty teams	Playing & nonplaying
11	Playoffs	Announced teams/assisted duty teams	Playing & nonplaying
12	Playoffs	(Jason absent)	Playing & nonplaying
13	Championship/awards/posttesting	(Jason absent)	Playing & nonplaying
14	Posttesting		Performer
15	Posttesting		Performer

Table 2 (cont.)

Lesson	Content	Teacher role	Student role
		Pickleball Season	
1	Team selection/skills testing		Skill development
2	Training camp/skills testing		Skill development
3	Team practice/posters	Assisted coaches	Coach-led practice
4	Team practice/role instruction	Nonplayer role instruction	Coach-led practice
5	Scrimmage	Monitored/assisted duty teams	Playing & nonplaying
6	Regular season	Monitored/assisted duty teams	Playing & nonplaying
7	Regular season	Monitored/assisted duty teams	Playing & nonplaying
8	Regular season	(Jason absent)	Playing & nonplaying
9	Regular season	Announced teams/assisted duty teams	Playing & nonplaying
10	Postseason	Monitored/assisted duty teams	Playing & nonplaying
11	Postseason	Monitored/assisted duty teams	Playing & nonplaying
12	Playoffs	Monitored/assisted duty teams	Playing & nonplaying
13	Playoffs/championship/awards	Monitored/assisted duty teams	Playing & nonplaying
14	Posttesting		Performer
15	Posttesting		Performer

Note. Adapted from "Student Role Involvement During a Unit of Sport Education," by P. Hastie, 1996, *Journal of Teaching in Physical Education, 16*(1), pp. 88–103.

The Intervention

The intervention consisted of a three-phase workshop that was designed and led by the first author. At the time of data collection, the first author had known Jason for approximately one year, having assisted him in learning about SE and teaching middle school students during a secondary methods course paired with an early field experience. After studying and writing about SDT and NSI for 2 years, the first author designed the workshop according to recommendations set forth by Su and Reeve (2011) and Sinelnikov, Kim, Ward, Curtner-Smith, and Li (2016). Prior to intervention, experts in the fields of professional development and SDT were consulted about the appropriateness of the workshop. During the first phase, Jason was presented with a slideshow lecture on the basic tenets of SDT, need-supportive versus need-thwarting interpersonal styles, and specific behaviors teachers can exhibit that have been empirically shown to nurture students' motivational capacities. During the second phase, Jason watched video of his own teaching from the first SE season (floor hockey), identifying and engaging in discussion about specific situations in which he demonstrated both need-supportive and need-thwarting behaviors. After observing the video, Jason and the expert engaged in role-play, providing opportunity to practice implementing various need-supportive behaviors in common scenarios. Then in the third phase, Jason answered a set of questions designed to assess his level of comprehension with respect to NSI. When Jason scored at or above 95% on the assessment, the workshop was complete (Sinelnikov et al., 2016). Finally, to maximize the possible effectiveness of the workshop, the first author provided Jason with sustained, immediate, and situated support throughout the postintervention SE season (pickleball) in the form of observations and briefing and debriefing sessions (Sinelnikov, 2012).

Data Collection

Need-supportive instruction. The first author video-recorded all of the lessons that Jason taught during both seasons. While teaching, Jason wore a lapel microphone, allowing his voice to be heard through the video recording. From these recordings, Jason's need-supportive teaching behaviors exhibited in every lesson were quantified via the Need-Supportive Teaching Behaviors in PE

observation instrument (NSTB-PE; Haerens et al., 2013). Specifically, the instrument identifies 21 need-supportive behaviors reflecting the three need-supportive dimensions (autonomy support, structure, and interpersonal involvement). The researcher observed the frequency of each behavior that exhibited Jason during a 5-min interval. At the end of the interval, the researcher assessed the frequency of that behavior during that interval using a 4-point scale, ranging from 0 (*never observed*) to 3 (*observed all the time*). Interval scores were then summed for each behavior and a behavioral sum score for the entire lesson was created. Behavioral sum scores for all behaviors were summed within each dimension of need support and an overall score for each need-supportive dimension (i.e., autonomy support, structure, and relatedness support) in each lesson was created.

Prior to analysis, we calculated measures of interrater agreement and intrarater reliability to ensure data reliability. To ensure the former, we had a trained NSTB-PE instrument observer who was not a part of the research team randomly select and code 33% of Jason's lessons. By comparing these results to those of the lead researcher's for corresponding intervals, we computed interrater reliability by dividing the total number of agreements by the total number of observations, then multiplying the quotient by 100. The interrater agreement reached 94%. We also calculated intraobserver reliability to prevent the observer from deviating from initial training procedures over time and modifying the coding definitions, a phenomenon known as *observer drift* (Smith, 1986). In this process, the lead researcher randomly selected and recoded one third of Jason's lessons, again dividing the total number of agreements by the total number of observations and multiplying by 100. Intrarater reliability reached 97%. Both measures of reliability exceeded the recommended 80% threshold for behavioral sciences (van der Mars, 1989).

Student learning. Student learning was measured in the cognitive domain through pencil-and-paper exams and in the psychomotor domain through decontextualized and contextualized skill assessments.

Cognitive assessments. Because we were unable to locate validated cognitive exams for fifth-grade students in two content areas (floor hockey and pickleball), two multiple-choice tests were developed around what Ward (2009) referred to as *common content*

knowledge. In particular, common content knowledge comprises the knowledge and skills one needs to perform a task successfully. This level of knowledge includes rules, etiquette, techniques, and tactics (Ward, 2009). Following procedures outlining creation of a common content knowledge test (Devrilmez, Dervent, Ward, & Ince, 2019), a panel of experts (two PETE faculty and two PE teachers) created 32 questions that were instructionally aligned (S. Cohen, 1987) to contents of floor hockey and pickleball units. Each common content knowledge construct measure initially included eight multiple-choice questions, each with four answers, but only one correct answer. Identical to the procedures that Devrilmez et al. (2019) outlined, and for content validity to be further established, questions were reviewed by four PETE faculty and two PE teachers who have expertise in invasion and net/wall games and have taught both contents. Questions considered too difficult for elementary students were removed and the wording to remaining questions was refined. This procedure resulted in a measure that presented 12 questions, three questions for each construct (rules, etiquette, techniques, and tactics) for floor hockey and pickleball. For example, three questions assessed a tactical construct of a game of pickleball and three questions assessed the same in floor hockey. This is consistent with accepted psychometric methodology in which a minimum of three items measuring the same construct are necessary for the researcher to adequately explore the construct and perform psychometric tests (Lloret-Segura, Ferreres-Traver, Hernández-Baeza, & Tomás-Marco, 2014). While the face and content validity of the measure were sufficiently established by following procedures that Devrilmez et al. (2019) set forth, the establishment of construct validity, reliability, and psychometric tests was beyond the scope of the study. Thus, we acknowledge that their absence poses a limitation of this study.

Decontextualized skills assessment. Decontextualized skills necessary for success in both activities were assessed at the beginning (before training camp) and end (after the culminating events) of both seasons. Based on the work of Hastie and Trost (2002), we used six isolated tests to assess decontextualized hockey skills: (1) dribble and shoot, (2) speed dribble, (3) agility dribble, (4) shot accuracy, (5) rapid fire, and (6) flicking the ball. We used a seventh test, assessing slap shot speed with a radar gun, because puck velocity is

influenced by skill level (Wu et al., 2003). We used Wasem's (1994) service, forehand, and backhand tests to assess decontextualized skills in pickleball.

Contextualized skills assessments. We used the previously validated floor hockey and pickleball assessments from the South Carolina Physical Education Assessment Program (South Carolina Department of Education, 2010a, 2010b) to document student gains in a more authentic environment. The floor hockey assessment was carried out for a 2-v-1 (offense-to-defense) game played on a 24' × 24' playing area. Trained observers coded one member on offense for 60 s and assigned the student a score of 0 to 4 for three offensive components, namely (1) movement without the ball (i.e., support), (2) passing, and (3) receiving. We used the aggregate of these three scores to quantify contextualized skill performance. The pickleball assessment included two students playing a 3-min cooperative game of pickleball, switching sides halfway through. Using the same scoring scale as with the floor hockey assessment, the observers evaluated performances based on ability to (1) execute forehand and backhand shots, (2) return to the center of the court during a rally (i.e., positioning), and (3) maintain a rally. Interrater reliability for floor hockey and pickleball was 94% and 93%, respectively (van der Mars, 1989).

Data Analysis

Data analysis began with standard screening and cleaning procedures (Tabachnick & Fidell, 2013). We used paired-samples *t* tests to detect changes in Jason's provision of each need-supportive dimension between corresponding lessons pre- to postintervention. We used a 3 × 2 (Time × Sport) factorial ANOVA with Bonferroni post hoc analysis to compare changes in cognitive performance from the beginning of each season through approximately one month after the conclusion of each season. We used a 2 × 2 (Time × Sport) factorial ANOVA to examine changes in contextualized skill performance between pre- and posttest in both seasons. We used an independent-samples *t* test to detect significance in the magnitude of learning growth between floor hockey and pickleball. Given that

the decontextualized skills assessments administered during floor hockey and pickleball differed in number and unit of measurement, the ability to compare decontextualized skill performance across seasons was not appropriate. Changes in performance on each decontextualized skill test were, however, assessed within each season via paired-samples *t* tests. We used partial eta squared as a measure of effect size in the factorial ANOVA models (Warner, 2012) and Cohen's *d* to estimate effect size for *t* tests (J. Cohen, 1992).

Results

To test the hypothesis that the workshop would affect Jason's provision of NSI, we performed paired-samples *t* tests for autonomy support, structure, and relatedness support. Table 3 displays the results of these tests. Within the structure of SE, Jason significantly increased his provision of all three dimensions of need support from pre- to postworkshop. Figure 1 shows his average provision of need support, by dimension, across seasons. These results support the hypothesis that there would be a significant increase in Jason's provision of NSI during the pickleball season (postworkshop) relative to the floor hockey season (preworkshop), indicating the efficacy of the workshop.

Table 3
Descriptive Statistics and t Test Results for Each NSI Category

	Sport				
	FH	PB			
NSI category	*M* (*SD*)	*M* (*SD*)	*t*	*p*	*d*
AS	21.44 (9.77)	38.78 (11.29)	3.74	.006*	1.64
Structure	48.67 (9.91)	95.11 (25.84)	5.89	< .001**	2.37
RS	67.00 (12.35)	87.89 (9.96)	3.98	.004*	1.86

Note. FH = floor hockey; PB = pickleball; AS = autonomy support; RS = relatedness support.

*$p < .05$. **$p < .001$.

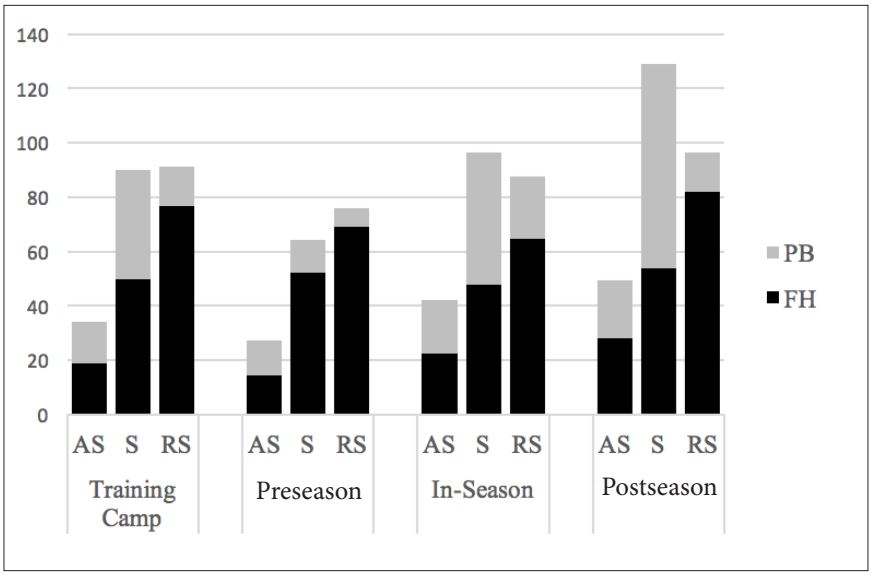

Figure 1. The average frequencies of Jason's autonomy-supportive (AS), structure (S), and relatedness-supportive (RS) instructional behaviors by season phase from pre- to postworkshop. Pickleball (PB) values are in addition to floor hockey (FH) values.

Differences in Student Learning

Given the effectiveness of the workshop in increasing Jason's provision of NSI, it was necessary to examine the ANOVA results comparing cognitive and contextualized skill learning pre- and postworkshop. We present the results of the cognitive and contextualized assessments first, followed by those for the decontextualized assessments.

Cognitive and contextualized skill learning. Table 4 contains descriptive and ANOVA results for the cognitive and contextualized skill assessments. Additionally, Figure 2 shows means plots for cognitive and contextualized data. With regard to cognitive performance, significant main effects were observed for Sport, $F(1, 53) = 61.14$, $p < .001$, partial $\eta^2 = .536$, and Time, $F(2, 106) = 109.94$, $p < .001$, partial $\eta^2 = .675$. Scores for floor hockey were generally higher than those for pickleball, and significant growth from pretest to retention test was observed in both seasons. While students' cognitive scores significantly increased from pre- to posttest in both seasons, post hoc analysis revealed differences across seasons from posttest

to retention test. Only during pickleball did students' scores increase significantly from posttest to retention test, $t(53) = 2.20$, $p = .033$, $d = .22$. Contextualized skill data revealed a significant main effect for Time, $F(1, 57) = 113.15$, $p < .001$, partial $\eta^2 = .665$, and a significant Time × Sport interaction effect, $F(1, 57) = 11.25$, $p = .001$, partial $\eta^2 = .165$. Students contextualized skill performance increased significantly during floor hockey and pickleball. Independent-samples *t*-test results between floor hockey and pickleball change scores indicated significantly more improvement during the pickleball season than the floor hockey season, $t(114) = 3.19$, $p = .002$, $d = .59$.

Table 4
ANOVA Table for the Measures of Student Learning by Season and Time

Variable iteration/ factor	Sport		ANOVA statistics		
	FH *M* (*SD*)	PB *M* (*SD*)	*F*	*p*	Partial η^2
		Contextualized			
Pre	4.34 (1.98)	4.10 (1.36)			
Post	5.55 (1.73)	6.28 (1.99)			
Time**			113.15	< .001	.665
Sport			1.66	.202	.028
Interaction**			11.25	.001	.165
		Cognitive			
Pre	68.15 (12.19)	52.87 (13.14)			
Post	84.59 (10.71)	71.74 (14.53)			
Retention	83.69 (11.99)	75.17 (15.42)			
Time**			109.94	< .001	.675
Sport**			61.135	< .001	.536
Interaction*			3.29	.047	.058

Note. FH = floor hockey; PB = pickleball.

*$p < .05$. **$p < .001$.

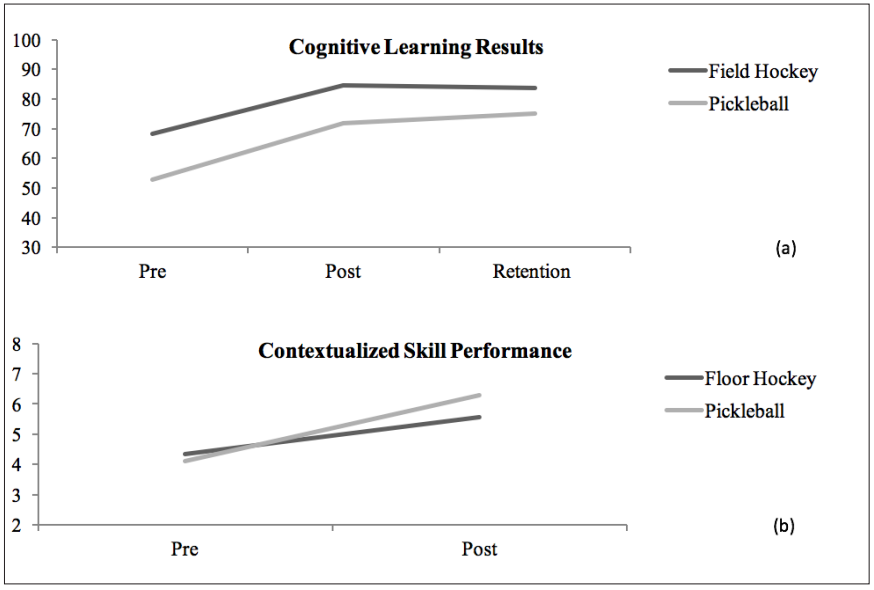

Figure 2. Means plots for students (a) cognitive and (b) contextualized skill performance during floor hockey and pickleball.

Decontextualized skill learning. Table 5 shows paired-samples *t*-test results comparing students' scores on the individual components of the contextualized skill assessment and decontextualized skill assessments from beginning to end in each season. While students' overall scores for the contextualized skills assessment significantly improved during both seasons, in an examination of the individual components of the assessment the results suggest that students experienced more holistic improvement during pickleball than during floor hockey. Students' scores improved significantly from pre- to posttest for all three components of the pickleball contextualized skills assessments (forehand/backhand use, positioning, and rally length), whereas significant improvements were discovered for one of the three components in the floor hockey contextualized skills assessment (support). With reference to the decontextualized skills assessments, scores significantly improved in five of seven floor hockey decontextualized skills, namely, speed dribble, agility dribble, shot accuracy, shot speed, and rapid fire. Postintervention, students significantly improved from pre- to posttest in serving and backhands.

Table 5
Descriptive Statistics and Paired-Samples t-Test Results for Contextualized and Decontextualized Skills Assessments

Assessment	Pre *M* (*SD*)	Post *M* (*SD*)	*t*	*df*	*p*	*d*
		Floor Hockey				
Decontextual Assessment						
Dribble and Shoot	3.88 (1.14)	4.18 (1.02)	1.61	56	.114	.28
Speed Dribble**	7.63 (1.72)	6.62 (1.62)	8.54	50	< .001	.60
Agility Dribble**	12.56 (3.24)	11.40 (2.43)	5.22	50	< .001	.41
Shot Accuracy**	7.07 (3.67)	9.23 (4.19)	3.63	55	.001	.55
Rapid Fire**	6.25 (2.45)	8.10 (2.28)	4.29	57	< .001	.54
Shot Speed**	31.23 (7.00)	40.26 (9.83)	7.45	57	< .001	1.06
Flicking	11.17 (6.13)	12.57 (4.26)	1.69	57	.096	.27
Contextual Assessment**	1.74 (.67)	2.46 (.73)	7.24	56	.001	1.03
Support*	1.49 (.72)	2.20 (.73)	6.50	54	.005	.98
Passing	1.62 (.80)	1.80 (.68)	1.46	54	.090	.24
Receiving	1.47 (.77)	1.65 (.75)	1.40	54	.159	.24
		Pickleball				
Decontextual Assessment						
Serve*	9.56 (6.57)	11.95 (6.96)	2.33	56	.024	.35
Forehand	5.91 (3.92)	7.04 (4.49)	.88	56	.381	.27
Backhand**	3.65 (3.00)	6.07 (4.34)	3.76	56	< .001	.65
Contextual Assessment**	1.67 (.66)	2.62 (.81)	14.15	57	< .001	1.29
Forehand/Backhand**	1.33 (.57)	1.95 (.76)	8.49	57	< .001	.92
Positioning**	1.60 (.65)	2.41 (.80)	8.98	57	< .001	1.11
Rally Length**	1.17 (.38)	1.91 (.76)	8.19	57	.001	1.23

*$p < .05$. **$p < .001$.

Discussion

While interventions with a similar objective have proven successful internationally (Aelterman et al., 2013; Reeve & Cheon, 2016; Tessier et al., 2010), it seems inappropriate to generalize the applicability of findings from other countries, because PE perspectives and practices may differ between cultures (Curtner-Smith et al., 2008). In the only study of this nature working with preservice teachers,

Perlman (2015) reported the success of an online intervention in bringing about an increase in 31 preservice teachers' provision of autonomy-supportive instruction in the United States. Nonetheless, for teachers to fully nurture their students' motivational capacities, their instructional styles should, theoretically, also nurture their students' needs for competence and relatedness through the provision of structure and relatedness support, respectively. In concert with previous findings (Ko et al., 2006; Sinelnikov et al., 2016) reporting on effective workshops within PE, the findings from this study provide empirical support for determining the efficacy of an NSI intervention in changing one preservice teacher's provision of autonomy support, structure, and relatedness support within the SE model. After the floor hockey season, instructional observation data indicated that Jason's instruction was already appreciably need supportive. This was not surprising in light of his familiarity with SE, a model that is inherently motivational for students (Perlman, 2012; Perlman & Goc Karp, 2010; Sinelnikov & Hastie, 2010a). However, as a result of the workshop described in this study, Jason provided significantly more autonomy support, structure, and relatedness support to his students in the pickleball season postintervention than in the floor hockey season preintervention. Having established the increase of the teacher's NSI postintervention, we then examined the impact of the increase in Jason's NSI on student learning in the subsequent SE season. As noted, student learning in this study was measured through paper-and-pencil exam score (pre, post, and retention) and contextual (game play) and decontextual skill performance (skill tests), both pre and post.

Cognitively, student performance increased significantly from pre- to postiterations of the cognitive assessment. While cognitive scores on the floor hockey test decreased from the postiteration to the retention iteration, they increased significantly between the same two iterations following the pickleball season. This finding supports previous research (Mesquita et al., 2012) and suggests that need-supportive instruction fosters learning on a deeper level that is capable of attenuating a time effect. This significant finding is compounded by previous research demonstrating students' deeper understanding accrued in models-based practice lasting

years beyond contact with SE (Sinelnikov & Hastie, 2010b; Wahl-Alexander, Sinelnikov, & Curtner-Smith, 2017).

A large body of literature on student learning within SE approach confirms that students can achieve significant gains in learning (cognitive and psychomotor) by participating in quality SE seasons (Araújo, Mesquita, & Hastie, 2014; Hastie, de Ojeda, & Luquin, 2011). While our study supports previous findings, this is the first study that empirically demonstrates important avenues by which teachers can have a greater impact on student learning within SE seasons. In other words, we knew that students learn over time with SE, but our findings demonstrate that the learning can be greater if the teacher uses NSI within SE. This is a particularly significant finding, one that needs to be further examined, perhaps with other pedagogical models such as Teaching Games for Understanding (Oslin & Mitchell, 2006), Cooperative Learning (Casey & Dyson, 2012), and Personal and Social Responsibility (Hellison, 2011), among others.

With respect to contextualized skill performance, significant improvements in both seasons were observed. This finding is congruent with a significant body of research on student learning in SE (Hastie, Calderón, Rolim, & Guarino, 2013; Hastie et al., 2009), demonstrating the ability of the model to foster learning. The results of the *t* tests in the present study indicate, however, that students' contextualized skill performance increased more so postworkshop than preworkshop, suggesting that increased NSI may further promote contextual skill learning. We can partially attribute this finding to students' satisfaction of autonomy, competence, and relatedness through Jason's increased provision of autonomy support, structure, and interpersonal involvement.

Finally, decontextualized skill performance increased significantly in approximately the same percentage of assessments between both seasons. Students significantly improved in five of seven floor hockey decontextual assessments (71%) and in two of three pickleball assessments (66%). Though comparisons across the seasons were not possible given the incompatibility of the decontextualized assessments, these results indicate that a teacher can, essentially, do no harm to students' learning skills by being more need supportive. Moreover, with the other two measures of learning as a frame of

reference, student learning appears to occur more holistically and on a deeper level when the teacher provides more need support in class.

Conclusion

One of the important findings of this study was that while students experienced gains in both seasons, a greater increase was observed in the pickleball season (postintervention). This suggests that with respect to authentic performance in physically active settings, student learning may increase with the instructor's provision of NSI. The exact nature of this relationship, however, remains unclear and warrants additional investigation. Perhaps NSI aids student learning to a point, before its effects attenuate.

Worthy of mention are the limitations of this study. First, the inclusion of only one preservice teacher who taught at a middle school in which students were familiar with SE limits the generalizability of the findings. Future research needs to determine the impact of a similarly designed workshop on the NSI of preservice teachers working at elementary and high school levels in schools more unfamiliar with the model for implementation. Second, the preservice teacher in this study possessed a teaching orientation. Added inquiry focused on determining the impact a similar intervention can have on the instruction of more coaching-oriented preservice teachers seems warranted. Third, though face and content validity were established for our cognitive exam, future measures of cognitive knowledge should include evidence of construct validity to further ensure that questions are related to the constructs of interest. Finally, in support of previous recommendations (Perlman, 2015), future studies focusing on enhancing NSI in PE should strive to include a qualitative approach to gain a more thorough understanding of preservice teachers' perceptions of the workshop, its impact on their teaching, and how this process can be improved.

The Society of Health and Physical Educators (2014) touts the profession of PE as being predicated on the notion that a physically active lifestyle is preferential to one characterized as being primarily sedentary. Quite simply, the motivation to learn about and engage in physical activity precedes the volitional decision to engage in such. PE serves as a suitable context for fostering this motivation. Within this context, the teacher is in a position to influence the extent to which this motivation is fostered (Taylor & Ntoumanis, 2007). This

logic highlights the need for continued investigation into the most effective means of equipping preservice teachers and teachers alike with the pedagogical strategies necessary for maximizing their students' motivational capacities. It is evident from this study that it is possible for teachers to increase their NSI during teaching using a models-based approach and that students experience greater gains in learning when teachers use NSI within the SE pedagogical model.

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