A SELF-DETERMINATION THEORY PERSPECTIVE OF STUDENT PERFORMANCE AT THE END OF A VOLLEYBALL UNIT IN COMPULSORY HIGH SCHOOL PHYSICAL EDUCATION

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Abstract

Physical Education (PE) research has shown that students' in-class performance on a range of tasks can be explained using self-determination theory (SDT). However, little attention has been given to students' applied motor skill performance from an SDT perspective. Therefore, the purpose of this study was to examine relationships between students' perceived autonomy support, basic need satisfaction, autonomous motivation, applied volleyball skills, volleyball knowledge, and attitude towards a PE course. Participants included students (N = 141; M = 14.90, age range: 14-18 years) and teachers (N = 4; M = 41.25, age range: 29-56 years) from four intact PE classes at one large high school in the Southeastern United States. Students completed questionnaires assessing perceived autonomy support, basic need satisfaction, autonomous motivation, and attitude towards the PE course. Skills and knowledge were assessed using standardized performance-based protocols. Structural equation modeling indicated that perceived autonomy support was positively related to basic need satisfaction and attitude towards PE directly. Perceived autonomy support also appeared to facilitate students' applied volleyball performance and game-relevant knowledge through the mediation model proposed by SDT. Pedagogical implications reflected in the interrelated psychological constructs are offered.

Keywords: *Motivation, Physical Education, Autonomy Support, Autonomous Motivation, Motor Skill Performance*

INTRODUCTION

Self-determination theory (SDT; Deci & Ryan, 1985) is a theory of human motivation that has direct relevance to compulsory high school physical education (PE), given that adolescents vary considerably in their motivation to engage in PE (Deci & Ryan, 2000; Haerens, Kirk, Cardon, De Bourdeauduij, & Vansteenkiste, 2010; Ntoumanis, Pensgaard, Martin, & Pipe, 2004), and this variance in motivation has implications for the efficacy of successful PE learning goals (Ntoumanis & Standage, 2009). Self-determined motivation is generally defined as "the innate energy that people demonstrate when they pursue a goal or an activity because it is interesting or fun (Koestner & Losier, 2002, p. 101)". SDT conceptualizations of motivation focus mainly on controlled and autonomous reasons for behavioral engagement. Controlled motives involve feeling compelled to do something by external or internal pressures (e.g., External Regulation, "because a teacher will reward me for doing it", and Introjected Regulation, "because of anxiety, guilt or shame if you don't do something, respectively). Autonomous motives involve those that reflect personal interest and values (Identified Regulation: "because it is personally important to do"; Integrated Regulation: "because it will make me a

better at something" and Intrinsic: "because it is fun and enjoyable") (Deci & Ryan, 2000).

In most educational environments, research has demonstrated that students tend to fall within the regulatory styles associated with extrinsic motivation (Deci, Koestner, & Ryan, 1999). This could be partially due to the controlling nature of teachers within the learning environment (Reeve, 2009). Unfortunately, PE research has shown that students who reported being more controlled in their motivation to learn also reported higher levels of boredom as well as lower levels of effort and enjoyment in class activities (Ntoumanis, 2002). Conversely, students who adopted more autonomous motivation (i.e., integrated and intrinsic motivation) also reported higher levels of concentration, positive affect, and perseverance in challenging tasks (Standage, Duda, & Ntoumanis, 2005). Furthermore, there is mounting evidence that autonomous motivation is directly and positively related to performance measures in PE, including cardiovascular endurance, strength and conditioning knowledge (Shen, McCaughtry, Martin, & Fahlman, 2009) and motor skill performance (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008; Kalaja, Jaakkola, Watt, Liukkonen, & Ommundsen, 2009; Mouratidis,

Vansteenkiste, Lens, & Sideridis, 2008). It is becoming clear that autonomous motivation benefits students in ways that are aligned with a range of behavioral, cognitive, and affective performance goals in PE (Ntoumanis & Standage, 2009) but what remains unknown is whether autonomous motivation plays a role in the application of skills in authentic game play settings. A better understanding of the motivational mechanisms underlying the application of rules and tactics during game play can help enrich teachers' abilities to support learning through meeting psychological needs.

Aligned with Basic Needs Theory (Ryan & Deci, 2001; Vansteenkiste, Niemiec, & Soenens, 2010), in both general education and PE, the tendency to for more autonomous or controlled motivation is a direct result of the satisfaction of basic psychological needs. Ryan & Deci (2001), postulate that autonomous motivation is enhanced when individuals' basic needs for autonomy, competence, and relatedness are satisfied. In learning environments, students' need for autonomy refers to a desire to be "the source of one's own behavior and achieving congruence between the activity and one's integrated sense of self" (Taylor & Ntoumanis, 2007, p. 747). Along with autonomy, the more students experience mastery of a task or activity (competence), and the more connected the student feels to others (relatedness), the more autonomous the student's motivation to act will be (Connell & Wellborn, 1991). Perceived competence promotes autonomous motivation because feeling competent allows students to "identify a link between their behavior and desired performance outcomes" (Taylor & Ntoumanis, 2007, p. 747). The role of perceived relatedness in autonomous motivation rests in wanting to model one's own behaviors after valued others (Ryan & Deci, 2000). Further, teacher-provided autonomy support, structure, and involvement support help to satisfy the need for autonomy, competence, and relatedness, respectively (Cheon, Reeve, & Moon, 2012; Haerens, Aelterman, Van den Berghe, Meyer, Soenens, & Vansteenkiste, 2013). Reeve and Jang (2006) define autonomy support as "the interpersonal behavior one person provides to involve and nurture another person's internally locused, volitional intentions to act" (p. 210). Examples of autonomy support behaviors are providing choice, acknowledging students' perspectives, and providing rationales for tasks and limits (Reeve, 2009). Structure is defined as the extent and clarity of teacher expectations,

consequences of student behavior, and the presentation of information about how to succeed on learning tasks (Connell & Wellborn, 1991). Involvement support consists of using strategies that communicate that the teacher is interested in and emotionally supportive of students, such as learning about a student's background (Connell & Wellborn, 1991).While the provision of each of these nutriments (autonomy support, structure, involvement support) contributes in unique and relevant ways to students' need satisfaction (Haerens, et al., 2013), and structure is fundamental to a successful learning environment (Reeve, 2006), it is noteworthy that autonomy support has been shown to be independently capable of nurturing all three basic needs in PE (Cheon, et al., 2012; Standage, Duda, & Ntoumanis, 2006). PE research shows that students' perceptions of autonomy support were directly related to need satisfaction (autonomy, competence, and relatedness), which in turn was directly related to autonomous motivation (e.g., Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2005; Vierling, Standage, & Treasure, 2007; Zhang, Solmon, Kosma, Carson, & Gu, 2011).

Taking into consideration the theoretical framework and research discussed above, the present study was designed to build on research that has investigated student performance in PE from an SDT perspective. A unique focus of the current study was students' applied motor skill performance. In previous research (Boiché et al., 2008; Kalaja et al., 2009; Mouratidis et al., 2008), students were tested on basic tasks that do not very well simulate motor skill performance in authentic (i.e., "real world") movement environments. Examples of basic skills tested in these studies are fundamental gymnastics skills, such as the backward roll and cartwheel (Boiché et al., 2008), fundamental balancing, leaping, and dribbling skills (Kalaja et al., 2009), and performance on the shuttle run (Mouratidis et al., 2008). An important next step for SDT research in PE is to determine the utility of SDT in explaining applied motor skill performance in authentic movement contexts. A recommended method for capturing such performance is the use of performance-based assessments. Lund and Kirk (2002) indicate performance-based assessments are characterized by protocols that represent real life situations, such as performance during game play. SDT research using performance-based assessment of students' motor skills would help to determine the reach of autonomous motivation to movement situations that have more ecological

validity than controlled tests of isolated fundamental motor skills. Highly authentic performance-based assessments, particularly in novel movement form contexts can help to circumvent or at least reduce threats to internal validity such as student experience with the movement form which may bias teachers' autonomy supportiveness thereby influencing perceptions of competence and autonomy. Volleyball for example is a great experience equalizer in PE contexts because at the time of the study, it was not a popular sport where high school student ability levels were expectedly low. Furthermore, volleyball lends itself to studying underlying motivation mechanisms because it involves only a few skills, rallies in which authentic assessments occur are initially short but become increasing longer over short learning periods and success is easily perceived when the ball makes over a net and with learning, to open space within at three-hit limit. Accordingly, there are also several opportunities for autonomy support from teachers.

In the United States, the National Association for Sport and Physical Education (NASPE, 2004) outlines behavioral, cognitive, and affective performance goals for PE. Within this framework, key focus areas include emphases on physical skills, knowledge, and attitudes needed to participate competently in sport and physical activity. These goals can most clearly be articulated when considering certain contextual elements in PE, such as whether the course is compulsory or elective in nature, what grade level is being taught, and how far a unit of instruction has progressed. At the completion of an instructional unit during compulsory high school PE, successful student performance could arguably be defined as having the movement skills and knowledge of rules and procedures needed to recreationally participate in and enjoy the sport/activity that was the focus of the unit. Further, a positive attitude toward PE would be an important indicator of success, as this would arguably promote continued interest in engaging in the subject and potentially improving performance in subsequent units.

Figure 1. Hypothesized model predicting volleyball skills, volleyball knowledge, and attitude toward the PE course.
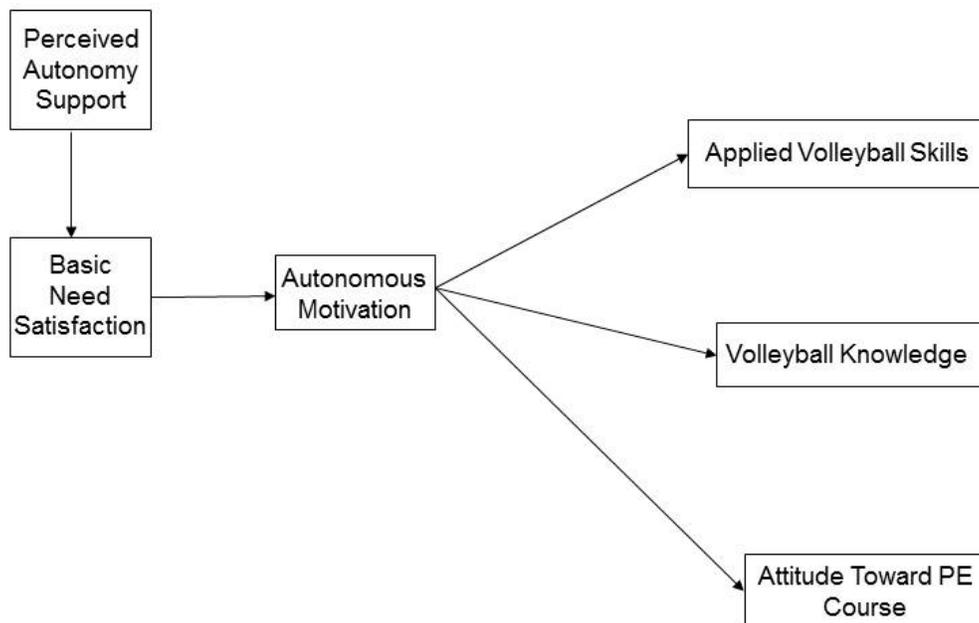
To subsequently inform pedagogical decisions and intervention efforts the purpose of this study was to examine the relationships among perceived autonomy support, basic need satisfaction, autonomous motivation, applied motor skills performance, cognitive performance, and attitude toward PE at the conclusion of a unit of instruction that was part of a compulsory PE course for high school students in South Carolina. Consistent with basic psychological needs theory

(Ryan & Deci, 2001) and the extant SDT research in PE (Van den Berghe, et al., 2012), we hypothesized that perceived autonomy support would be directly and positively related to basic need satisfaction, which in turn would be directly and positively related to autonomous motivation. We further hypothesized, based on previous research supporting the relationship between autonomous motivation and performance

METHODS
Participants and Setting
The context for the present study was a state-mandated, coeducational high school PE course for ninth grade students in South Carolina that lasted 16 weeks. The course was the final PE requirement for students. Participants included students (N = 154; M = 14.90, age range: 14-18 years) and teachers (N = 4; M = 41.25, age range: 29-56 years) from four intact classes at one high school. Students were 66 males and 67 females (23 did not report gender), whose self-identified racial/ethnic makeup was 54.8% African American, 17.8% Caucasian, 11.5% other, 3.2% Hispanic, and .6% Asian. Students in the study represented 9% of the total student enrollment at the school. Gender and race/ethnicity closely matched the overall school demographic.

Teachers were two men and two women who identified their race/ethnicity as White Caucasian. Their self-reported teaching experience ranged from 4 to 30 years (M = 12.5, SD = 11.93). All four teachers were certified, specialist PE teachers. Each teacher taught a different class of students, with class size ranging from 37-42 students, using a large indoor gymnasium equipped with five volleyball nets and enough volleyballs for students to practice volleying skills with a partner.

Data for this study were collected at the conclusion of a six-week volleyball unit. Volleyball was chosen for this study for several reasons: 1) volleyball represented a common content area taught in high school PE courses in this area of the country, 2) gymnasium space and appropriate amount of equipment allowed for small-sided games using a team sport content area, 3) all four teachers felt comfortable teaching and assessing volleyball, had not yet taught volleyball as part of the PE course, and had planned to cover volleyball during the semester. Across the six weeks, the researchers took turns observing the PE classes as part of a larger study. We observed four class periods for each teacher. The volleyball unit consisted of warm-up activities (e.g., fitness

outcomes in PE (see Van den Berghe et al., 2012 for an overview), that autonomous motivation would be directly and positively related to three performance outcomes: applied motor skill competency in a performance-based assessment task of the content taught during the unit, knowledge of rules and procedures related to the content taught in the unit, and attitude toward the PE course.

exercises, such as jogging, push-ups, and sit-ups), volleyball "drills" that focused on skill development in the serve, forearm pass, overhead set, spike, and game play. While it was beyond the scope of this study to analyze the range of instructional behaviors the teachers used, it was clear most teachers mostly used what Mosston and Ashworth (2002) refer to as the practice style of direct instruction, or what Rink (2010) refers to as interactive teaching, which was characterized by the teacher establishing the learning task followed by the students practicing the task.

Instrumentation
Perceived Autonomy Support. The Learning Climate Questionnaire (LCQ) was used to assess students' perceived autonomy support (Ntoumanis, 2005). The LCQ is a 6-item questionnaire measuring student perceptions of teacher's autonomy support rated on a 5-point Likert scale, anchored with 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Modifications to Ntoumanis' (2005) version were made to reflect volleyball/fitness as the unit of instruction (e.g., "In this volleyball unit, I feel that my PE teacher provides me choices and options." Scores were computed by taking the average score of all items within the survey. The measure has been previously used in PE settings and has been found to be internally consistent (α = .81; Ntoumanis, 2005). The measure was also internally consistent with the present sample (α = .91).

Basic Need Satisfaction. The Basic Need Satisfaction Scale (BNS) was used to assess students' basic psychological need support (Ntoumanis, 2005) The BNS is a 21-item questionnaire measuring students' perceptions of autonomy, competence, and relatedness need satisfaction rated on a 7-point Likert scale, anchored with 1 = strongly disagree, 4 = neutral, and 7 = strongly agree . Modifications to Ntoumanis' version were made to reflect volleyball as the unit of instruction (e.g., "In this volleyball unit, I am free to express my thoughts and

opinions"). Due to the low sample size, a composite score was formulated by averaging the scores on all 21 items in the scale after reverse coding, according to questionnaire protocol. The measure has been previously used in PE settings and has been found to be internally consistent (α = .73; Ntoumanis, 2005). The measure was also internally consistent with the present sample (α = .73).

Autonomous Motivation. The Self-Regulation Questionnaire (SRQ) was used to assess students' autonomous motivation (Goudas, Biddle, & Fox, 1994). The SRQ is a 20-item questionnaire measuring the five motivational levels of students' self-regulation: (intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation) on a 7-point Likert scale for each item, anchored with 1 = strongly disagree, 4 = neutral and 7 = strongly agree (Goudas, Biddle, & Fox, 1994). The scale was modified to focus on the specific context of the volleyball/fitness unit using the stem "I took part in this volleyball unit…." A composite relative autonomy index (RAI) was calculated to determine the degree of autonomous motivation experienced among the students, using the following calculation: (2 x Intrinsic motivation) + Identified regulation - Introjected regulation – (2 x External regulation). Use of the RAI is well founded in the SDT literature and has been correlated with intrinsic motivation, perceptions of autonomy, and learning outcomes (Grolnick & Ryan, 1989). Ntoumanis (2005) has shown the SRQ to be internally consistent as an overall measure of motivation (α = .81). The measure was also internally consistent with the present sample (α = .73).

Applied Volleyball Skills. Students' applied volleyball skills were assessed using pre-established, performance-based high school PE assessment criteria for volleyball (South Carolina Physical Education Assessment Program [SCPEAP], 2007). The SCPEAP provides performance-based assessments for a broad range of physical activities and has been used in PE research to assess students' competency levels in high school (Rink, 2004), middle school (Williams & Hall, 2010) and elementary school (Kirby, Barton, & Templeton, 2010). The assessments follow specific protocol for data collection, including videotaping student performance, verbal instructions for students, and the testing situation. For the volleyball assessment, students play a modified volleyball game competing with four players per

side for 14 minutes. Students are scored on four skills: the forearm pass, the overhead pass, the serve, and rules and strategy. For each skill, scores range from 0-3, with 3 being the highest level of performance. Performance criteria focus on proficient technique and consistency of use. For example, students are given a score of 3 for the forearm pass if they consistently use (i.e., 75% of the time or more) proficient technique (i.e., no observable errors in performance). For the purposes of this study, the score for each skill was summed for a total score, ranging from 0-12. Two independent raters – both experienced PE teachers – were trained to score the students' volleyball skills, yielding an inter-rater reliability score of .85.

Volleyball Knowledge. Students' knowledge of volleyball rules and procedures was assessed using a written test created by the four teacher participants. The test specifically measured students' ability to correctly identify portions of the court, direction of rotation, and rules of the game. Questions were in the form of true/false and fill in the blank with no open-ended questions. The teacher-participants used an answer key to assess students' performance on the volleyball knowledge test. The test was scored out of 30 points, with each question worth 1-2 points. Scores were converted to a percentage of correctly answered items, with 70% considered average performance. We obtained the test scores from all teachers. The teachers were also asked to submit the tests; however, not all teachers complied with our request. Therefore, we calculated split-half reliability to ensure consistency of the measure (α = .82).

Attitude toward the PE Course. Students' attitudes toward the PE course were assessed using the Student Attitudes toward Physical Education Survey (Subramanian & Silverman, 2000). This 20-item questionnaire measures enjoyment ("The games I learn in PE make my PE class interesting to me") and usefulness ("I feel my PE teacher makes learning in my PE class valuable for me"), rated on a 5-point Likert scale and anchored with 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, and 5 = strongly agree. For the purposes of this study, an overall indicator of student attitude was computed by summing responses for all scale items which is consistent with Subramanian & Silverman (2000). The measure has been shown to be internally consistent in previous research (α = .86 for enjoyment; α = .84 for usefulness;

Subramanian & Silverman, 2000). The measure was also internally consistent with the present sample (α = .79).

Procedure
After securing institutional review board approval and permission from the school district and school principal, we solicited teacher participation through the head of the PE department at the school (one of the participating teachers in this study), who helped us to garner the cooperation of the other three teachers in the department. Before participating, teachers gave informed consent and all but seven students gave informed consent with permission from their parents/guardians. All data were collected at the end of the volleyball unit. The researchers administered the questionnaires to the students with instructions that participation was voluntary, not tied to students' grades, and all information collected would remain confidential. Students took less than 20 minutes to complete the questionnaires and every attempt was made to have students fill each questionnaire out completely. The teachers administered the SCPEAP (2007) assessment and the volleyball knowledge test. The teachers had been trained in, and had experience using, SCPEAP assessments because at the time of the study, there was a state mandate requiring all PE programs to submit SCPEAP data to the SC Department of Education. All data for the study were collected during regularly scheduled class time.

Data Analysis
Descriptive statistics, internal consistency on questionnaire items, and correlations were run using SPSS v. 19 to determine normality of the data as well as to construct a covariance matrix for use in the path model. Amos v.21 was used to test the proposed path model. A path model was investigated (Thompson & Green, 2006) to infer causal relationships between the variables in this study (Lleras, 2005). Parceling – a procedure that combines scale items to improve issues related to small sample sizes – was used within the model for basic need satisfaction and self-regulation. This approach limits the number of variables, thereby strengthening the ratio of the number of participants to items (Schumaker & Lomax, 2004). Parceling of the BNS and SRQ scales has been employed in previous PE studies (Grolnick & Ryan, 1989; Ntoumanis, 2005).

Because all data met the assumptions of normality, and parceling produced continuous data, the maximum likelihood estimate was used (Hoyle & Panter, 1995). Several fit indices were chosen to assess model fit. Chi square was selected to examine how well the model fit with the population under study (Satorra & Bentler, 1994). The goodness of fit index (GFI) was also chosen, with a cutoff score of .95 established to indicate a good fit for the model (Tanaka & Huba, 1989). The Root Mean Square Error of Approximation (RMSEA) was used to determine how close to reality the model represented, with .05 or less indicating good fit. The Comparative Fit Index (CFI) was used to determine how well the model fit compared to a null model, with a score closer to 1 indicating a better fitting model. Finally, the Adjusted Goodness of Fit Index (AGFI) was used to determine how much variance the model accounted for relative to degrees of freedom, with a cutoff of .9 indicating a good fit (Schumaker & Lomax, 2004). Parameter estimates were also examined to determine significance. T-values over 2 were considered significant as they represent values larger than the critical value of the test statistic, set in this study as one standard deviation above the mean (Hoyle & Panter, 1994). Although only the standardized parameter estimates are reported, both unstandardized and standardized parameter estimates were examined.

Direct and indirect effects were evaluated from the AMOS output. In addition, R^2 values were computed for basic need satisfaction, autonomous motivation, volleyball skills, volleyball knowledge, and attitude toward the PE course to determine the amount of variance accounted for by the variables in the model.

RESULTS
Descriptive Statistics, Correlations and Scale Reliability
Descriptive statistics and correlations are presented in Table 1. For perceived autonomy support, basic need satisfaction, and autonomous motivation the mean ratings were above the scale means. For performance outcomes, mean performance for volleyball skills was low, indicating students were averaging just above a score of 1 for each of the four performance criteria. A score of 1 on the SCPEAP (2007) assessment reflects poor technique across skills, inconsistent use of the forearm pass or application of basic rules, and little evidence of strategy. Mean volleyball knowledge (80%) was above average (70%). The mean rating for attitude toward the PE course was favorable, with students indicating relatively positive attitudes. Several

positive and significant correlations between variables were noted, warranting their inclusion in the path model.

Table 1. *Descriptive Statistics and Correlations among Variables*

Variable	1	2	3	4	5	6
1. Perceived Autonomy Support						
2. Basic Needs Satisfaction	.37**					
3. Autonomous Motivation	.37**	.53**				
4. Volleyball Skills	.06	.18*	.37**			
5. Volleyball Knowledge	.25**	.20*	.28**	.18*		
6. Attitude Toward PE Course	.50*	.05	.08	.02	.01	
Mean	3.36	4.37	.76	4.12	.79	59.03
Standard Deviation	1.08	.67	5.75	2.80	.07	9.67
Range	1 - 5	2.5 - 6.2	-12 - 18	0 - 12	0 - 1	20 - 89

Note. *:$p<.05$, **:$p<.01$

Testing the Model

The ratio of participants to variables for the model was acceptable at approximately 22:1 (Bentler and Chou, 1987). The results of the path model indicated relatively poor fit, (χ^2 [10, N=141] = 58.74, p < .001; GFI = .90, RMSEA = .19, CFI = .66, AGFI = .79). Modification indices suggested a direct path be added from perceived autonomy support to student attitudes toward the PE course. After adding this path, model fit was much improved, (χ^2 [9, N=141] = 18.01 p < .05; GFI = .96, RMSEA = .09, CFI = .94, AGFI = .91). Figure 2 illustrates the direct relationships and standardized parameter estimates for the path model. The hypothesized relationship between perceived autonomy support and basic need satisfaction was confirmed, as was the relationship between basic needs satisfaction and autonomous motivation. Perceived autonomy support was also directly related to volleyball knowledge and student attitudes towards the PE course. Also as expected, autonomous motivation was directly and positively related to volleyball skill and knowledge performance measures. However, autonomous motivation was not related to student attitudes toward the PE course.
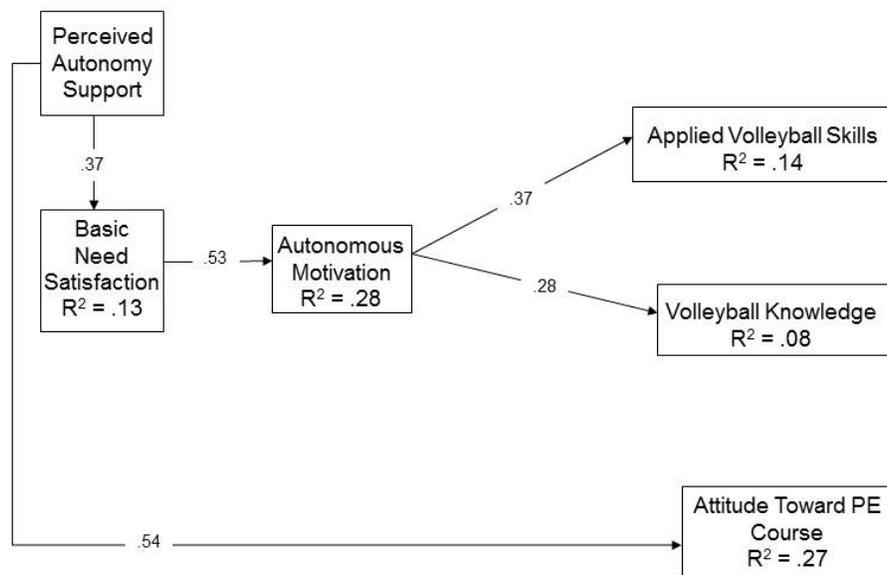

Figure 2. Path model predicting volleyball skills, volleyball knowledge, and attitude toward the PE course. All paths included in the figure are significant at p < .05. Congruent with assumptions, all variables were allowed to correlate. Errors are not given in the model for sake of clarity

Table 2 presents the indirect relationships. Perceived autonomy support was indirectly related to autonomous motivation, volleyball skills, and

volleyball knowledge. Basic need satisfaction was indirectly related to volleyball skills and volleyball knowledge.

Table 2. Indirect Effects among Variables

	1	2	3	4	5	6
1. Perceived Autonomy Support						
2. Basic Needs Satisfaction						
3. Autonomous Motivation	.11***					
4. Volleyball Skills	.04***	.12***				
5. Volleyball Knowledge	.02***	.12***				
6. Attitude Toward PE Course						

***p < .001

DISCUSSION

Given that NASPE (2004) defines PE learning goals in terms of behavioral, cognitive, and affective performance, investigating mechanisms underpinning such performance is an important goal of PE research. This study is unique in that if focused on applied motor skill performance (volleyball game play) as a motivational consequence, which has not been investigated in previous studies. Consistent with SDT studies in PE, the present study demonstrates the importance of considering the pedagogical implications tied to student motivation when attempting to understand differences in students' performance in PE. Because this study contextualizes student motivation and performance within a course that constitutes the final requirement for compulsory PE in South Carolina, the findings have direct implications for the motivational strategies that teachers might employ to increase the chances that adolescents will leave a PE program with the knowledge and skills they need to participate in volleyball and perhaps a positive attitude towards future participation in this recreational activity.

The hypothesized relationships for the path model were based on key theoretical propositions in SDT (Ryan & Deci, 2000), and informed by previous SDT research in PE (Boiché et al., 2008; Kalaja et al., 2009; Mouratidis et al., 2008; Ntoumanis & Standage, 2009; Shen et al., 2009; see Van den Berghe et al., 2012 for an overview). However, the initial model showed poor fit to the data, whereas adding a path between perceived autonomy support and attitude towards the PE course resulted in a better fitting model. From a practical perspective, the direction connection between these two variables is plausible because teachers who provide autonomy support directly

communicate the value and importance of learning in addition to making the class interesting, fun, and exciting, all of which are indicative of a favorable attitude towards the teacher. Along with the direct path, the insignificant path between autonomous motivation and attitude can also be explained by the fact that overall autonomous motivation was low for this group. Based on such relationships and previous research on need support in PE (Haerens, et al., 2011), it is possible that teachers could offset potential negative attitudes by applying differentiation of tasks (relatedness support), providing positive feedback (structure during the learning process), and asking questions about interests, problems, values or wishes (relatedness support, autonomy support, and structure). More research is needed to fully demonstrate this potential cause-effect relationship. More importantly, from a practical standpoint, this finding implies that if students already have positive attitudes towards a unit, then providing autonomy support may be irrelevant. To offset potential negative attitudes, teachers are encouraged to innovatively present or facilitate outcome-specific learning perhaps by including historical accounts of home team success a major competitions (e.g., U.S. Olympic sand volleyball), illustrate lessons with current media such as available through Youtube or have students organize a community-based tournament where students provide pedagogically parallel instruction to tournament participants.

Despite the unexpected results surrounding the role of the attitude construct in our model, our other hypotheses were well supported. In line with SDT, perceived autonomy support was directly related to basic need satisfaction, which in turn was directly related to autonomous

motivation. That is, students who perceived their teachers as providing choices and options, were understanding, encouraged questions, were good listeners and nurtured confidence also enjoyed and understood their class as interesting and valuable (i.e., higher autonomous motivation as measured by the LSQ). Further, autonomous motivation was directly related to both cognitive and applied volleyball skills, explaining 8% and 14% of the variance, respectively. That the relationship in the authentic setting explained more variance is not surprising given the congruence between practice and testing situations where teachers respond to students' behaviors; cognitions are not easily recognizable and subject to autonomy supportive feedback. This is particularly important when authentic assessment occurs in recreational PE contexts, such as volleyball, where ability gaps are smaller than in more popular competitive sport learning contexts. Teachers are encouraged to structure learning, practice and feedback experiences reflective of the aforementioned autonomous behaviors represented in the LCQ as a way of fostering authentic development of autonomous motivation and appreciation for the unit.

Given that the behavioral and cognitive performance measures in this study were designed to assess applied skills and knowledge deemed particularly relevant to playing volleyball in authentic, "real world" contexts, the results of this study extend previous SDT research in PE that has used relatively contrived motor tasks to test students' basic / fundamental motor skills. This is an important step forward for SDT research in PE because applied performance on authentic movement tasks (e.g., game play) provides information about whether students are equipped with the competencies deemed necessary for enjoyment and participation in a given activity in recreational settings (NASPE, 2004). Subsequent longitudinal studies focused on observing for the quality and frequency of teachers' autonomy supportive behaviors associated with applied learning would be the next step towards enhancing the ecological validity of the present findings. These would also provide stronger evidence for learning over time.

This study had several limitations. First, this was not an intervention study where authentic teacher behaviors were measured or one that evaluated the magnitude of learning. Rather, pedagogical implications are drawn from the motivational constructs measured and as they relate to

students' cognitive performance on both written and more importantly, applied assessments. Second, with self-report research there is always the chance that some participants were not honest in their reporting, felt uncomfortable answering certain questions, or provided responses they felt were socially desirable. The use of overt measures of autonomy support (e.g., Haerens et al., 2013; Tessier, Sarrazin, & Ntoumanis, 2010) is recommended for future studies to provide a more objective view of teacher behavior. Overtly assessed teacher autonomy support would also assist in the development of context-specific (e.g., within a high school volleyball unit) pedagogical strategies to support students' autonomy. Third, a larger sample size would allow for testing each basic psychological need to examine its unique relationship with performance outcomes in PE. Lastly, despite its accepted use as a technique to test theoretical relationships (Schumaker & Lomax, 2004), the use of SEM procedures in this study allows for only tentative conclusions regarding potential cause-effect relationships and must be complimented in the future with longitudinal and experimental research designs (Netemeyer, Bentler, Bagozzi, Cudeck, & Cote et al., 2001; Johnson, 2010).

The results of this study add to mounting evidence that an autonomy supportive learning environment can support PE in reaching behavioral, cognitive, and affective goals (Ntoumanis & Standage, 2009). Continued SDT research in PE employing performance-based assessments is recommended, as our study provides initial evidence that SDT has utility in explaining variation in applied motor performance. Additional studies, focusing on varied movement tasks that represent authentic participation characteristics, are needed. Integrating multiple theoretical perspectives and pedagogical frameworks in future research is also recommended, as this will help to ensure that an understanding of relationships between the social context, student motivation, and performance in PE develops in a manner that is congruent with, and hopefully serves to more closely unite, the trajectories of different disciplines and niches within PE research that often examine shared questions with singular lenses.

PRACTICAL ASPECTS

Based on the results of this study, it seems that by providing autonomy support, PE teachers can assert a positive influence on students' game skills

and knowledge important to recreational participation. Behaviors such as encouraging questions, providing choices and listening to students ideas is directly related to attitudes toward the unit and indirectly to both written and especially applied skills in authentic game-play settings. While this study was not designed to determine causality, the underlying assumptions of the structural model are in line with the well-supported idea that autonomy supportive teaching plays an important role in helping physical education reach its goals. Our results support the suggestion that teachers, by providing autonomy support, can directly enhance students' attitudes toward PE and indirectly exert a positive influence on students' activity-specific game playing skills and knowledge. Given that mean values of perceived autonomy support, basic need satisfaction, and autonomous motivation were not much higher than the scale midpoints, it seems reasonable to assume that increased autonomy support could have resulted in improved motor skill performance.

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