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PEDAGOGY

Evaluation of an Intervention to Increase Student Motivation and Enrollment in Physical Education

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Abstract

This study examined the influence of a 4-month intervention on students' motivation in Grade 10 physical education and enrollment in elective physical education. Health Promoting Secondary School Physical Education (HPSS PE) was designed to improve students' psychological need satisfaction in physical education, based on self-determination theory. A matched comparison pre–post design was used with 10 schools (5 intervention, 5 usual practice). Students (N = 373) completed questionnaires that assessed perceptions of autonomy, competence, and relatedness, and school personnel provided enrollment information. Results indicated that HPSS PE was not effective in increasing participants' psychological need satisfaction; however, female students receiving the intervention were significantly more likely to enroll in elective physical education. Insights contribute to the evidence about creating need-supportive environments in physical education and improving enrollment rates in elective programming.

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It has been widely acknowledged that school-based physical education programs can play a critical role in positively influencing students' attitudes toward, and patterns of, physical activity (Alderman et al., 2012; Bassett et al., 2013; Chen et al., 2014; Trudeau & Shephard, 2005). Young people who have positive experiences in physical education will more likely engage in physical activity outside of school and are more prone to continue this involvement throughout life (Haerens et al., 2010; Shen et al., 2007; Shephard & Trudeau, 2000). However, despite such promise, many students report negative experiences in physical education (Rikard & Banville, 2007; van Daalen, 2005), a lack of motivation to participate in physical education (Mowling et al., 2004; Ntoumanis, 2001; Ntoumanis et al., 2004), and low participation in elective physical education courses (Gibbons, 2009; Sulz et al., 2010).

The motivational processes influencing the participation and experiences of students in physical education programs are garnering research attention. This interest stems from the association between student motivation during physical education lessons and positive physical and affective consequences. Students' motivation in physical education class has been linked to effort (Ntoumanis, 2001; Ntoumanis et al., 2004; Taylor et al., 2010), levels of physical activity during class time (Cox et al., 2008; Lonsdale et al., 2009), intensity of involvement (Biddle & Mutrie, 2008), intention to engage in physical activity during leisure time (Lim & Wang, 2009; Shen et al., 2007), and participation in elective physical education (Ntoumanis, 2005; Shen, 2010). In addition, student motivation has been associated with increased enjoyment, interest (Zhang, 2009), and higher positive affective states during physical education class (Ntoumanis, 2005). It is, therefore, important to understand the motivational processes that influence whether students are motivated in physical education and regard physical education as an enjoyable and rewarding experience, or are unmotivated in physical education and regard physical education as boring and worthless (Ntoumanis, 2001).

Theoretical Framework

A theoretical framework that is commonly used in the study of motivation in physical education settings and that offers insight into the motivational process of students in physical education is Deci

and Ryan's (1985) self-determination theory (SDT). SDT posits there are three basic needs to which humans strive to satisfy: autonomy (i.e., a sense of choice), competence (i.e., a sense of efficacy), and relatedness (i.e., a sense of social connection). The satisfaction of these needs will enhance personal motivation toward behavior and in turn result in positive consequences (Deci & Ryan, 1985, 2000). Specifically, if students' needs for autonomy, competence, and relatedness are met, they could experience elevated levels of intrinsic motivation. In contrast, when these basic psychological needs are thwarted, the associated benefits are diminished and low motivation or avoidance will result (Deci & Ryan, 2000).

In physical education settings, a large portion of the literature has focused on the correlation and/or mediation of the theoretical propositions of SDT on students' motivational state and associated outcomes (e.g., How et al., 2013; Lim & Wang, 2009; Ntoumanis, 2001; Rutten et al., 2012; Standage et al., 2003). For example, numerous studies have documented that students' perceived autonomy support from physical education teachers positively predicted intrinsic motivation in physical education settings (How et al., 2013; Lim & Wang, 2009; Standage et al., 2003). Further, emphasis on students' improvement and the reduction of interpersonal ability comparisons can satisfy students' need for competence (Ntoumanis, 2001) and physical education teachers' relatedness support has been associated with students' state of motivation (Cox & Williams, 2008; Ferriz et al., 2013; Shen et al., 2009). In addition, Ntoumanis (2005) found that students' psychological need satisfaction was related to students' enrollment in elective physical education courses the following year, suggesting that students in elective courses may have decided to enroll in optional physical education based to some degree on psychological need satisfaction.

Although these noted studies and others have contributed much to the literature and have informed the associations between the basic psychological needs posited by SDT and positive outcomes, the majority of research has been cross-sectional and correlational in nature. A few studies have attempted to manipulate the psychological need for autonomy to increase specific targeted behaviors (e.g., physical activity, autonomy support) in physical education settings. These studies have been short-term researcher-controlled

interventions with a primary focus on satisfaction of autonomy through free-choice "open-gym" periods (e.g., Lonsdale et al., 2009, 2013) and activity selection (e.g., Ward et al., 2008) with little focus on curricula objectives. These studies emphasized the importance of providing choices in physical education to help increase students' physical activity during class time and autonomy support. However, it is important to recognize that physical education classes have multiple objectives beyond physical activity, including skill development and general health and physical education (Lonsdale et al., 2009). Therefore, this type of autonomy-supportive environment, in which students are given equipment in an "open-gym" concept or choices between two activities, may not be practical or may be an often-repeatable lesson format due to other curricular demands.

Although these intervention studies have enhanced our understanding of how meeting students' autonomy needs can increase student motivation in physical education, SDT posits that the degree of achievement of self-determined motivation is dependent on three psychological needs. Van den Berghe et al. (2014) conducted a systematic review of SDT-grounded work in physical education and identified the need not only for studies that examine all three need-supportive practices but also for more intervention studies overall and for those that account for more contextual factors. Specifically, we identified research gaps and areas for future work, including (a) combinations of the three dimensions of need-supportive practices, (b) more intervention studies, and (c) relevant physical education contextual factors taken into account.

Thus, although SDT has been extensively studied within physical education, limited intervention research is available. Further, a program that is flexible enough to be applied in diverse physical education contexts and activity units and that is consistent with physical education curricula objectives is warranted.

Background

Health Promoting Secondary Schools Physical Education

A SDT-based physical education curricular intervention component (HPSS PE) was designed as part of a study entitled Health Promoting Secondary Schools (HPSS; Wharf Higgins et al., 2013). HPSS has been described previously (Wharf Higgins et al., 2013), but

in short is a 1-year "whole-school" intervention designed to improve the physical activity and eating behaviors of Grade 10 students in five intervention schools and five usual-practice high schools. HPSS includes changes to school policies, school environment, curricular activities (physical education and health education), and student leadership opportunities. In line with SDT, a choice-based design in which participants were required to deliver the HPSS intervention core components was offered, but specific intervention pieces and implementation details were tailored to the needs of individual school communities (Sulz, Gibbons, et al., 2016; Wharf-Higgins et al. 2013).

HPSS PE is one of the core curricula components of the larger HPSS study. HPSS PE was designed based on SDT to enhance students' psychological need satisfaction in Grade 10 physical education and increase enrollment rates when physical education becomes an elective in Grade 11. HPSS PE incorporates autonomy (e.g., choice of group members, choice of activities taught within the course), competence (e.g., skill development, optimally challenging learning activities), and relatedness (e.g., class team-building activities) within physical education lessons.

Our research contributes to the understanding of motivational processes in physical education by examining the effect of the HPSS PE intervention on students' basic psychological need satisfaction and enrollment in Grade 11 elective physical education programs.

Method

Research Design

Ten schools within a western Canadian province were matched on geographic and demographic characteristics and randomized to either an intervention or a wait-list usual-practice condition for 1 school year. The physical education–specific pre–post investigation described in this article was nested within the larger HPSS study.

Participants

Grade 10 students enrolled in participating schools were invited to take part in the pre- and postintervention measures. We recruited Grade 10 students for two main reasons: (a) Grade 10 is the final year of compulsory physical education in the participating province

and (b) to evaluate the effectiveness the HPSS PE component on Grade 10 students' enrollment rates in Grade 11 elective physical education. Participants (N = 373; M_{age} = 15.32 years, SD = 0.37) were enrolled in 39 physical education classes from the 10 participant high schools (22 classes from intervention schools, 17 classes from usual-practice schools). School demographics showed a mean household income of $80,097 and 25% of students identified as a visible minority, 7.4% of First Nations heritage. Of the 22 Grade 10 physical education classes receiving the HPSS PE intervention, five were gender-segregated (3 all girls, 2 all boys) and 17 were coeducational classes. Fifteen high school physical education teachers taught the HPSS PE component across the five intervention schools (5 females, 10 males). Participating teachers had an average of 11.2 years teaching experience (SD = 5.14; range of 4–20 years) and 7.2 years experience teaching Grade 10 physical education (SD = 4.81; range of 1–16 years). Table 1 presents information on the overall numbers of students who participated in the evaluation of HPSS PE.

Table 1
Participants' Sex and Age by Condition

Variable	Total (*n*, *SD*) (*N* = 373)	HPSS PE (*n* = 194)	Usual practice (*n* = 179)
Sex			
Female (%)	182 (48.8)	103 (56.6)	79 (43.4)
Male (%)	191 (51.2)	91 (47.9)	100 (52.4)
Age, *M* (*SD*)	15.32 (0.37)	15.25 (0.34)	15.39 (0.38)

HPSS PE Intervention

HPSS PE teachers received a resource (hard copy binder and electric copy via USB) that included promotional ideas for increasing enrollment in Grade 11 elective physical education programs, classroom instructional strategies, ready-to-use lessons and examples of effective activities/actions to enhance students' perceptions of autonomy, competence, and relatedness. For example, some of these strategies included engaging students in decision-making processes by offering choices such as activity selection, difficulty of task, and partner or equipment choices; creating learning environments where

individual self-improvements are emphasized over social comparisons, competitive play is minimized, and goal setting is taught; and establishing meaningful connections and acceptance in which support and encouragement underpin teacher philosophies and activities are implemented to enhance relationships among classmates. Ideas for promotion of Grade 11 elective PE were included in the HPSS PE resource and based on previous research. For example, Sulz et al. (2010) identified factors influencing intention to enroll in Grade 11 elective physical education, such as "lack of knowledge" regarding the Grade 11 programs and "teacher promotion" of elective physical education courses. HPSS PE teachers were encouraged to provide Grade 10 students with information regarding the Grade 11 course and engage in promotional activities. Table 2 provides actions that physical education teachers can use in their lessons to foster the psychological needs of SDT.

The HPSS PE component was implemented over one semester (approximately 4 months). Teachers participated in a workshop (approximately 1 to 2 hr) at the beginning of the school semester to familiarize themselves with the resource. A trained HPSS Facilitator was available throughout the HPSS to assist and support teachers with the planning of the HPSS PE component and visited each school site bimonthly. We asked physical education teachers to deliver the HPSS PE intervention components with choices regarding which actions they implemented into their courses allowing for flexibility and a context-specific program.

Implementation Levels

To understand implementation levels, we asked Grade 10 physical education teachers to keep track of their actions in a purpose-built tracking tool. Activities were recorded by SDT construct and using a fixed HPSS options list. Tracking tools were submitted to the HPSS Facilitator by email or in person at the completion of the intervention. Table 3 shows the mean SDT actions that teachers implemented into their physical education class. Table 4 provides examples of elective physical education promotion activities implemented in intervention schools.

Table 2
Application of SDT to HPSS PE

Actions	Autonomy	Competence	Relatedness
Curricula activities	Survey students about physical activity preferences Provide choice around what will be assessed	Focus on the development of skill and ability Provide student leadership opportunities	Include team-building activities Include activities where everyone is on the same level
Learning environment	Provide choices in game play Choice in physical activity attire Offer competitive and noncompetitive activities	Focus on improvement, effort, and enjoyment Avoid social comparisons Provide optimally challenging activities	Create a safe, supportive, and caring learning space Encourage inclusive language and respect for diversity
Teacher behaviors	Allow for student input Engage students in the decision-making process	Provide opportunity for regular self-assessment Offer constructive feedback	Establish meaningful connections Enhance peer relationships Focus instructional strategies on social connectedness and collaboration

Note. Adapted from "Girls Getting Active: Exploring a Physical Education Program Tailored to Young Women," by L. A. Pfaeffli and S. L. Gibbons, 2010, *PHEnex Journal*, 2(3), 1–21, and "Relatedness-Supportive Learning Environment for Girls in Physical Education," by S. L. Gibbons, 2014, *LEARNing Landscapes*, 7(2), 139–150.

Table 3
Implementation of HPSS PE Intervention

Actions/activities/lessons	*M*
Autonomy	9.64
Competence	11.71
Relatedness	5.28
Promotion of Elective PE	2.2

Table 4
Examples of Activities Used to Promote Enrollment in Elective Physical Education

Activities Used for Promotion of Enrollment in Grade 11 Elective Physical Education
• Physical Education Department Head went into all Health Education 10 and Physical Education 10 courses to discuss and promote Grade 11 elective physical education. • Physical education teachers approached individual students to encourage enrollment. • Students enrolled in Grade 11 elective physical education went into Grade 10 physical education classes to discuss their experiences, explain the course, and encourage student enrollment. • Grade 10 physical education students participated in "a week in Grade 11 physical education" to provide students with a "taste" of elective physical education.

Measures

Psychological Need Satisfaction and Perceptions of Autonomy, Competence, and Relatedness

We used the Physical Education – Autonomy, Relatedness, Competence Scale (Sulz, Temple, & Gibbons, 2016) to measure overall psychological need satisfaction and perceptions of autonomy, relatedness, and competence of students in high school physical education classes. Students responded on a 7-point likert scale (1 = *strongly disagree* to 7 = *strongly agree*) to the stem question "When I am in physical education…" followed by items representing autonomy (e.g., "I am doing the activities I want"), relatedness (e.g., "my classmates seem to like me") and competence (e.g., "I am

good at the things we do"). This questionnaire provides an overall psychological need satisfaction score (i.e., the degree in which students' psychological needs of autonomy, relatedness, and competence are satisfied) and the degree to which the person experiences satisfaction of each of the three needs. Validity and reliability of scale factor structure in high school physical education has been shown previously (Sulz, Temple, & Gibbons, 2016). The questionnaire was administered to students during physical education class time at the beginning of the semester (i.e., baseline, September) and at the end of the semester (i.e., postintervention, December/January).

Enrollment in Elective Physical Education

To assess whether HPSS PE influenced participants' enrollment in optional physical education in Grade 11, we collected the status of Grade 11 elective physical education enrollment (i.e., enrolling or not enrolling) from intervention and usual-practice schools. Enrollment data were collected at the end of the intervention year with the help of school personnel at each participant school. School personnel were provided with a list of names of the participants and asked to indicate by selecting "yes" or "no" whether each student was enrolled in Grade 11 physical education for the following school year.

Analyses

Analysis included multivariate analysis of covariance (MANCOVA), a chi-square analysis, and the mean and range of the actions recorded in teacher tracking tools. To measure students' overall psychological need satisfaction scores, we summed each subscale (autonomy, relatedness, competence) together and used a single score as an indicator of students' overall psychological need satisfaction toward Grade 10 physical education. The Physical Education – Autonomy, Relatedness, Competence Scale (Sulz, Temple, & Gibbons, 2016) comprises 12 items on a 7-point scale; therefore, students' psychological need satisfaction could range from a score of 12 (lowest need satisfaction) to 91 (highest need satisfaction). To measure students' need satisfaction for each individual SDT construct, we took the mean score of the series of questions from each construct and used it for analysis. For example, autonomy was measured based on the mean score of four questions related to

students' perceptions of autonomy in their Grade 10 physical education class.

We used SPSS 21.0 to analyze data. We performed a MANCOVA to test whether students' psychological need satisfaction and perceptions of autonomy, competence, and relatedness toward Grade 10 physical education differed between conditions. Postintervention scores served as the dependent variables, condition as the independent variable, and baseline scores as covariates. We calculated effect size (partial η^2) to determine the relative magnitude of the experimental treatment, using the following formula: Partial η^2 = SS(effect) SS(effect) + SS(error for that effect). Partial eta squared was interpreted as small (.01), medium (.06), and large (.14; Cohen, 1988).

To compare HPSS participants' enrollment in Grade 11 elective physical education between intervention and usual-practice schools, we used chi-square analyses. Three chi-square analyses were conducted. The first focused on overall HPSS participant enrollment (i.e., female and male participants), whereas the second and third analyses focused on gender differences in enrollment rates.

To analyze implementation data, we counted and categorized actions recorded in teacher tracking tools based on SDT constructs and use of HPSS resources. We calculated mean and range for each SDT construct.

Results

Baseline

Table 5 displays the descriptive statistics for the baseline and follow-up measures of and change scores for psychological need satisfaction and perceived autonomy, competence, and relatedness by condition. No significant differences in psychological needs satisfaction, autonomy, competence, or relatedness between the conditions were observed at baseline, Wilks' $\Lambda = .983$, $F(4, 369) = 1.596$, $p = .175$, $\eta^2 = .017$. Significant associations between the proportion of students currently enrolling in Grade 11 physical education and intervention condition were demonstrated by the chi-square test of association ($p = .000$). A significantly greater proportion of usual-practice school students (52%) were enrolled in Grade 11 elective physical education compared to students at intervention schools (42%; $p = .000$). In addition, there was a significantly ($p = .003$) greater proportion of

Table 5
Significance of and Descriptives for Psychological Need Satisfaction (PNS Score) and Perceived Autonomy, Competence, and Relatedness by Condition

Dependent variable	Condition	Baseline (T1) Sum ± SD (Range for PNS)	Follow-up (T2) Sum ± SD (Range for PNS)	Change	Sig.
PNS score	HPSS PE	71.80 ± 11.94 (20.00–89.00)	73.24 ± 11.89 (24.00–90.00)	+ 1.44	NS
	Usual Practice	74.44 ± 12.74 (40.00–91.00)	74.06 ± 11.75 (25.00–91.00)	− .38	NS
Perceived autonomy	HPSS PE	4.29 ± 1.06	4.51 ± 1.10	+ .22	NS
	Usual Practice	4.50 ± 1.33	4.49 ± 1.26	− .01	NS
Perceived relatedness	HPSS PE	5.49 ± 1.07	5.54 ± 1.06	+ .05	NS
	Usual Practice	5.66 ± 1.06	5.68 ± 1.00	+ .02	NS
Perceived competence	HPSS PE	5.43 ± 1.02	5.52 ± 1.02	+ .09	NS
	Usual Practice	5.61 ± 1.07	5.66 ± .92	+ .05	NS

Note. Psychological need satisfaction (PNS Score) could range from a score of 12 (lowest need satisfaction) to 91 (highest need satisfaction). Perceived autonomy, relatedness, and competence scores were on a 7-point scale (1 = *lowest need satisfaction*; 7 = *highest need satisfaction*).

female (38%) and male (66%) students in usual-practice schools enrolled in elective physical education compared to female (29%) and male (55%) students in intervention schools.

Outcome Measures

Psychological Need Satisfaction and Perceptions of Autonomy, Competence, and Relatedness

The MANCOVA showed no significant differences for any variables between conditions at follow-up while controlling for baseline, Wilks' $\Lambda = .991$, $F(4, 369) = .867$, $p = .484$, $\eta^2 = .009$.

Enrollment in Elective Physical Education

No significant associations were found for the proportion of students enrolling in Grade 11 at follow-up and intervention condition for all participants ($p = .272$). Gender analysis showed a significant association ($p = .013$) in the proportion of female participants enrolling in Grade 11 elective physical education across condition: 48% in the intervention schools compared to 30% in the usual-practice schools. See Table 6.

Discussion

The HPSS PE intervention aimed to increase Grade 10 students' perceptions of autonomy, competence, and relatedness, and improve enrollment in elective Grade 11 physical education. Specifically, HPSS PE altered features of existing physical education environments (e.g., curricula activities, learning environment, teacher behaviors) to meet the three basic psychological needs posited by SDT and to align with curricula outcomes. A unique aspect of the HPSS PE component was the choice-based design in which emphasis was placed on the specific needs and preferences of the participating students and teachers. Overall, the results showed no significant difference in autonomy, competence, and relatedness between the intervention schools and usual-practice schools. However, HPSS PE intervention was positively associated with enrollment in Grade 11 physical education among female participants.

The absence of an effect on SDT factors may be related to implementation levels. The number of intervention actions carried out in physical education classes was low. The implementation level may be attributed to factors related to the HPSS program, such as the

Table 6

Enrollment in Grade 11 Elective Physical Education by Condition at Follow-Up

	Follow-up														
	Total participants (N = 2031)					Female participants (*n* = 992)					Male participants (*n* = 1039)				
	Enrolled		Not enrolled			Enrolled		Not enrolled			Enrolled		Not enrolled		
Condition	*n*	%	*n*	%	*p*	*n*	%	*n*	%	*p*	*n*	%	*n*	%	*p*
HPSS PE	101	52	93	48	.272	50	48	53	52	.013	47	52	44	48	.245
Usual practice	83	46	96	54		24	30	55	70		60	60	40	40	

choice-based design and the complexity of targeting all three SDT constructs (e.g., too much choice). The choice-based design of HPSS PE was based on SDT; comprehensive school health tenets (Beaudoin, 2011); and education and health promotion literature that emphasizes the importance of pragmatic methods, contextual relevance, and stakeholder engagement (Glasgow, 2013). For example, educational change literature has suggested that the integration of new programs into existing school practices is more likely when the autonomy of teachers and students is considered, when their voices and ideas are heard and incorporated (Fullan, 2007; Niemiec & Ryan, 2009; Reeve, 2012). Previous school-based motivational studies have been primarily short-term (one lesson or one unit), highly controlled programs focused on the manipulation of one psychological need, most often the need for autonomy. That is, teachers were given a short preset activity or lesson developed by researchers and students' motivation was assessed directly prior to and following the activity (e.g., Lonsdale et al., 2009, 2013; Ward et al., 2008). Although some researchers (e.g., Bryan & Solmon, 2007; Taylor et al., 2010) have suggested physical education settings would be an ideal setting for intervention studies to target all three SDT constructs, we suspect that this was too demanding for the participant teachers, considering the duration of the intervention. This aligns with the literature examining school-based intervention implementation, which suggests that as intervention complexity and time requirements from those responsible for implementation increase, the level of treatment integrity decreases (Lane et al., 2004; Storey et al., 2016). Future research is needed to explore and better understand the 'optimal' level of choice.

A second possibility for the nonsignificant findings could be high baseline scores, creating a ceiling effect. Within the literature, cross-sectional studies conducted with high school students revealed lower baseline means than our sample (e.g., Standage et al., 2005, 2012; Taylor et al., 2010). One challenge in SDT-based randomized controlled trials (similar to the larger HPSS intervention) concerns the characteristics of the participants (Fortier et al., 2010). Participants who tend to volunteer for physical activity–based studies also had elevated initial levels of motivation (Duda et al., 2009; Fortier et al., 2007; Silva et al., 2008). The baseline scores of our

participants showed high levels of motivation. Our participants were students from the larger HPSS study sample (Wharf Higgins et al., 2013), in which participants volunteered to complete physical testing (i.e., 20-m shuttle run) and anthropometric measures (i.e., weight, height, waist circumference, hip circumference) in addition to the completion of the questionnaires within this study. Due to the data collection procedures of the larger HPSS study, which included physical tests, it is likely that participants were highly motivated toward physical activity.

Corresponding with the high baseline perceptions on SDT constructs were the Grade 11 elective physical education enrollment rates. Both school-level and student-level enrollment appeared higher than the provincial average (28%). Similarly, it appeared that the physical education programs offered to students in the usual-practice condition were meeting their basic psychological needs. Perhaps the teachers in the usual-practice schools who volunteered for this study may have already been providing a Grade 10 physical education program that met the needs of their students. Fortier et al. (2010) concluded that such intuitive support in the usual-practice conditions will likely result in smaller intervention effects. They stated that this issue merits assessment of treatment integrity in the usual-practice conditions. Our program did not assess treatment integrity in the usual-practice conditions nor were students blinded to the HPSS intervention components (students in the waitlist control groups were promised the intervention the next year).

In examinations of the SDT constructs individually, students' perceptions of autonomy, competence, and relatedness remained relatively stable pre- to postintervention. For perceptions of autonomy, research has effectively increased students' perceived autonomy in physical education classes through free-choice periods (e.g., Lonsdale et al., 2009, 2013) and activity selection (e.g., Ward et al., 2008). These studies have been short-term (e.g., 20-min activities, one unit), high-dose (e.g., free-choice lesson; choice of one of two activities) interventions with postmeasure occurring directly after choice was offered. Unique aspects of the HPSS PE Grade 10 intervention were the alignment to curricula outcomes and the ability to integrate activities and lessons throughout a physical education program. However, the intervention dose (frequency and length) may be inadequate for enhancing perceptions of autonomy.

Despite the efforts of the HPSS PE program to target age-salient sources of competence (e.g., enhancement of self-comparison, optimally challenging activities, and internalized standards such as improvement, effort, and enjoyment) and to follow recommendations in the literature (e.g., Alderman et al., 2006; Bryan & Solmon, 2007), no significant differences were found for students' perceptions of competence between conditions and their perceptions remained relatively stable across time periods. One plausible explanation for this may be that by the time students enter Grade 10, their perceptions of competence related to physical education and physical activity may already be established. Studies aimed at enhancing younger children's perceptions of competence in physical activity settings have been effective (e.g., Fu & Gao, 2013; Valentini & Rudisill, 2004), but similar to ours, the limited studies conducted with adolescents have had no discernible effect on perceptions of competence (Wallhead & Ntoumanis, 2004). Moreover, Li et al. (2005) and Bryan and Solmon (2007) stated that past experiences could influence perceptions of competence. Longitudinal studies tracking students' perceptions of competence toward physical education over the school years are limited; however, a study conducted by Barnett et al. (2009) found that being physically competent during childhood was influential in positive perceptions of sport competence in adolescence. This suggests that a person's perceptions of competence during childhood influence perceptions of competence during adolescence. Further, Deci and Ryan (1985) proposed that motivation is not solely experienced at situational levels (i.e., physical education class) but also experienced at global levels (i.e., across various life contexts). Based on this, students' motivation in a physical education course (i.e., a person's situational motivation) may be influenced by their global motivation in different contexts (e.g., previous physical activity experience). Although this is one plausible explanation, more research needs to evaluate whether high school students' perceptions of autonomy, competence, and relatedness toward physical education are established and perhaps less malleable to change strategies by adolescence.

The outcomes of our investigation also revealed that relatedness perceptions did not differ significantly by condition. There is limited information about enhancing social connection and relationships

in physical activity and physical education settings. According to Ntoumanis (2001) and Deci and Ryan (2000), relatedness in physical activity settings is a lesser consequence on a person's motivational processes than autonomy and competence. However, physical education is a unique context where students interact with other students regularly and where their physical abilities are placed on display. It is, therefore, important that social connectedness is established between students, their peers, and their teacher for students to be motivated (Cox et al., 2009; Cox & Williams, 2008). Unfortunately, the implementation dose for relatedness activities was the lowest among the SDT constructs, making it difficult for us to conclude that interventions would have no effect. Future studies should address this with greater dose to determine if relatedness needs can be changed.

Despite null findings related to needs satisfaction, enrollment rates were proportionally higher among female students in the intervention schools. On the surface, these findings suggest that improving students' experiences in physical education courses and meeting the needs posited by SDT may positively influence students' enrollment in elective physical education programs. However, it may also be the influence of an extraneous external factor such as the promotion of the elective courses by other actors in the school (HPSS actions noted in Table 6). Research has identified factors influencing enrollment intention in elective physical education programs among Grade 10 students (Sulz et al., 2010). Findings revealed a barrier to enrollment was a lack of knowledge regarding the Grade 11 physical education program. Students reported being unaware and uniformed about the Grade 11 physical education course. The authors suggested educators need to provide students with information prior to their selection of courses to help promote student enrollment. Our findings highlight the importance of teachers promoting enrollment and providing information on physical education elective courses to their students.

Our study has several strengths including the randomized comparison design and the strong theoretical framework informing intervention strategies. In addition, schools in our study are diverse in characteristics and geographical location, enhancing generalizability. Furthermore, the HPSS PE component is novel in that it targets all three psychological needs proposed by SDT. The HPSS PE

component contributes to the motivational literature in that it examines students' motivational processes for the duration of one high school physical education course. Moreover, HPSS PE is designed to be integrated into the existing practices of school-based physical education programs and to align with curriculum objectives and thus offers feasible and context-relevant pedagogical strategies. Most uniquely to HPSS PE, teachers are given choices and flexibility within the framework of the intervention. This allows for a program that could be adapted by the teachers to meet the specific needs of their school and their students.

Our study also has a few limitations. First, participant schools were invited to be part of this study focused on enhancing student motivation toward physical activity and physical education. As such, schools may have been serving the psychological needs of their students at the outset, which could explain the high baseline scores and enrollment rates of the intervention and usual-practice schools. Second, students who volunteered for the study also consented to the larger portion of HPSS. This larger aspect of our study involved more rigorous (albeit feasible and affordable) measurements (i.e., physical measurements, 20-m shuttle run), constraining the pool of participants who volunteered to take part in the investigation to the already active and motivated. Clearly, future research needs to employ alternative measurement tools that attract and engage the entire student body, not merely the fit and enthusiastic. Last, the lack of process evaluation data in the usual-practice schools limits our understanding of the activities (including need-supportive activities) and environment that the usual-practice schools provide their students.

In conclusion, the HPSS PE component supports a choice-based framework that promotes perceptions of autonomy, competence, and relatedness in high school physical education settings. It also supports the promotion of elective physical education programs. This approach appears to contribute to physical education enrollment. Studies of longer duration intervention might be necessary (i.e., over several semesters) and program complexity and its effect on implementation needs to be considered in future interventions. Insights gained from our study contribute to the practical understanding of SDT intervention development, implementation, and practices in high school physical education programs.

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