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PEDAGOGY

Measuring Student Motivation in High School Physical Education: Development and Validation of Two Self-Report Questionnaires

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Abstract

The aim of this research was to develop measures to provide valid and reliable representation of the motivational states and psychological needs proposed by the self-determination theory (Deci & Ryan, 1985, 2000) within a physical education context. Based on theoretical underpinnings of self-determination theory, two questionnaires were developed to measure students' motivation and psychological need satisfaction in high school physical education: (a) the Physical Education Motivation Scale (PEMS) and (b) the Physical Education Autonomy, Relatedness, Competence Scale (PE-ARCS). Validity and reliability concerning the scales were examined. Exploratory factor analysis supported the validity and test–retest reliability of a 3-factor, 9-item solution for PEMS and a 3-factor, 12-item solution for PE-ARCS. The results provide evidence supporting the validity and reliability of PEMS and PE-ARCS as promising physical education-specific measures of motivation developed within the framework of self-determination theory.

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It is widely supported and acknowledged that school-based physical education programs present a tremendous opportunity to positively influence the attitudes and patterns of physical activity participation among adolescents (Alderman, Benham-Deal, Beighle, & Erwin, 2012; Basset et al., 2013; Chen, Kim, & Gao, 2014; Trudeau & Shephard, 2005). Motivation is recognized as an important factor related to meaningful student engagement and participation in physical education classes (Cox, Smith, & Williams, 2008; Ntoumanis, 2001; Shen, Li, Sun, & Rukaving, 2010). Motivation in physical education has been associated with a number of important outcomes, such as increases in physical activity levels during class time (Cox et al., 2008; How, Whipp, Dimmock, & Jackson, 2013; Lonsdale et al., 2013; Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009), intention to be physically active outside of class (Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003), positive changes in the experiences of students within physical education (Ntoumanis, 2002; Standage, Duda, & Ntoumanis 2005; Zhang, 2009) and intention for future physical education participation (Shen et al., 2010). Therefore, it may be reasonable to assume that physical education programs will have a more positive impact when students are motivated to participate (Haerens, Kirk, Cardon, De Bourdeaudhuij, & Vansteenkiste, 2010; Ntoumanis, 2002). Despite the fact that motivation has been related to several positive outcomes in physical education, instruments used for assessing motivation in physical education settings have been adapted and/or modified from other domains. In light of this, the aim of this research was to develop theoretically grounded domain-specific valid and reliable measures of student motivation in physical education contexts.

Self-Determination Theory

Within physical education, self-determination theory (Deci & Ryan, 1985) is a commonly used theoretical framework to study motivation given that its major propositions and constructs are significantly pertinent in physical education settings (Ntoumanis & Standage, 2009). Self-determination theory postulates that providing students with a social context that satisfies three innate psychological needs of autonomy, relatedness, and competence one's motivation can be positively influenced (Deci & Ryan, 1985, 2000; Vallerand, 2001). The need for autonomy represents an individual's

desire to experience a sense of choice and feel volition in carrying out a task (Deci & Ryan, 1985, 2000). According to the theory, individuals feel autonomous when they understand the value or relevance of the task and therefore can identify with it (Deci & Ryan, 2000; Ryan & Deci, 2000). Relatedness refers to an individual's inherent desire to feel connected to others (Deci & Ryan, 1985, 2000). Ryan and Deci (2000) suggest relatedness support is important, as people are not inclined to internalize value from those they do not feel connected to. Last, the need for competence represents an individual's inherent desire to feel effective in their environment (Deci & Ryan 1985, 2000). Feelings of competence are necessary for individuals to approach optimal challenge that allow them to learn and develop (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000). Specifically, if students' need for autonomy, relatedness, and competence are met they will experience self-determined motivation. In contrast, when these basic psychological needs are thwarted, the associated benefits are diminished and low motivation or avoidance will result (Deci & Ryan, 1985, 2000).

According to Deci and Ryan (1985, 2000) and Hagger and Chatzisarantis (2007), one's motivation can be broadly categorized as intrinsically motivated (e.g., doing something because it is inherently interesting and enjoyable), extrinsically motivated (e.g., pursing an activity for reasons outside the activity itself, such as, external rewards or pleasurable psychological states), or amotivated (e.g., lack of motivation or passive contribution) based on the different reasons or goals that accompany an action. Each motivational state is projected to have a variety of consequences for learning, performance, development, and personal experience. Several studies have demonstrated that intrinsic motivation is associated with positive behavioral outcomes, such as increased physical activity levels activity levels in and out of physical education class (Cox et al., 2008; Lonsdale et al., 2009; Lonsdale et al., 2013; Ntoumanis, 2001; Shen et al., 2010) and affective outcomes, such as increased enjoyment (Cox, Duncheon, & McDavid, 2009; Zhang, 2009) and happiness (Standage et al., 2005). These findings highlight the importance of understanding the motivational processes that can determine students' effort, interest, and attitude towards physical education and their future involvement in physical activity.

Measures of Motivation in Physical Education

To date, measures have been developed to assess motivation in sport contexts (e.g., Intrinsic Motivation Scale, McAuley, Duncan, & Tammen, 1989; Sports Motivation Scale, Pelletier et al., 1995), exercise settings (e.g., Exercise Motivation Scale; Li, 1999; Basic Need Satisfaction Scale, Vlachopoulos, & Michailidou, 2006), and specific activities (e.g., Situational Motivational Scale, Guay, Vallerand, & Blanchard, 2000). However, domain-specific scales that assess the three motivational states and three psychological needs posited by self-determination theory within physical education contexts are limited within the literature.

To address this, researchers adapt existing motivational scales by altering the stem question and/or scale item(s) to fit the physical education context or by using an abridged version of a preexisting measurement scale. For example, researchers (e.g., Granero-Gallegos, Baena-Extremera, Gomez-Lopez, & Abraldes, 2014; Granero-Gallegos, Baena-Extremera, Perez-Quero, Ortiz-Camacho, & Bracho-Amador, 2012; How et al., 2013; Ward, Wilkinson, Vincent, & Prusak, 2008) have adapted the Sport Motivation Scale (Pelletier et al., 1995), which was designed to measure motivation toward sport, for the physical education context by using an abridged version (16-item version of the original 28-item scale) and by changing the original stem question ("Why do you participate in sport?") to fit physical education contexts (e.g., "Why do you participate in physical education?"). This adapted stem question may not be applicable to physical education contexts as full volition cannot be granted due to curricula objectives and student behaviors being influenced by teachers and grades. Likewise, when assessing the three psychological needs posited by self-determination theory, a common practice among researchers is to use subscales from existing questionnaires to measure each individual construct. For instance, researchers (e.g., Cox et al., 2008; Lonsdale et al., 2013; Standage & Gillison, 2007; Standage, Treasure, Duda, & Prusak, 2003a; Taylor, Ntoumanis, Standage, & Spray, 2010) have assessed autonomy from the 5-item autonomy subscale of the Situational Motivation Scale, assessed competence by using the perceived competence subscale (5 items) from McAuley et al. (1989) 18-item Intrinsic Motivation Inventory and assessed relatedness through the adaption of the

Need for Relatedness Scale (Richer & Vallerand, 1998), which originally was developed for relatedness in the workplace. Researchers are using multiple subscales from existing questionnaires because a measure that assesses all three psychological needs posited by self-determination theory in physical education settings is limited within the literature. Using instruments designed for other contexts does not adequately address the unique context of the physical education environment and jeopardizes the original instruments' validity and reliability.

To help address these issues, researchers have validated the altered versions of the questionnaires in physical education settings. However, the majority of this work has been focused on middle school contexts. For example, Standage et al. (2003a) assessed the validity and reliability of the 14-item abridged Situational Motivation Scale used by numerous researchers (e.g., Lonsdale et al., 2009; Lonsdale et al., 2013; Moreno, Gonzalez-Cutre, Martin-Albo, & Cervello, 2010; Ward et al., 2008) among students in middle school physical education (Grades 7 and 8). The authors concluded the 14-item Situational Motivation Scale measure is a valid and reliable tool for assessing situational motivation in middle school physical education settings. Moreover, Goudas, Biddle, and Fox (1994) adapted the Self-Regulation Questionnaire (Ryan & Connell, 1989), which assessed intrinsic and extrinsic forms of motivation and added the amotivation scale from the Academic Motivation Scale (Vallerand et al., 1992) to measure types of behavioral regulation in physical education and sport contexts. This questionnaire has been used by researchers in physical education contexts (e.g., Ntoumanis, 2002; Ntoumanis, 2005; Shen, McCaughtry, & Martin, 2007) and shown to be valid and reliable among 12- to 14-year-old physical education students. Further, Lui and Chung (2014) developed and validated a measure designed for assessing psychological need satisfaction in middle school students (Grades 7 to 9) in Hong Kong. In studies examining the motivational processes of high school students (e.g., How et al., 2013; Granero-Gallegos et al., 2012; Granero-Gallegos et al., 2014), instruments designed to measure motivation in other contexts (e.g., sport contexts) that have been adapted for physical education settings (e.g., Sport Motivation Scale, Pelletier et al., 1995) and validated by others tend to be used. For example, Granero-Gallegos

et al. (2014) used the Sport Motivation Scale (Pelletier et al., 1995), which was previously validated by Moreno, Llamas, and Ruiz (2006) to assess the motivation of high school students in physical education. As the motivational processes of middle school students and the structure of middle school physical education classes likely differ from that of high school students and high school physical education programs, and the physical education setting differs from that of other contexts, the development and validation of domain-specific measures of high school physical education is warranted.

In sum, an instrument that measures the three broad motivational states in high school physical education (Grades 9 to 12; students 14 to 18 years of ages) and an instrument that measures all three psychological needs in high school physical education classes are limited within the literature. As such, there is a considerable scope for the development and validation of measures of motivation in high school physical education contexts. The present study sought to develop two domain-specific questionnaires to provide valid and reliable representation of the motivational states and psychological needs proposed by self-determination theory within high school physical education contexts. The Physical Education Motivation Scale (PEMS) was developed to measure students' state of motivation (intrinsic motivation, extrinsic motivation, amotivation) and the Physical Education Autonomy, Relatedness, Competence Scale (PE-ARCS) was developed to measure students psychological need satisfaction (autonomy, relatedness, and competence).

Method

The development of PEMS and PE-ARCS followed recommendations within the literature regarding scale development. Worthington and Whittaker (2006) and Cabrera-Nguyen (2010) discuss recommendations for best practices in scale development research. The recommendations from the authors included (a) conducting exploratory factor analysis to assess underlying factor structure and refine pool items as early stage scale development, (b) providing definitions of the constructs to be measured, (c) having experts review the item pool to confirm or invalidate the definitions of constructs and evaluate items for clarity and conciseness, and (d) follow DeVellis' (2003) steps to scale development as a sequence of steps to be taken prior to factor-analytic techniques.

DeVellis' (2012) eight steps to developing measurement scales were adhered to in the development of PEMS and PE-ARCS. Because theory aids the conceptualization of constructs (DeVellis, 2012), all constructs were aligned with self-determination theory and clearly defined at the beginning of the development process. Following a literature search of the constructs of interest, a large pool of items for each scale was developed (39 items for PEMS and 53 items for PE-ARCS). Items were generated from existing measures of motivation and psychological needs within other settings (e.g., exercise, sport, workplace) and were modified for the physical education context. A 7-point Likert scale was chosen for both questionnaires, as this format allowed participants to select a neutral point while giving them two choices between the extremes of the scale. Once the initial questionnaires were constructed, a Delphi Group composed of a panel of six experts (five professors and one graduate student in related fields—physical education pedagogy with prior research with SDT) were asked to review the initial pool of items and evaluate (a) whether the items captured the essence of the construct being assessed, (b) if the items were theoretically grounded, and (c) if the wording of each item was age appropriate and relevant to physical education. Specifically, experts were asked to identify the subscale each proposed item corresponded with (i.e., autonomy, competence, relatedness; intrinsic motivation, extrinsic motivation, amotivation) or if the item corresponded with more than one subscale or no subscale. Experts were also asked to review items for relevance, wording, and reading level. Based on the above criteria and the feedback provided by the Delphi Group, we revised and adjusted the items accordingly. The revisions resulted in a reduced item pool of 27 items for PEMS (intrinsic motivation: 8 items; extrinsic motivation: 11 items; amotivation: 8 items) and 20 items for the PE-ARCS (autonomy: 7 items; relatedness: 6 items; competence: 7 items). These versions of the questionnaire were administrated to a sample of high school students to examine construct validity via exploratory factor analysis and to establish test–retest reliability.

Participants

Validation sample. High school students from four urban and suburban public high schools in Western Canada (N = 309; 154 female, 155 male) participated in the validation study. Students were

in Grades 9–12 and ranged in age from 14 to 18 years (M = 15.50, SD = 1.11).

Test–retest (reliability) sample. The reliability sample composed of 131 students (64 females, 67 males) in Grades 9–12. The participants were recruited from four physical education classes within two of the schools that participated in the validation study. Participants' age ranged from 14–18 years old (M = 15.53; SD = 1.12).

Data Collection Procedures

University and school board ethical approval were obtained and all students provided written informed consent. Questionnaires were mailed to the schools and administered by the physical education teacher during approximately 20 min of one physical education class. Students were informed participation was voluntary; they could decide not to participate at any time or choose not to answer any questions they did not feel comfortable with. Teachers were asked to ensure students were informed of the purpose of the study, understood that their answers would be kept confidential and used for research purposes only, and the teacher would not see their responses. Teachers were asked to place questionnaires into the provided envelope, seal, and return to researcher after completion to ensure confidentiality and anonymity. Students were also informed the questionnaire was not an examination; therefore, there were no right or wrong answers. Students were instructed to answer the questions as honestly as possible and base their answers on their current physical education experiences. The retest to establish reliability occurred 5 days after the initial questionnaire administration. The teachers used prepaid envelopes to return questionnaires to the University.

Data Analyses

Prior to performing exploratory factor analysis, variables were examined for normality and were considered to be nonnormal if their skewness and kurtosis values extended the acceptable limit of ±2.0 (Tabachnick & Fidell, 2012). Although the majority of items did not have severe violations of normality, preliminary analysis indicated that the data distribution for PEMS and PE-ARCS was nonnormal with a few items deviating from normality. To account for non-normal data, principal axis factoring using varimax rotation was performed (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

Outlier scores were considered within the normal range (below -3.29 and above 3.29), as identified by Tabachnick and Fidell (2012). Construct validity was examined using scree plots and exploratory factor analysis. For the rotated solution, items with eigenvalues below 1.0 (Stevens, 2001) and items with primary loadings of < .50 and secondary loadings of > .32 were removed (Tabachnick & Fidell, 2012). To examine the test–retest reliability of the scales, intraclass correlation coefficients (ICC) were applied.

Results

The following section presents the results of exploratory factor analyses and test–retest reliability of PEMS and PE-ARCS. The factor structure and corresponding factor loadings are presented for each scale. Reliability of subscales are also presented with item means, standard deviations, and corresponding ICC values.

Physical Education Motivation Scale (PEMS)

An exploratory factor analysis was conducted on the 27-item scale administered to the students to identify underlying factors. Employing multiple iterations with the criteria set out by Stevens (2001) and Tabachnick and Fidell (2012) and being consistent with the theoretical framework, an acceptable fit model was determined with 3-factor, 9-items solution: 3 intrinsic motivation items, 3 extrinsic motivation items, 3 amotivation items (Table 1; Appendix A). A corresponding scree plot verified the solution and eigenvalues for each of the factors were above 1.0, which is deemed an acceptable criterion (Stevens, 2001). The final 3-factor, 9-item model resulted in 57.3% of the variance accounted for; explaining 23.5% of the variance in intrinsic motivation, 17.1% of the variance in extrinsic motivation, and 16.7% of the variance in amotivation. Test–retest reliability results for final model of PEMS are shown in Table 2. The results revealed substantial levels of test–retest reliability for PEMS and substantial to excellent levels of stability for the subscales (Landis & Koch, 1977).

Table 1
Physical Education Motivation Scale (PEMS) Items and Corresponding Factor Loadings

PEMS item	Factor 1: Intrinsic Motivation	Factor 2: Extrinsic Motivation	Factor 3: Amotivation
Intrinsic Motivation			
I participate in physical education because it is fun	.90		
I participate in physical education because it is interesting	.74		
I find physical education enjoyable	.82		
Extrinsic Motivation			
I try to do well in physical education so my teacher will think I am a good student		.79	
I try hard in physical education because I want a good grade		.61	
I do my best so my physical education teacher will like me		.70	
Amotivation			
I don't see the point in participating in physical education			.62
I don't see why I have to take physical education			.89
Physical education is a waste of my time			.50
Explained Variance	23.5%	17.1%	16.7%

Table 2
Test–Retest Reliability of the Physical Education Motivation Scale (PEMS) and Subscales

	Time 1		Time 2			
Scale/Subscale	***M***	***SD***	***M***	***SD***	***p***	**ICC**
PEMS	36.42	6.47	37.05	6.70	.13	.75
Intrinsic Motivation	16.74	4.18	17.00	3.94	.22	.82
Extrinsic Motivation	13.95	4.62	14.27	4.70	.27	.75
Amotivation	5.73	3.91	5.77	4.11	.86	.73

Physical Education Autonomy, Relatedness, Competence Scale (PE-ARCS)

Similar to PEMS, an exploratory factor analysis was conducted on the PE-ARCS 20-item scale to identify underlying factors. Using the criteria set out by Stevens (2001) and Tabachnick and Fidell (2012) multiple iterations were employed and an acceptable fit model was determined with 3-factor, 12-item solution: 4 autonomy items; 4 relatedness items; 4 competence items (Table 3; Appendix B). A corresponding scree plot verified the solution and eigenvalues for each of the factors were above 1.0 (Stevens, 2001). The final 3-factor, 12-item model resulted in 64.1% of the variance accounted for; explaining 18.6% of variance in autonomy, 23.1% of variance in relatedness, and 22.4% of variance in competence. Test–retest reliability ICCs for the final model of the questionnaire and subscales can be found in Table 4. Similar to PEMS, PE-ARCS demonstrated excellent test–retest reliability (Landis & Koch, 1977).

Table 3
Physical Education Autonomy Relatedness Competence Scale (PE-ARCS) Items and Corresponding Factor Loadings

PE-ARCS item	Factor 1: Autonomy	Factor 2: Relatedness	Factor 3: Competence
Autonomy			
I choose which activities I want to practice	.70		
I make a lot of my own decisions	.57		
I have input in which skills I want to practice	.63		
I am doing what I want	.75		
Relatedness			
My classmates seem to like me		.75	
I really like the people I am with		.74	
I feel my classmates accept me		.81	
I feel connected to my classmates		.76	
Competence			
I am good at the things we do			.78
I am able to perform well			.82
I feel skilled			.79
I am confident in my ability			.59
Explained variance	18.6%	23.1%	22.4%

Table 4
Test–Retest Reliability of the Physical Education Autonomy, Relatedness, and Competence Scale (PE-ARCS) and Subscales

	Time 1		Time 2			
Scale/subscale	***M***	***SD***	***M***	***SD***	***p***	**ICC**
PE-ARCS	62.75	12.35	62.50	11.95	.68	.84
Autonomy	18.90	5.08	18.77	5.48	.65	.81
Relatedness	21.80	4.89	21.69	4.70	.67	.79
Competence	22.05	4.53	22.04	4.42	.98	.74

Discussion

The purpose of this study was to develop, validate, and establish test–retest reliability of two questionnaires, PEMS and PE- ARCS, to assess domain-specific motivational states and psychological need satisfaction in high school physical education contexts. We found initial evidence of validity and reliability of scores from PEMS and PE-ARCS that could be used in high school physical education settings as measures of motivational state and satisfaction of autonomy, relatedness, and competence. The fundamental premise of self-determination theory is that individuals need to feel self-determined, connected and competent within their social environment in order to elevate their levels of motivation and receive the physical, cognitive, and affective benefits (Deci & Ryan, 1985; 2000). In physical education, it is essential the ways in which students are motivated be understood in order to assist physical education programs in providing positive physical activity experiences. Overall, our findings indicate PEMS and PE-ARCS have utility in measuring high school students' motivation and psychological need satisfaction within physical education settings.

The results from exploratory factor analysis revealed that PEMS had a 3-factor structure that represented intrinsic motivation, extrinsic motivation, and amotivation. This 3-factor, 9-item solution accounted for 57.3% of the total variance, which is parallel with measures of motivation within other contexts. For example, the Situational Motivation Scale (Guay et al., 2000), which measures motivation in education settings, accounted for 65% of total variance. One of the largest contributors to explained variance of PEMS was intrinsic

motivation accounting for 23.5% of the variance. This also parallels the finding from the Situational Motivation Scale, in which intrinsic motivation accounted for the greatest amount of variance (35.1%; Guay et al., 2000). The slight differences in total variance accounted for between PEMS and the Situational Motivation Scale (57.3% vs. 65%) and the difference in variance accounted for by intrinsic motivation (23.5% vs. 35.1%) may be attributed to the different study populations. The participants who took part in the study conducted by Guay et al. (2000) were college students engaging in an academic activity in their college library (e.g., reading a book for a course, completing an assignment). As college students might have greater autonomy over educational activities in comparison to students in high school physical education classes, it is likely the students participating in Guay et al. (2000) possess different motivational processes than students in the current investigation. The factor contributing the least explained variance was amotivation, which accounted for 16.7% of explained variance of PEMS. In physical education context, true forms of amotivation are not often attainable, as their physical education teacher monitors students' behaviors and their class grade is dependent on their actions. As such, students may be more extrinsically motivated by teacher acceptance and/or a good grade, which may explain the low accounted variance of amotivation. Although students may not be completely amotivated due to the external pressures, amotivation accounted for 16.7% of explained variance of PEMS, implying that amotivation is an important construct in measuring students' motivation in physical education.

The exploratory factor analysis for PE-ARCS supported a 3-factor, 12-item solution inline with the psychological needs of self-determination theory. PE-ARCS accounted for 64.1% of the variance. Although, all three constructs were strong contributing factors, relatedness emerged as the strongest factor accounting for 23.1% of the explained variance. This finding contradicts other scales measuring self-determination theory constructs in other physical activity settings in which autonomy and competence were stronger factors in comparison to relatedness. For example, Vlacholpoulos and Michailidou (2006) developed and validated the Basic Psychological Needs in Exercise Scale to measure autonomy, relatedness, and competence in exercise settings and found when examining the contribution of relatedness in the prediction of the outcomes, relatedness

did not contribute to the prediction of any of the outcomes. These findings may be explained by Deci and Ryan's (2000) proposition that the need for relatedness in certain situations may be less influential on one's intrinsic motivation, particularly in settings in which people engage in a behavior in isolation, such as exercise settings. Bryan and Solmon (2007) affirm Deci and Ryan's (2000) proposition and suggest that relatedness is thought to be a lesser consequence of intrinsic motivation than autonomy and competence, due to the notion that an individual can be intrinsically motivated to engage in an activity without the connection to another person. However, physical education is a unique context in which 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 in order to intrinsically motivate students in physical education settings. Cox et al. (2009) found students who felt accepted by their classmates and supported by their teacher in physical education experienced a sense of relatedness, which was indirectly associated to motivational consequences such as enjoyment. Moreover, Cox and Williams (2008), Shen, McCaughtry, Martin, and Fahlman (2009) and Standage et al. (2005) reported that physical education teachers' relatedness support was directly associated to students state of motivation. Ferriz, Sicilia, and Saenz-Alvarez (2013) also found the satisfaction of the need for relatedness to be a significant predictor of intrinsic motivation and student satisfaction in physical education. Therefore, the findings of this study confirm the distinctiveness of the physical education context. On this basis, researchers are encouraged to use the PE-ARCS as a measure of self-determination theory constructs within high school physical education contexts to account for the importance of the relatedness construct.

Similar to relatedness, the role of competence and autonomy on students' motivational states in physical education settings is unique to that of other physical activity contexts. Within the literature, perceived competence frequently emerges as a crucial construct in predicting student motivation in physical education (Ferrer-Caja & Weiss, 2000; Ntoumanis, 2001; Standage, Gillison, & Ntoumanis, Treasure, 2012) as the public nature of physical education makes it unlikely for students who doubt their competence in physical activi-

ties to maintain active engaged involvement. Moreover, providing an autonomy-supportive environment in physical education has been shown to be an important factor in positively enhancing one's motivation during physical education class time (Lonsdale et al., 2009; Lonsdale et al., 2013; Prusak, Treasure, Darst, & Pangrazi, 2004; Ward et al., 2008). It must be noted autonomy in physical education is not equivalent to complete independence, rather a level of choice regarding decisions made throughout the lesson (e.g., equipment choices, activity choices; Bryan & Solmon, 2007). This becomes important, as physical education is a distinctive context in which full autonomy cannot be granted due to teacher and curricular responsibilities, which make autonomy in physical education settings unique in comparison to autonomy in other physical activity contexts.

The present study can be considered of importance as it addressed a gap in the literature by developing two domain-specific measures allowing researchers to evaluate students' motivation and psychological need satisfaction in high school physical education programs. While the current findings are indicative of PEMS and PE-ARCS potential to assess students' motivational state and the psychological needs posited by self-determination theory, respectively, a few issues must be acknowledged and future directions outlined. We attempted to develop and validate both questionnaires for high school students in Grades 9–12; however, in the location in which data was collected, physical education programs in Grades 11 and 12 are elective courses. As such, students who choose to enroll in physical education in Grades 11 and 12 may have different motivational processes than those students in mandatory physical education programs. Research has shown a link between motivation and enrolment in physical education programs (Ferrer-Caja & Weiss, 2002; Ntoumanis, 2005), therefore future work should confirm the present findings with samples of Grade 11 and 12 students who are required to participate in physical education as factors such as autonomy may differ among students who willingly enrolled in elective physical education programs. It is also recognized that future work on PEMS and PE-ARCS may require a confirmatory factor analysis for each scale. Confirmatory factor analysis will explicitly test the model proposed by the exploratory factor analysis and is the next logical step in the validation of PEMS and PE-ARCS.

In conclusion, the importance of physical education in fulfilling its principle objective of positively affecting students' physical activity behaviors both in and out of physical education class and establishing positive affective states toward physical activity, is arguably underpinned by understanding student motivation. The low levels of physical activity among youth is becoming a public health concern and physical education programs have been repeatedly and consistently identified as a key setting for the promotion of lifelong activity participation. Our findings provide valid and reliable instruments, which can be used to assist in the understanding of student motivation in high school physical education classes.

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Appendix A

Physical Education Autonomy Relatedness Competence Scale (PE-ARCS)

We are interested in your experiences in physical education (PE) class. Using the scale below, please indicate by circling, to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simple want to know how you personally feel about PE.

When I am in PE...	Strongly disagree			Neutral			Strongly agree
1. My classmates seem to like me	1	2	3	4	5	6	7
2. I am good at the things we do	1	2	3	4	5	6	7
3. I can choose which activities I want to practice	1	2	3	4	5	6	7
4. I really like the people I am with	1	2	3	4	5	6	7
5. I am able to perform well	1	2	3	4	5	6	7
6. I make a lot of my own decisions	1	2	3	4	5	6	7
7. I feel like my classmates accept me	1	2	3	4	5	6	7
8. I feel skilled	1	2	3	4	5	6	7
9. I have input in which skills I want to practice	1	2	3	4	5	6	7
10. I feel connected to my classmates	1	2	3	4	5	6	7
11. I am confident in my ability to learn	1	2	3	4	5	6	7
12. I am doing what I want	1	2	3	4	5	6	7

Codification key: Autonomy items: Items 3, 6, 9, 12; Competence items: Items 2, 5, 8, 11; Relatedness items: Items 1, 4, 7, 10.

Appendix B

Physical Education Motivation Scale (PEMS)

We are interested in your experiences in physical education (PE) class. Using the scale below, please indicate by circling, to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simple want to know how you personally feel about PE.

When I am in PE...	Strongly disagree			Neutral			Strongly agree
13. I participate in PE because it is fun	1	2	3	4	5	6	7
14. I try to do well in PE so my teacher will think I am a good student	1	2	3	4	5	6	7
15. I don't see the point of participating in PE	1	2	3	4	5	6	7
16. I participate in PE because it is interesting	1	2	3	4	5	6	7
17. I try hard in PE because I want a good grade	1	2	3	4	5	6	7
18. I don't see why I have to take PE	1	2	3	4	5	6	7
19. I find PE enjoyable	1	2	3	4	5	6	7
20. I do my best so my PE teacher will like me	1	2	3	4	5	6	7
21. PE is a waste of my time	1	2	3	4	5	6	7

Codification key: Intrinsic motivation items: Items 1, 4, 7; Extrinsic motivation items: Items 2, 5, 8; Amotivation: Items 3, 6, 9