Need Support, Need Satisfaction, Intrinsic Motivation, and Physical Activity Participation among Middle School Students

Tao Zhang¹, Melinda A. Solmon², Maria Kosma², Russell L. Carson², Xiangli Gu²
¹University of North Texas, ²Louisiana State University

Using self-determination theory as a framework, the purpose of this study was to test a structural model of hypothesized relationships among perceived need support from physical education teachers (autonomy support, competence support, and relatedness support), psychological need satisfaction (autonomy, competence, and relatedness), intrinsic motivation, and physical activity. Participants were 286 middle school students in the southeastern U.S. They completed previously validated questionnaires assessing their perceived need support from teachers, need satisfaction, intrinsic motivation, and physical activity. The hypothesized model demonstrated a good fit with the data ($RMSEA = .08; CFI = .97; NFI = .96; GFI = .96$). Need satisfaction and intrinsic motivation mediated the relationship between need support and physical activity. The constructs of perceived autonomy, competence, and relatedness represent the nutrients that facilitate students’ intrinsic motivation and ultimately positively predict students’ physical activity. The findings supported the theoretical tenets of self-determination theory.

Keywords: Self-determination theory, supportive environment, achievement motivation

According to Healthy People 2010, participation in regular physical activity has been identified as an influential factor in promoting health for people of all ages (U.S. Department of Health and Human Services [USDHHS], 2000). Despite the extensive evidence of the health benefits of regular physical activity participation (Bouchard, Blair, & Haskell, 2007), the majority of U.S. adolescents do not meet national guidelines for physical activity (60 min or more of moderate to vigorous physical activity on a daily basis), and the prevalence of obesity and overweight has been steadily increasing in this group (Centers for Disease Control and Prevention).
Zhang, Solmon, Kosma et al. (CDC), 1997; Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). Given that the physical activity behaviors developed during adolescence have a long-term influence on lifelong physical activity habits (Daley, 2002), the prevalence of physical inactivity and increased levels of obesity among adolescents call for immediate actions (National Association for Sport and Physical Education [NASPE], 2004; USDHHS, 2008).

School physical education programs should provide favorable environments that introduce adolescents to beneficial lifestyle behaviors and encourage adolescents to engage in physical activity regularly (NASPE, 2004; USDHHS, 2008). Further, positive student motivation in physical education could prompt adolescents to adopt physically active lifestyles as adults (Daley, 2002). Despite the assertion that school physical education can play a vital role in the promotion of adolescents’ physical activity, to date researchers have not fully investigated the multifaceted social environmental factors that influence physical activity participation within the physical education setting (Chatzisarantis, Hagger, & Smith, 2007; Hagger et al., 2009). To encourage school students to adopt and maintain a physically active lifestyle, a complete understanding of the social variables that support students’ motivation becomes a critical issue for those interested in the promotion of adolescents’ physical activity.

**Self-Determination Theory**

Self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000) is a promising theoretical framework for explaining adolescents’ physical activity motivation and behavior. Deci and Ryan (1985) proposed a self-determination continuum, ranging from intrinsic motivation (full self-regulation and engagement in activities for their own sake) to amotivation (absence of motivation and lack of intention). Four levels of extrinsic motivation, including integrated regulation (very high degree of self-regulation), identified regulation (moderately high degree of self-regulation), introjected regulation (moderately low degree of self-regulation) and external regulation (very low degree of self-regulation), fall between these two extremes on the continuum.

Based on SDT (Deci & Ryan, 1985; Ryan & Deci, 2000), the most desirable and long lasting level of motivation is *intrinsic motivation*. Intrinsic motivation refers to highly autonomous behaviors whereby an individual engages in physical activity for the inherent feeling of pleasure, accomplishment, and the experience of learning new things. When individuals are intrinsically motivated, they choose to engage in an activity for its own sake rather than for an external reason. That is, intrinsic motivation is considered to be the most desirable form of motivation regarding adherence because physical activity participation is based on appreciation of the activity itself rather than appreciation for benefits provided by the activity. Dimensions of intrinsic motivation representing the same degree of self-determination have been identified by Pelletier and his colleagues (Pelletier, Fortier, Vallerand, Tuson, & Brière, 1995), include motivation to know, motivation to accomplish, motivation to experience stimulation and pleasant sensations.

In contrast, extrinsic motivation refers to activities that are carried out as a means to an end that is valued (e.g., praise, extrinsic reward) and not for the sake of the activity itself (Deci & Ryan, 1985). According to SDT, extrinsic motivation
is multidimensional in nature and comprises four dimensions: integrated regulation (behaviors that are performed out of choice to harmonize and bring coherence to different parts of the self), identified regulation (behaviors that are highly valued and performed out of choice), introjected regulation (behaviors that individuals perform to achieve social recognition or avoid internal pressures and feelings of guilt), and external regulation (behaviors regulated through external means, such as rewards or constraints). Finally, amotivation refers to the absence of both intrinsic and extrinsic motivation and represents a complete lack of self-determination and volition with respect to the targeted behavior (Deci & Ryan, 2000).

According to SDT, intrinsic motivation is the most enduring and long lasting form of motivation (Ryan & Deci, 2000). Most physical activities tend to elicit a high degree of intrinsic motivation, but extrinsic motivation may be the incentive for some physical activities (Frederick-Recascino & Ryan, 1993; Ryan, Frederick-Recascino, Lopes, Rubio, & Sheldon, 1997). For example, some children may engage in various forms of physical activity for external reasons, such as pleasing their parents, because they are forced to participate (such as mandatory physical education classes) or as a result of some other form of external pressure. When the external forces are no longer influential, individuals will most likely withdraw from the activity. Although understanding the progression from extrinsic motivation to more internalized and self-regulated forms such as intrinsic motivation is an important area of investigation, we chose in this study to focus on exploring motivational constructs that foster intrinsic motivation that should lead to long term engagement in physical activity.

**Psychological Need Satisfaction**

Three innate psychological needs for autonomy, competence, and relatedness are central concepts within SDT to understand the initiation and regulation of behavior (Deci & Ryan, 2000). These three psychological needs for autonomy, competence, and relatedness have been combined into a composite variable labeled psychological need satisfaction (Ryan & Deci, 2000). Self-determination theory proposes that human beings always choose their behavior in an attempt to satisfy their basic psychological needs. Specifically, autonomy refers to the need for individuals to decide their own behavior and engage in activities of their own choice. Competence is described as an individual’s striving or need to experience a sense of accomplishment, achievement, or success. Relatedness is defined as an individual’s attempts to have a satisfying and coherent involvement with others or to the feeling that one belongs to a given social milieu.

According to SDT, satisfying or fulfilling these needs is the mechanism through which individuals move toward more self-determined motivation, and should promote an individual’s enjoyment of activities and the autonomous self-regulation of behaviors (Deci & Ryan, 2000; Ryan & Deci, 2000). For example, people are more likely to be intrinsically motivated, that is, to do an activity simply for the enjoyment they derive from it, when they can freely choose to pursue the activity (autonomy), when they master the activity (competence), and when they feel connected and supported by important people, such as a teacher or classmates (relatedness). Empirical research has shown that all three needs are relevant to the physical education context because students want a choice of activities, strive to
feel efficacious in these activities, and seek to be accepted by their teachers and peers while performing them (Ntoumanis, 2001, 2005; Standage, Duda, & Ntoumanis, 2005).

Hierarchical Model of Motivation

The antecedents and outcomes of different types of motivation have been outlined by Vallerand (2000) in his hierarchical model of motivation. This hierarchical model of motivation is framed in terms of social environmental variables that affect feelings of autonomy, competence, and relatedness and, in turn, different types of motivation and motivational consequences (Vallerand, 2000). It can be expressed through a chain of processes as follows: “social environment factors → psychological need satisfaction → types of motivation → consequences” (Vallerand, 1997, 2000; Ntoumanis, 2001).

Specifically, social environmental factors, such as the degree of autonomy support, competence support, and relatedness support created by physical education teachers in class, can play an important role in shaping and promoting self-determined motivation if they satisfy the three innate psychological needs for autonomy, competence, and relatedness (Standage et al., 2005). Social environmental variables that support the satisfaction of these basic psychological needs should promote an individual’s enjoyment of activities and the autonomous self-regulation of behaviors (Ryan & Deci, 2002). Finally, different types of motivation lead to important cognitive, affective, and behavioral consequences. Collectively, meeting the basic psychological needs satisfaction for autonomy, competence, and relatedness are hypothesized to mediate the relationship between perceived social environmental factors and different types of motivation. In turn, self-determined motivation is purported to affect cognitive, affective, and behavioral consequences such as intention to be active, enjoyment, and physical activity participation (Ryan, Williams, Patrick, & Deci, 2009).

Based on the hierarchical model of motivation, the motivational sequence of “social environment factors → psychological need satisfaction → types of motivation → consequences” can be extensively applied to physical activity settings (Vallerand, 2000). For instance, Ntoumanis (2001) reported that social environmental factors, including cooperative learning, self-referenced improvement, and choices of tasks, were positively related with students’ perceived competence, autonomy, and relatedness in physical education classes. Ntoumanis (2005) also found that autonomy support provided by the physical education teachers was related to student need satisfaction, which in turn predicted self-determined motivation. Standage, Duda, and Ntoumanis (2003) reported that perceptions of an autonomy-supportive climate positively influenced hypothesized mediating variables (i.e., autonomy, competence, relatedness) to foster self-determined motivation. Research evidence also supports the notion that students participating in an autonomy-supportive physical activity class are more likely to be intrinsically motivated to be physically active in their leisure time (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005).

Taken together, sufficient empirical evidence has provided support for the utility of self-determination theory and the hierarchical model of motivation in physical activity settings (i.e., Edmunds, Ntoumanis, & Duda, 2006; Goudas &
Biddle, 1994; Ntoumanis, 2005). There is, however, limited empirical evidence of the relationships between a multifaceted social environment (i.e., autonomy support, competence support, and relatedness support from physical education teachers) and physical activity through psychological need satisfaction (i.e., autonomy, competence, and relatedness) and self-determined motivation among adolescent middle-school students (Standage et al., 2005). Thus, more investigation is needed to explore the influences of social environmental factors on behavioral outcomes (e.g., students’ physical activity participation within and beyond school settings), with psychological need satisfaction and intrinsic motivation in physical education being tested as potential mediators. By adopting a self-determination theory perspective, it may be possible to elucidate the motivational process by which need support influences need satisfaction, intrinsic motivation in physical education and engagement in health-related behavior such as physical activity participation. Identifying the mediator effects of need satisfaction and intrinsic motivation on physical activity using structural equation modeling (SEM) has the potential to facilitate our understanding of positive physical activity behavior change among adolescents.

It should be noted that a mediator, or intervening variable, is on the causal pathway between an independent variable and a dependent variable (see Figure 1; Bauman, Sallis, Dzewaltowski, & Owen, 2002). The independent variable is conceptualized as a cause of the mediator, which in turn influences the dependent variable (Wu & Zumbo, 2008). According to Baron and Kenny (1986), a variable functions as a mediator when the following three criteria are met: (a) the independent variable significantly affects the presumed mediator (path A); (b) the mediator significantly predicts the dependent variable (path B); (c) when the above two effects are controlled, “a previously significant relationship between the independent and the dependent (outcome) variable is no longer significant, with the strongest demonstration of mediation occurring when path C is zero” (p. 1176). That is, a mediator is a variable that is necessary to complete a cause-effect link between independent variable such as need support from physical education teachers and dependent variable such as physical activity (Baron & Kenny, 1986; Bauman et al., 2002). There may be a single mediator between independent variable and dependent variable (Mediator 1), or a series of cascading mediators (Mediator 1, Mediator 2) that intervene and are related in sequence (path D) between independent variable and dependent variable (see Figure 1).

Based on the hierarchical model of motivation and previous studies, psychological need satisfaction and intrinsic motivation will be two mediators between need support from physical education teachers and students’ physical activity in this study (Vallerand, 2000; Ntoumanis, 2001). Although other individual factors (e.g., self-efficacy, enjoyment), social factors (e.g., peer support and family support), physical environment factors (e.g., safety, equipment accessibility) may predict students’ physical activity participation within and beyond school setting (Sallis & Owen, 2002), more attentions need to focus on social support from physical education teachers since physical education teachers play a vital role in the promotion of adolescents’ physical activity in the school setting (McKenzie, 2001; McKenzie, Marshall, Sallis, & Conway, 2000).

The purpose of this study, therefore, was to examine the relationship between need support from physical education teachers (autonomy support, competence support, and relatedness support) and physical activity through need satisfaction
(meeting basic psychological needs) and intrinsic motivation by testing a theoretical model based on the self-determination theory and Vallerand’s (2000) proposed motivational sequence. Specifically, it was hypothesized that: (a) need support from physical education teachers (autonomy support, competence support, and relatedness support) would positively predict students’ psychological need satisfaction (autonomy, competence, and relatedness); (b) students’ psychological need satisfaction (autonomy, competence, and relatedness) would positively predict their intrinsic motivation in physical education; and (c) students’ intrinsic motivation in physical education would positively predict students’ physical activity participation within and beyond school settings. It was expected that need satisfaction (autonomy, competence, and relatedness) and intrinsic motivation would mediate the relationship between perceived need support from physical education teachers (autonomy support, competence support, and relatedness support) and physical activity among middle-school physical education students.

Method

Participants and School Setting

Participants were 286 middle school students (95 sixth graders; 99 seventh graders; 92 eighth graders; 143 girls, 143 boys; \( M_{age} = 13.4 \) years, \( SD = 1.0 \)) from a suburban...
public school in the southeastern U.S. Data were collected from nine different physical education classes. Permission to conduct this study was obtained from the university’s institutional review board, the school district, the school principal, and the physical education teachers. In addition, parental consent and child assent forms were obtained from all participants before starting the study.

Three certified physical education teachers taught the 90-min physical education classes on alternate days. These physical education teachers taught a class in the three different classes of each grade and shared the same teaching assignments in each grade. They had more than 15 years teaching experience in public school settings. The typical curriculum activities consisted of a variety of cooperative games and sport skills, including capture the flag, jogging, tennis, and other physical fitness activities. The typical instructional protocol in the class included taking class attendance when students arrived in the gym, followed by student participation in some warm-up and physical activities. A general class included explaining and demonstrating basic motor skills to be learned, organizing and monitoring students for practice during the middle of the class, and providing and offering instant feedback to the students at the end of the class. During the period of the data collection, all the students participated in tennis classes on outdoor courts.

**Instrumentation**

**Demographic Variables.** Self-reported information on grade, age, sex, and race were obtained from the questionnaires to characterize the sample.

**Perceived Need Support.** Perceived autonomy support, perceived competence support, and perceived relatedness support were assessed using three previously validated scales. **Perceived autonomy support** was measured using the six-item physical education-modified health care climate questionnaire (HCCQ; Williams, Grow, Freedman, Ryan, & Deci, 1996). Example items include “My physical education teacher listens to how I would like to do things” and “My physical education teacher encourages me to ask questions.” To assess the degree of the participants’ **perceived competence support** in physical education, four items based on the recommendation of Standage et al. (2005) were used. A sample item is “The physical education teacher makes us feel like we are able to do the activities in class.” Additionally, to assess students’ **perceived relatedness support**, a five-item scale was used (Standage et al., 2005). “The physical education teacher encourages us to work together in practice” is an example item. The participants responded to these items on scales ranging from 1 (strongly disagree) to 7 (strongly agree). Each item followed the stem “In my physical education class.” Evidence for the reliability of these three scales has been provided by Standage et al. (2005), and the three scales were shown to have adequate internal reliability coefficients in this study (see Table 1).

**Perceived Need Satisfaction.** Three previously validated scales were used to assess participants’ perceived autonomy, competence, and relatedness. **Perceived autonomy toward physical education** was assessed using a six-item scale devised by Standage et al. (2005). Preceded by the stem “In my physical education class,” the participants responded to items such as “I can decide which activities I want to practice” and “I feel a certain freedom of action.” **Perceived competence** was
measured using five items from the perceived competence subscale of the Intrinsic Motivation Inventory (Ryan, 1982). Reworded to target the physical education context, exemplar items are “I think I am pretty good at physical education” and “I am pretty skilled at physical education.” Additionally, the participants’ perceived relatedness was measured using the physical education-modified subscale of the Need for Relatedness Scale (Richer & Vallerand, 1998). Preceded by the stem “With the other students in this physical education class I feel,” the participants responded to five items such as “supported,” “understood,” and “valued.” Participants responded to all of these items using a 7-point Likert-type scale anchored by 1 (strongly disagree) to 7 (strongly agree). Using Cronbach’s Alpha coefficients, previous work with similar-aged British children in physical education has supported the internal reliability of these three scales (Standage, Duda, & Ntoumanis, 2006), and the three scales had adequate internal reliability coefficients in this study (see Table 1).

**Intrinsic Motivation.** Students’ intrinsic motivation in physical education was assessed using a four-item questionnaire devised and used by Goudas and Biddle (1994). The stem for the four items was “I take part in my physical education class.” Example item included “because physical education is fun,” and “because of the enjoyment that I feel while learning new skills or techniques.” This questionnaire reflect 7-point Likert-type scales with responses ranging from 1 (strongly disagree) to 7 (strongly agree), and previous studies have supported the internal consistency of this scale by using Cronbach’s Alpha Coefficients (Goudas & Biddle, 1994). The internal consistency of this scale for the present sample was satisfactory (see Table 1).

**Physical Activity.** The Physical Activity Questionnaire for Older Children (PAQ-C) was used to assess students’ levels of physical activity within and beyond school.
settings (Kowalski, Crocker, & Faulkner, 1997). It is a 7-day recall questionnaire intended to assess moderate to vigorous physical activity in older children beyond grade three. The PAQ-C composite is calculated as the mean of the nine items, and all items from the PAQ-C were scored on appropriate scales for each item (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997; Kowalski, Crocker, & Faulkner, 1997). The PAQ-C is a reliable measure of physical activity for grade four students and beyond (Sallis, Buono, Roby, Micale, & Nelson, 1993). Using Cronbach’s Alpha Coefficients, the internal reliability of this scale for the present sample was satisfactory (see Table 1).

**Procedures**

The questionnaires were administered at the start of a regular physical education class. Before questionnaire administration, participants were informed that there were no right or wrong answers, and that they could decline to participate in the study or withdraw at any time. The students were also told that their physical education teachers would not have access to their responses. The researchers distributed the questionnaires and helped the participants who had questions pertaining to the wording of any of the items. Students completed the questionnaires in approximately 20 min.

**Data Analyses**

Using the Statistical Package of the Social Sciences (SPSS 16.0), internal consistency estimates and descriptive statistics were calculated on all study variables. Pearson correlations were also computed to examine the bivariate relationships of the variables. Using AMOS 16.0, a SEM analysis with maximum likelihood estimation was conducted to examine the hypothesized model in Figure 2. Based on the factor analytic-structural equation modeling approach, confirmatory factor analysis was first conducted on the study variables to verify the measurement model. After examining the measurement model, the relationships among the latent variables (need support and need satisfaction) and observed variable (intrinsic motivation and physical activity) were examined by using structural equation modeling in Figure 2. It is considered that following the standard steps (running both the measurement and structural models) is the strongest approach in modeling testing.

SEM is an advanced and powerful statistical method used for specifying and estimating models of linear relationships among variables (MacCallum & Austin, 2000). SEM is similar to regression (and other correlational methods) because it belongs to the general linear model family, but it is not a causal modeling. Comparing with other correlational methods, SEM allows all independent and dependent variables to be examined simultaneously and allows researchers to test indirect, direct, and total effect in a complex model (including relationships between latent variables and multiple observed variables). Maximum likelihood estimation was used in the SEM analyses because it has been recommended for research regarding theory testing, and it can provide efficient parameter estimates and global indices of model fit (Browne & Cudeck, 1993). In line with the recommendation of Hu and Bentler (1999), various indices of fit were examined to evaluate the adequate fit of the model to the data. These indices included chi-square statistic ($\chi^2$), the
Figure 2 — Hypothesized Model of the Variables. Note. Solid lines represent significant standardized parameter estimates. Circles represent latent variables, squares represent observed variables (or indicators of the latent variables).
Comparative Fit Index (CFI), Bentler-Bonett Nonnormed Fit Index (NFI), Goodness of Fit Index (GFI), and the Root Mean Square Error of Approximation (RMSEA).

It should be noted that latent variables, such as perceived need support and need satisfaction in this study, reflect concepts the researchers formulate based on SDT theory and previous studies. The measurement model of the hybrid model is sufficient to justify the structure of the latent variables and support the construct validity of the constructs (Kline, 2005), so we have chosen not to include confirmatory factor analyses. These constructs have been tested and used in a series of published studies and their validity and reliability for middle school students has been established (Standage et al., 2005, 2006). In addition, given the research purpose and variable conceptualization (e.g., average score for each variable), and in light of the sample size, intrinsic motivation, perceived autonomy support, perceived competence support, perceived relatedness support, perceived autonomy, perceived competence, perceived relatedness were treated as observed rather than latent variables in the current study. Previous work with similar-aged British children in physical education has also followed the same procedures to simplify the models (Standage et al., 2005).

Results

Descriptive Analyses and Scale Reliability

Alpha coefficients and descriptive statistics for each measure are presented in Table 1. As shown, self-report measures demonstrated acceptable levels of reliability, exceeding Nunnally’s (1978) criterion of .70. The mean scores of the self-reported variables were above the midpoint, showing positive perceptions of the study constructs and participation in some forms of physical activity.

Pearson bivariate correlations were computed to determine the relationships among need support from physical education teachers, need satisfaction, intrinsic motivation in physical education, and physical activity participation. These values are presented in Table 1. As shown, all correlations between the variables are positive and significant at the $p < .01$ level. Consistent with the theoretical prediction, need support was positively correlated with need satisfaction, intrinsic motivation, and physical activity participation. Need satisfaction was positively associated with intrinsic motivation and physical activity participation. Further, intrinsic motivation in physical education was also positively related with physical activity participation in the current study.

Structural Equation Model

Before testing the proposed structural model, a confirmatory factor analysis was conducted to test whether each proposed latent variable can explain the covariance among its observed variables. After the measurement model was confirmed, a structural equation model was tested to examine the hypothesized structural relations among the latent variables. The measurement model comprised two factors representing need support and need satisfaction, and other variables (perceived autonomy support, perceived competence support, perceived relatedness support,
perceived autonomy, perceived competence, perceived relatedness, intrinsic motivation, and physical activity) were treated as observed variables.

To evaluate the fit of the model to the data, various indices of fit were examined. Specifically, chi-square statistic ($\chi^2$) tests whether there is a statistically significant difference between model and sample data and degrees of freedom ($df$) for each model estimated. Given that $\chi^2$ can be heavily influenced by sample size, the $\chi^2/df$ ratio may also be reported. In health behavior research studies, $\chi^2/df$ ratios between 2 and 5 have often been employed (Buhi, Goodson, & Neilands, 2007). In addition, possible values for CFI, NFI, and GFI fit indices range between 0 and 1. CFI, NFI, and GFI values greater than .90 indicate a good fit of the model to the data, and values greater than .95 are typically considered an excellent fit (Hu & Bentler, 1999). Further, values less than .08 obtained from the RMSEA suggest a well-fit model, whereas values exceeding .10 are typically undesirable (Browne & Cudeck, 1993; West, Finch, & Curran, 1995).

The fit indices indicated that the measurement model adequately described the data (e.g., $\chi^2/df = 2.5 < 5; \text{RMSEA} = .07; \text{CFI} = .99; \text{NFI} = .98; \text{GFI} = .98; \text{Hu} \& \text{Bentler}, 1999; \text{Kline}, 2005; \text{MacCallum}, \text{Browne}, \& \text{Sugawara}, 1996). Further, it was evident that the standardized factor loadings of the observed variables on their respective latent variables were positive and exceeded the widely recognized criterion of .40 (Ford, MacCallum, & Tait, 1986), indicating the construct validity of the model latent variable was accepted and the measurement model was supported.

Based on the robust fit of the measurement model, a SEM analysis (AMOS 16.0) was used to test the structural model to examine the relationships between observed variables and latent variables, and the interactions among latent variables. Based on the goodness-of-fit statistics, the sample covariance matrix exhibited an acceptable fit to the hypothesized structural model (e.g., $\chi^2/df = 2.8 < 5; \text{RMSEA} = .08; \text{CFI} = .97; \text{NFI} = .96; \text{GFI} = .96; \text{Hu} \& \text{Bentler}, 1999; \text{MacCallum et al.}, 1996). Figure 3 represents the standardized parameter estimates of the model. All parameter estimates were statistically significant ($p \leq .05$) with appropriate magnitude and direction. Perceived need support had a large influence on perceived need satisfaction ($\beta = .89$), and perceived need satisfaction had a large influence on intrinsic motivation ($\beta = .75$). Similarly, intrinsic motivation had a significant influence on physical activity ($\beta = .43$). The variance explained in the dependent variables by the model was as follows: $\eta^2$ for physical activity = 19%, $\eta^2$ for intrinsic motivation = 56%, and $\eta^2$ for need satisfaction = 80%. The indirect effects of need support on intrinsic motivation and physical activity (.67 and .29, respectively) and the indirect effect of need satisfaction on physical activity (.32) were moderate to large and thus the mediating role of need satisfaction and intrinsic motivation on physical activity was supported (Baron & Kenny, 1986).

**Discussion**

The purpose of this study was to further our understanding of students’ motivation and physical activity by examining the relationship between need support from physical education teachers and physical activity through need satisfaction and intrinsic motivation based on the self-determination theory. The analyses revealed positive and significant correlations between the variables. Need support from
Figure 3 — Final Model of the Variables (all paths are significant). Note. Solid lines represent significant standardized parameter estimates. Circles represent latent variables, squares represent observed variables (or indicators of the latent variables).
physical education teachers, need satisfaction, intrinsic motivation in physical education, and students’ physical activity participation were positively correlated with one another in the current study. Further, the hypothesized model fit the sample covariance matrix, supporting the hierarchical model of motivation (Vallerand, 2000). In addition, the mediating role of need satisfaction and intrinsic motivation on physical activity was supported.

In accordance with the hypotheses, the findings of this study demonstrated that perceived need support from physical education teachers positively related to the students’ autonomy, competence, and relatedness, predicting their overall psychological need satisfaction. Further, there were positive relationships among need support from physical education teachers, students’ intrinsic motivation, and physical activity participations. The results revealed the importance of supportive environments created by physical education teachers on students’ psychological need satisfaction, intrinsic motivation, and physical activity.

From a practical perspective, these findings indicate that providing supportive environments can meet students’ psychological needs (Hagger & Chatzisarantis, 2007). Specifically, physical education teachers can structure autonomy supportive environment by listening to students’ concerns, making activities accessible to all, and asking students for activity-related ideas and input. Promoting challenging but realistic tasks, providing constructive feedback, setting attainable goals, and emphasizing self-referenced standards and self-improvement are strategies that physical education teachers can use to allow students the opportunity to achieve a sense of success and maintain positive perceptions of competence. When physical education teachers focus on cooperative learning (e.g., small group activities) by establishing peer-learning groups and structuring opportunities for positive peer interaction, they are likely to enhance students’ perceptions of relatedness (Ntoumanis, 2001, 2005; Standage et al., 2005). The results of this study suggest that when teachers employ these strategies effectively, their students’ psychological needs are met.

The results also showed that need satisfaction predicted students’ intrinsic motivation in physical education. It was also evident that there were significant positive relationships between need satisfaction and students’ physical activity participation. The constructs of perceived autonomy, competence, and relatedness represent the nutrients that facilitate students’ intrinsic motivation and motivational behavior such as physical activity participation. This result is consistent with the tenets of self-determination theory (Deci & Ryan, 1985), and is also consistent with recent work with regard to similar-aged British children in physical education (Ntoumanis, 2005; Standage et al., 2005, 2006). Based on these findings, physical education teachers should focus on helping students choose the right physical activities for them, involving them as much as possible in the decision-making process, selecting physical activities in which students can learn and make progress, and encouraging them to develop good relationships with their classmates in physical education classes (Standage et al., 2005). In doing so, students’ three innate psychological needs can be met and their intrinsic motivation can be fostered.

Intrinsic motivation in physical education positively predicted students’ physical activity participation within and beyond school settings, which is also consistent with our hypotheses. This finding makes conceptual sense, because students who enjoy physical education and appreciate the benefits of physical education will be
School Students’ Motivation and Physical Activity

more likely to participate in physical activity within and beyond school physical education, compared with those who are extrinsically motivated to be physically active, or feel pressured to participate in physical education classes. This result and the findings from similar studies suggest that physical education teachers should promote students’ high levels of intrinsic motivation in quality school-based physical education programs, which should foster students’ regular physical activity participation beyond the school setting (Standage et al., 2005, 2006).

Taken together, the present research revealed that need support from physical education teachers positively related to the students’ psychological need satisfaction, intrinsic motivation in physical education, and students’ physical activity participation within and beyond school settings. And students’ psychological need satisfaction, intrinsic motivation in physical education mediated the relationships between need support from physical education teachers and students’ physical activity participation, which is consistent with our hypotheses and Vallerand’s (2000) proposed motivational sequence. That is, physical education teachers’ need support significantly predicted students’ psychological need satisfaction and intrinsic motivation in physical education, which in turn predicted students’ physical activity participation. There was no significant direct relationship between physical education teachers’ need support and students’ physical activity participation, indicated physical education teachers should create a supportive environment in schools to increase students’ perceptions of psychological need satisfaction and intrinsic motivation, which in turn promote students’ physical activity participation.

Clearly, the current study provides empirical support for the hypotheses, and provides a solid basis for further study. Subsequent research efforts should be designed to address inherent limitations in this study, as well as to extend this line of inquiry. First, similar to previous studies (Ntoumanis, 2001, 2005; Standage et al., 2005, 2006), we relied on self-report physical activity rather than an objective measure. Incorporation of more objective measures of physical activity such as accelerometers, heart rate monitors, or pedometers would provide a more valid assessment of physical activity levels. Second, more studies should examine the influence of additional social environmental factors such as parents’ and friends’ influence on students’ motivation and physical activity behavior (Zhang, Solmon, Gao, & Gu, 2009). Finally, the cross-sectional research design limits the causal inferences in the current study because this correlational research cannot draw the causal conclusions by using SEM analyses. Longitudinal research or a prospective research design is needed to investigate the temporal relations among need support from physical education teachers, need satisfaction, student motivation in physical education, and physical activity across the school year.

In conclusion, the findings of this study highlight the importance of a need-supportive environment. Perceived need support from physical education teachers can promote middle-school students’ physical activity participation by meeting their psychological needs and enhancing their intrinsic motivation in physical education. The constructs of need satisfaction (i.e., perceived autonomy, competence, and relatedness) represent the nutrients that facilitate students’ intrinsic motivation and ultimately positively affect students’ physical activity. Collectively, the results of this study support the tenets of the self-determination theory and provide useful insights for physical education teachers, health promotion professionals, and researchers.
References


