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Associations between Adolescents' Situational Motivation and Objectively-Determined Physical Activity Levels in Physical Education

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Abstract

Purpose: This study aimed to examine the predictive strength of adolescents' situational motivation to their physical activity physical activity levels in physical education. **Method:** A total of 259 middle school students ranging from 11 to 14 years old participated in the study. Participants completed the Situational Motivation Scale in one class. Their PA levels were then assessed by pedometers and Actical® accelerometers for three days. Physical activity levels were quantified as steps per minute for pedometers and percentages of time in sedentary behavior as well as light physical activity and moderate-to-vigorous physical activity for accelerometers. **Results:** Multiple regression analyses yielded adolescents' intrinsic motivation was the only positive predictor for their time in moderate-to-vigorous physical activity (ß = .22, $p < .05$), and a significant negative predictor in sedentary behavior (ß = -.28, $p < .01$). Additionally, amotivation negatively predicted steps per minute (ß = -.15, $p < .05$). **Conclusion:** Physical educators should identify effective strategies to enhance adolescents' intrinsic motivation.

Keywords: *amotivation, external regulation, identified regulation, intrinsic motivation, moderate-to-vigorous physical activity*

Introduction

It has been well-documented that regular physical activity participation is positively related to health-related physical fitness (Centers for Disease Control and Prevention [CDC], n.d.). For instance, Davy, Harrell, Stewart, & King (2004) indicated a graded and negative relationship exists between Body Mass Index (BMI) and physical activity. Indeed, increasing

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individuals' physical activity levels is also associated with the prevention of weight gain over time (DiPietro, 1999; Welk & Blair, 2000) and the maintenance of weight loss (Grundy et al., 1999). However, school students do not participate in recommended amounts of PA—60 minutes of moderate-to-vigorous physical activity (USDHHS, 2008, 2010)—which has led to a remarkable increase in the prevalence of obesity and diabetes among this population (CDC, n.d.; Daniel, 2006). Therefore, promoting school students' physical activity levels in the U.S. has become a challenging yet imperative task to improve national health.

Physical education is regarded as an important means to promote students' overall physical activity levels given the fact that nearly 95% of youth in the U.S. attend school. For example, students enrolled in physical education were more likely to achieve the recommended levels of moderate and/or vigorous physical activity compared to students who were not enrolled (Gordon-Larsen, McMurray, & Popkin, 2000; Myers, Strikmiller, Webber, & Berenson, 1996; Pate, Ward, O'Neill, & Dowda, 2007; Tassitano et al., 2010). Furthermore, research has also shown that students' regular participation in physical education class can lead to a significant increase in their health and fitness (Sallis et al., 2012).

Positive motivation towards physical education has been indicated as an important contributor to youths' active engagement in physical education class (Parish & Treasure, 2003). Nevertheless, there has been a decline in students' positive motivation and physical activity participation in physical education settings (e.g., Parish & Treasure, 2003; Shen, Rinehart-Lee, McCaughtry, & Li, 2012). For example, most physical education classes did not provide sufficient activity for a child or adolescent to reach the goal of spending 50% of class time in moderate-to-vigorous physical activity participation recommended by National Association for Sport and Physical Education (NASPE, 2004). Thus, examining youths' motivation for actively engaging in physical activity during physical education is important—especially during adolescence when physical activity levels decline among both sexes (Riddoch et al., 2004). Further, if this examination is carried out within the framework of an established psychological theory, the study may be able to better provide physical educators practical recommendations for promoting a higher quality of physical activity during physical education.

The application of self-determination theory (SDT; Ryan & Deci, 2000) has been successful in the explanation of individual's motivation at different levels (i.e., situational motivation, contextual motivation, and global motivation) and achievement behaviors in education and sport settings. Therefore, it has been suggested that the situational motivation in SDT—referring tothe motivation individuals experience when participating in an activity—be used to understand students' initiation and regulation of behaviors in physical education (Bryan & Solmon, 2007). In past applications of the SDT within the physical education setting, four factors of the theory have been considered important for situational motivation (Gao, Hannon, Newton, & Huang, 2011). These four factors are intrinsic motivation (i.e., participation in activities for their own sake), identified regulation (i.e., behaviors that occur when individuals accept certain activities as important to their personal goals and values), external regulation (i.e., actions that are carried out in order to gain an external reward or avoid punishment), and amotivation (i.e., a lack of intention and a relative absence of motivation). Both intrinsic motivation and identified regulation refer to higher

levels of self-determined motivation and lead to positive consequences, while external regulation and amotivation represent lower levels of self-determined motivation and result in negative consequences. In the physical education setting, students with high levels of self-determined motivation tend to be more attentive during the learning process (Ryan & Deci, 2009). For example, students having higher intrinsic motivation and identified regulation reported greater effort and higher concentration in activities during physical education. By contrast, students displayed boredom in physical activity participation when they had dominant amotivation (Gao, Hannon, Newton, & Huang, 2011; Ntoumanis, 2001, 2005). To date, many studies have objectively assessed students' physical activity participation in physical education classes when examining the relationship between their situational motivational motivation and physical activity (Ding, Sun & Chen, 2013; Gao et al., 2011; Parish & Treasure, 2003). This is unsurprising given the fact both accelerometers and pedometers have proven valid and reliable in the assessment of youth physical activity levels (Colley & Tremblay, 2011; Gao et al.,, 2010; Heil, 2006; Puyau, Adolph, Vohra, Zakeri, & Butte, 2004; Schneider, Crouter, Lukajic, & Bassett, 2003). However, few studies have employed both pedometers and accelerometers simultaneously, along with a survey of situational motivation, when taking this perspective. For example, Gao et al. (2011) only used accelerometers to explore the relationship between students' situational motivation and moderate-to-vigorous physical activity, and Parish and Treasure (2003) only used pedometers to examine the association between their motivational beliefs and physical activity levels.

Therefore, this study aimed to examining (a) whether children would meet the recommendation of 50% of class time spent in moderate-to-vigorous physical activity (Gao, Oh, & Sheng, 2011; NASPE, 2004; Pate, Wang, Dowda, Farrell, & O'Neill, 2006); (b) the correlations between adolescents' situational motivation (intrinsic motivation, identified regulation, external regulation, and amotivation) and physical activity levels in physical education; and (c) the predictive strengths of the adolescents' situational motivation to their physical activity levels. Based on the SDT and empirical findings, it was hypothesized that students' intrinsic motivation and identified regulation would be the positive predictors, while external regulation and amotivation would be negative predictors, of physical activity levels during physical education. The novelty and uniqueness of this study were its employment of both pedometers and accelerometers in simultaneously measuring adolescents' physical activity levels in physical education. Furthermore, this study also conducted a detailed analysis, via the SDT, of the predictive strength of adolescents' situational motivation to their physical activity levels including steps per minute and times in sedentary behavior, light physical activity (e.g., slow walking) and moderate-to-vigorous physical activity.

Examining the links between situational motivation and physical activity level is important for physical educators to fully understand issues associated with students' motivation in the physical education setting. In addition, this investigation is beneficial for informing the teaching practices of physical educators as results could be used to implement different motivational strategies to increase students' engagement in physical education classes.

Methods

Participants and Research Setting

In total, 259 middle school students (6^{th} – 8^{th} grade) ranging from 11 to 14 years old (M age = 12.47, SD = .97) were recruited as a single convenience sample from one public school in the U.S. The students had three 60-minute physical education classes each week taught by three physical education teachers on alternate days. There were approximately 35 students in each physical education class and all three teachers were physical education specialists. Physical education was a mandatory course in this school and the physical education teachers adopted a conventional multi-activity curriculum. That is, physical education was comprised of approximately eight units over the school year, and included a variety of movement and sport-skill activities, including health-related fitness stations, dance, jogging/walking, basketball, capturing the flag, football, soccer, etc. In addition, the physical education class was organized in a co-educated pattern and no choice was given to the students regarding the teaching contents.

Measures

Situational motivation. The Situational Motivation Scale (SIMS) was used to assess the participants' situational motivation in physical education classes. The data generated from this instrument exhibited acceptable validity (Comparative Fit Index [CFI] = .96) and reliability (Cronbach's alpha = .83 - .90) among children in previous physical education research (Standage & Treasure, 2002). This scale was a 16-item self-report inventory (Guay et al., 2000). A 7-point Likert scale, ranging from 1 = *strongly disagree* to 7 = *strongly agree*, were used for all responses. Sample items from the SIMS included: (a) because I think that this activity is interesting (i.e., intrinsic motivation); (b) because I am doing it for my own good (i.e., identified regulation); (c) because I am supposed to do it (i.e., external regulation); and (d) there may be a good reason to do this activity, but personally I don't see any (i.e., amotivation). The mean scores of intrinsic motivation, identified regulation, external regulation, and amotivation were calculated to analyze the students' situational motivation toward the physical activities. The range of the mean scores of all the four situational motivation types was from 1 to 7, with higher scores meaning greater intrinsic motivation, identified regulation, external regulation and amotivation. Participants' intrinsic motivation, identified regulation, external regulation, and amotivation were employed as independent variables in current study.

Physical Activity Levels. To measure students' in-class physical activity levels, Actical® accelerometer was utilized for three physical education classes. Physical activity levels were quantified as average activity counts per minute (average count/min) for activities of moderate to vigorous intensity. Recently, research on the validity and reliability of Actical® accelerometer has demonstrated that it can measure and provide accurate objective data for physical activity levels of youth (Colley & Tremblay, 2011; Heil, 2006; Puyau, Adolph, Vohra, Zakeri, & Butte, 2004). The activity counts were measured in 15-second epochs to capture students' activity pattern based on the study aims and the duration of the physical education class in this study. According to the cut-off points established by Puyau et al.

(2004), activity counts per minute from 0 to 99, from 100 to 1500, and over 1500 were categorized as levels of sedentary behavior, light physical activity, and moderate-to-vigorous physical activity, respectively. In this study, participants' percentages of time spent in sedentary behavior, light physical activity, and moderate-to-vigorous physical activity were used as the dependent variables.

In addition, the Yamax Digi-Walker SW-701 pedometer was used to measure participants' physical activity levels along with the Actical® activity monitor. It has also shown to be one of the most accurate pedometers for measuring youth's physical activity levels in a field setting with a large sample (Gao et al.,, 2010; Schneider, Crouter, Lukajic, & Bassett, 2003). Pedometer step output was expressed as steps per minute (SPM), which were calculated by dividing the total steps in class by the class time (Scruggs, Beveridge, Watson, & Clocksin, 2005), and used as another dependent variable in this study. Following the validation procedure recommended by Vincent and Sidman (2003), each pedometer was shaken vertically 100 times before its use. After that, the error between shaken and recorded steps was examined. Only the pedometers having a deviation less than 5% from the 100 shakes were employed for the study. Students were instructed to reset the pedometers to zero at the beginning of the class activities.

Procedures

After this study was approved by the University Institutional Review Board and the school district, informed parental consent forms and child assent forms were obtained. The data collection occurred in four health-related fitness unit classes. In addition, the data were collected in the middle of the four-week instructional period after students were familiar with the fitness activities. Therefore, students could accurately evaluate their motivational beliefs toward the fitness activities. Specifically, students completed the situational motivation survey and demographic information at the end of the class in the first physical education day of data collection, which took approximately ten minutes. After that, their in-class physical activity levels were assessed by pedometers and accelerometers in the following three physical education days.

Prior to the study, two undergraduate students were recruited and trained to provide assistance to the data collection and instruct the participants on how to put on and take off the waistbands attached with pedometers and accelerometers. Before each class wherein physical activity measurements were to take place, the student assistants placed the waistbands in numeric order on a table at the entrance of the gym. Students then grabbed and put on the waistbands based on their previously assigned IDs that matched with the numbers of the accelerometers and pedometers on the waistbands. In this way, the normal class procedures were not delayed. Furthermore, the in-class activity time in each class was monitored and recorded by the researchers so that all the data from these two instruments reflected identical time frames.

Data Analysis

First, Cronbach's alpha coefficients were utilized to examine the internal consistency of the self-report measure. Second, descriptive statistics and Pearson product-moment

correlation coefficients were calculated for sample description and correlations evaluation. Finally, a series of multiple regressions were performed to test the predictive strengths of intrinsic motivation, identified regulation, external regulation, and amotivation to steps per minute and percentages of time spent in sedentary behavior, light physical activity and moderate-to-vigorous physical activity.

Results

Correlation Analyses

Table 1 displays the Cronbach's alpha coefficients for the situational motivation subscales, descriptive statistics, and correlation coefficients for the sample. Based on data collected with the current sample, students' responses for each of the subscales exhibited adequate levels of internal reliability, as the coefficients exceeded .70 (Nunnally & Nernstein, 1994). The descriptive statistics revealed that students had moderate to high intrinsic motivation, identified regulation, external regulation and low amotivation toward the fitness activities provided in the physical education, as the median of each variable is 4. Nevertheless, students displayed large variability in their steps per minute and percentages of time in moderate-to-vigorous in classes. Regarding their physical activity levels, the results showed that students' average steps/minute were 41, which was much lower than the recommendation (82-88) proposed by Scruggs (2007). The preceding result may be attributable to the fact the children still engaged in some time spent standing still during the physical educator's instruction as well as waiting their turn to engage in the physical activity. Despite the fact the students' steps per minute might not have met established recommendations, it was found through accelerometry that, on average, students had high percentage of time in moderate-to-vigorous physical activity (68.71%), which met NASPE (2004) recommendations of greater than 50% of class time spent in moderate-to-vigorous.

Table 1. Internal Reliabilities, Descriptive Statistics, and Correlations among Variables

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1.Intrinsic motivation	.81							
2.Identified regulation	.74*	.84						
3.External regulation	-.17*	.01	.79					
4. Amotivation	-.42*	-.30	.42*	.85				
5. Steps/min.	.11	.03	-.08	-.17*				
6. Sedentary	-.27*	-.25*	.01	.07	-.16			
7. Light PA	.02	.11	.00	-.15	-.29*	-.06		
8. MVPA	.21*	.14	-.01	.04	.32*	-.79*	-.57*	
Mean	5.24	5.19	4.58	3.12	41.00	9.39	21.90	68.71
SD	1.30	1.25	1.49	1.42	27.25	14.78	11.05	17.92

Notes. PA = Physical activity level; MVPA = Moderate-to-vigorous PA; SD = Standard deviation. * $p < .05$.

As shown in Table 1, correlation analyses yielded that students' intrinsic motivation was positively and significantly related to identified regulation (r = .74, r^2 = .55, $p < .05$) , but negatively and significantly related to external regulation and amotivation (r = -.17, r^2 = .03, $p < .05$; r = -.42, r^2 = .18, $p < .05$, respectively). And students' external regulation was positively and significant related to amotivation. (r = .42, r^2 = .18, $p < .05$). Additionally, students' amotivation was significantly and negatively related to steps per minute (r = -.17, r^2 = .03, $p < .05$). Moreover, their intrinsic motivation and identified regulation were significantly and negatively related to percentage of time in sedentary behavior (r = -.27, r^2 = .07, $p < .05$; r = -.25, r^2 = .06, $p < .05$, respectively), and only intrinsic motivation was significantly and positively related to percentage of time in moderate-to-vigorous physical activity (r = .21, r^2 = .04, $p < .05$).

Predictive Strengths of Situational Motivation on Physical Activity Levels in Physical Education

As displayed in Table 2, students' amotivation significantly predicted steps per minute (ß = -.15, $p < .05$). In addition, intrinsic motivation was the only negative predictor of students' time spent in sedentary behavior (ß = -.28, $p < .01$), meanwhile the positive predictor of their time in moderate-to-vigorous physical activity (ß = .22, $p < .05$).

Table 2. Results of Regression Analyses on Physical Activity Levels

Dependent variable	Independent variable	β	p
Steps/minute	Intrinsic motivation	.02	> .05
	Identified regulation	-.03	> .05
	External regulation	.02	> .05
	Amotivation	-.15	< .05
Sedentary	Intrinsic motivation	-.28	< .01
	Identified regulation	-.13	> .05
	External regulation	-.02	> .05
	Amotivation	-.12	> .05
MVPA	Intrinsic motivation	.22	< .05
	Identified regulation	.03	> .05
	External regulation	.01	> .05
	Amotivation	.22	> .05

Notes. MVPA = Moderate-to-vigorous PA; β values are standardized regression coefficients.

Discussion

This study was designed to examine the relationships between middle school students' situational motivation and physical activity levels in physical education. Specifically, this study investigated the predictive strengths of middle school students' intrinsic motivation, identified regulation, external regulation, and amotivation to their steps per minute and well as percentages of time spent in sedentary behavior, light physical activity and

moderate-to-vigorous physical activity. It was anticipated that students' intrinsic motivation and identified regulation would positively, while external regulation and amotivation would negatively, predict physical activity levels in physical education.

In line with the findings reported in previously published research studies (Gao et al., 2011; Standage & Treasure, 2002), results of internal reliability analysis in this study supported the internal consistency of the situational motivation measures used for middle school students in the physical education setting. Descriptive analyses indicated that students had a moderate level of intrinsic motivation, identified regulation, and external regulation in addition to a low level of amotivation towards the activities. In addition, they displayed large variability of their steps per minute and percentage of time in moderate-to-vigorous physical activity during physical education class.

The uniqueness of this study includes its employment of both pedometers and accelerometers in measuring students' physical activity levels in physical education. From the results provided by the pedometer measurement, it is known that students' average physical activity levels did not meet the goal of 50% of class time engaged in physical activity in physical education suggested by NASPE (2004). That is, their average steps/minute was 41, which was much lower than the number of 82-88 recommended by Scruggs (2007). However, the results from the accelerometer measurement indicated that, on average, students had high percentage of time in moderate-to-vigorous physical activity (68.71%), which has met the recommendation (moderate to vigorous physical activity $\geq$ 50%) by NASPE (2004). According to Berlin, Stori, and Brach (2006), steps per minute provided by the pedometers do not reflect the intensity levels of physical activity participation. In contrast, the accelerometer provides information on the intensity levels of the physical activity participation within a period of time and, thus, is regarded as the criterion measure of children's physical activity and more accurate than the pedometer, even though steps per minute and percentage of time in moderate-to-vigorous physical activity are significantly related (Gao et al., 2010). Therefore, it is suggested that the use of the accelerometer should be encouraged in the future research examining youth's physical activity participation in the physical education setting if the use of this objective measurement tool is possible. Additionally, results from both measurements indicated that there was a large variability of students' physical activity levels in the classes. This indicates that physical educators should still improve their teaching, motivational, and managerial skills to provide an effective teaching environment capable of getting all students actively engaged in physical activity during physical education class.

The correlation analyses showed that students' intrinsic motivation was positively and significantly related to identified regulation, whereas intrinsic motivation was found to be negatively and significantly related to external regulation and amotivation. In addition, students' external regulation and amotivation were positively and significantly correlated. These findings were in line with many previous studies (e.g., Gao, Podlod, & Huang, 2013) and the simplex-ordered correlation structure addressed by SDT. That is, intrinsic motivation is more positively associated with identified regulation than with external regulation or amotivation. The correlations found in the current study, especially the fact that intrinsic motivation demonstrated a significant negative relationship with external regulation and

amotivation, further illustrate that the various types of situational motivation in SDT lie along a relatively autonomous continuum. This continuum of autonomy is dependent on many factors such as the research population and settings.

To date, research using situational motivation has indicated that students who had higher intrinsic motivation and identified regulation displayed greater effort in physical education. On the contrary, students who had amotivation demonstrated a lack of intention and engagement in physical education (Gao et al., 2011; Ntoumanis, 2001, 2005; Standage, Duda, & Ntoumanis, 2003). In consistent with Gao et al. (2011) in which intrinsic motivation was the only positive predictor of adolescents' moderate-to-vigorous physical activity in physical education, intrinsic motivation positively predicted students' percentage of time in moderate-to-vigorous physical activity in current study. An additional finding in this study was that intrinsic motivation also negatively predicted students' sedentary behavior, which further demonstrates the importance of intrinsic motivation in promoting physical activity, especially the intensity of the physical activity, during activity sessions in physical education. Surprisingly, intrinsic motivation was not significantly related to but predicted steps per minute, which is contradictory with the results of previous findings (Gao et al., 2011; Ntoumanis, 2005). It is speculated that this discrepancy might be due to the different measures of physical activity levels in these studies.

In current study, the steps per minute that represented the physical activity levels was measured by pedometers, while the measures of physical activity levels in Gao et al. and Ntoumanis's studies were accelerometers and self-report questionnaires, respectively. Also, the employment of two different measures in assessing physical activity levels in this study also partially led to the following mixed results. That is, amotivation emerged as a negative predictor of steps per minute, which is in line with the some previous findings (Gao et al., 2011; Ntoumanis, 2001, 2005). However, amotivation was not significantly related to moderate-to-vigorous physical activity and this result is supported by Gao et al. (2013). Another logical explanation for these mixed results can be the nature of amotivation, a state of lacking motivation to participate in an activity. In current study, students' disinterest or antipathy towards the health-related fitness activities would either be negatively or not significantly related to their physical activity levels, which is consistent with previous findings (e.g., Standage, Duda, & Ntoumanis, 2003).

In this study, identified regulation was not a significant predictor of students' physical activity engagement in the fitness activities. According to Biddle (1999), identified regulation is directly linked to individuals' perceived physical activity outcomes to perform physical activities. Although engaging fitness activities is beneficial to one's health, students in this age group (11-14 years) might not consider or identify the functional outcomes of fitness activity participation. Consequently, as mentioned above, their active involvement in physical activity was due to the pleasure and satisfaction achieved from the participation, rather than the awareness of the health benefits of the involvement of the activities (Biddle & Armstrong, 1992; Gao et al., 2013). Moreover, although external regulation could result in undesirable consequences, it did not predict students' any type of physical activity levels. This finding is not surprising because intrinsic motivation, other than external regulation, has been regarded as the key factor directly influencing students' physical activity participation (Ntoumanis,

2001, 2005). As mentioned earlier, physical education in the school where the study was conducted was a mandatory course and students had no right to choose the learning content. Simply put, if they want to obtain credit from physical education, they had to follow the rules and requirements by the instructors and actively participate in the physical education activities, even though some of the contents may not have been perceived as enjoyable or worthwhile to them. This fact could also be plausible to explain why external regulation failed to predict students' physical activity levels in this study, which is supported by Gao et al (2011).

There are certain limitations that should be noted when interpreting the findings of this study. First, all the participants in this study came from a single school site. A large diversity of students from multiple schools should be recruited in future studies to expand the generalizability of these findings. Second, psychological and physical measurements were only administered in one instructional unit. Expanding these measurements to other instructional units can provide more information on students' situational motivation toward and physical activity levels in other curricular activities. Finally, qualitative measures should have been conducted to give insight into the association between students' situational motivation behavioral outcomes during physical education in this study.

Conclusions and Teaching Implications

In summary, while acknowledging the limited transferability of this study to a diverse population and physical education units, the importance of this study lies in the relationship found between students' situational motivation and their physical activity levels in physical education. That is, intrinsic motivation emerged as the positive predictor for students' physical activity participation in physical education, while amotivation was a negative predictor of physical activity. Therefore, physical educators should increase students' intrinsic motivation and decrease their amotivation in physical education by selecting curricular activities that students are interested in and presenting these activities in an attractive and interesting way. In addition, physical educators should also foster an environment to fulfill students' needs of competence, autonomy, and relatedness during physical education. Specifically, physical educators may first offer challenging activities that are also appropriate to students' motor skill level to foster optimal perceptions of competence. Second, physical educators should provide settings that facilitate an atmosphere of cooperation, such as group or pair activities, to better promote feelings of relatedness among students. Finally, students' sense of autonomy can be enhanced by providing them more options by allowing them to choose the activities, partners, etc. With such a dedicated effort, students' levels of physical activity in physical education are more likely to be promoted.

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