

Effects of a Classroom Curriculum on Physical Activity and Its Psychological Predictors in High School Students

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Recent research indicates that recommended amounts of physical activity suggested for health benefits are rarely met in high-school–age adolescents. A pilot study was conducted to investigate the effects of a classroom health-education–based curriculum intervention on the physical activity of high school students. A within-group research design was used on data from a sample of ninth grade boys and girls ($N = 104$) who received six classroom health education lessons over 5 weeks based on social cognitive theory. The lessons focused on improvements in the theory-based psychological variables of mood, body satisfaction, physical self-concept, and exercise self-efficacy. Mixed-model repeated-measures ANOVAs indicated an overall statistically significant increase in physical activity, with no significant difference by sex. There were no statistically significant changes found in mood, body satisfaction, physical self-concept, or exercise self-efficacy. Results from a multiple regression analysis indicated that changes in the psychological variables tested explained 6% of the variance in physical activity change, which was not statistically significant. Results from this study may help researchers, school administrators, classroom health teachers, and developers of curricula better understand the role of the psychological factors of mood, body satisfaction, physical self-concept, and exercise self-efficacy in adolescent physical activity behavior and assist in the design of future school-based interventions.

Keywords: *physical activity, social cognitive, school health, psychological aspects, adolescents*

Introduction

Physical activity is an important behavior for improving or maintaining overall health (United States Department of Health and Human Services [HHS], 2010). Some benefits of physical activity are weight control, strengthening bone and muscle, improving mental health, improving quality of life, and reducing risk of cardiovascular disease, type 2 diabetes, and certain cancers (HHS, 2008). The National Association for Sport and Physical Education (2008) and the Centers for Diseases Control and Prevention ([CDC], 2008) suggested that children should accumulate at least 60 min, and up to several hours, of physical activity on all or most days of the week. Despite these recommendations, research has indicated that physical activity typically decreases in adolescence and continues to decline throughout adulthood (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Nelson, Neumark-Stzainer, Hannan, Sirard, & Story, 2006). According to the Youth Risk Behavior Survey, only 28.7% of high school students had been physically active in moderate to vigorous

intensity physical activity for a total of at least 60 min per day on each of the 7 days prior to the survey being completed (CDC, 2012). Accelerometer-based studies found that only 31% of 15 year-olds across the United States are moderately to vigorously active during weekdays, and only 17% are moderately to vigorously active on weekend days (Nader et al., 2008).

Schools are often called upon to increase the proportion of youths who participate in daily physical education and to increase physical activity during those classes in order to reach the recommended weekly min of physical activity (HHS, 2000). In addition to its health benefits, physical activity has been shown to enhance cognition in children and to have a positive effect on academic performance (Singh, Uijdewilligen, Twisk, Van Mechelen, & Chinapaw, 2012; Davis & Pollock, 2013). The CDC (2010) reviewed 50 studies that examined associations between physical activity and academic achievement and found that physical activity was positively related to academic performance in over half of the studies. In their review, the authors from the CDC (2010) suggest to school boards, administrators, and principals that "maintaining or increasing time dedicated for physical activity during the school day will not have a negative impact on academic performance, and it may positively impact students' academic performance" (p. 28). However, the CDC (2012) also reported that enrollment of high school students in daily physical education classes in the United States decreased from 45% in 1991 to 33% in 2009. Across the country, physical education is required in 50% of schools for grades 1 through 9, but in only 21% of schools in grade 12 (Lee, Burgeson, Fulton, & Spain, 2007). Only 2% of high schools provide daily physical education (Lee et al., 2007). In schools that do provide physical education classes, most of the class time is not spent being physically active (Smith, Lounsbery, & McKenzie, 2014). Rather, students are typically in moderate-to-vigorous physical activities less than one-third of class time (Matthews-Ewald, Moore, Harris, Bradlyn, & Frost, 2013). Overall, physical education classes provide less than one-third of the minimum weekly recommendation of 300 min (HHS, 2008; McKenzie et al., 1995; Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). Thus, an increase in physical activity outside of school physical education classes has been suggested (Beighle, Morgan, Le Masurier, & Pangrazi, 2006; HHS, 2010; Tudor-Locke et al., 2006).

Health education classes are commonly integrated into school curricula, with many states mandating a specific number of hours in such classes (National Association for Sport and Physical Education, 2010). Although topics covered vary from state to state, in their report entitled *Developing Healthy People 2020*, HHS (2010) suggested that school health curricula include units on the importance of physical activity for improving health and quality of life. However, little is known about how this suggestion may affect physical activity outside of the classroom. If a classroom health education curriculum could affect behaviors in such a way as to increase the amount of physical activity, this might help students meet the recommended amounts. Interventions have sometimes had success at increasing the physical activity of school-age participants when administered through physical education classes (Gorely, Nevill, Morris, Stensel, & Nevill, 2009; Van Sluijs, McMinn, & Griffin, 2008) or through a classroom health component supplementing traditional physical education (Pate et al., 2007; Pate et al., 2005; Sallis et al., 1997; Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2007). However, given the present reductions in physical education classes (CDC, 2012), fewer students may be exposed to these types of interventions.

Various theoretical models have been used as the bases of interventions intended to increase physical activity (Stice, Shaw, & Marti, 2006), with the most common being social cognitive theory (Buckworth & Dishman, 2002). According to Albert Bandura (1998), the developer of social cognitive theory, "Social cognitive theory in its totality specifies factors governing the acquisition of

competencies that can profoundly affect physical and emotional well-being as well as the self-regulation of health habits" (p. 624). Bandura suggested that people require more than knowledge about the risks associated with poor health habits and that an individual's self-influences must be engaged in order to change unhealthy behaviors into healthy behaviors (Bandura, 1998). Bandura described general social cognitive theory determinants that are needed to effectively create change in health habits as (a) knowledge of health risks and benefits, (b) perceived health-related self-efficacy, (c) outcome expectations of healthy behavior, (d) health-related goals, and (e) impediments or barriers to healthy behavior change (Bandura, 2004). A social cognitive approach to health behavior change could influence an individual's health-related behaviors through his/her use of various self-management skills (Bandura, 2004).

Baker and Brownell (2000) extended social cognitive theory and posited that improvements in the psychological factors of mood and well-being, body image, self-efficacy, self-esteem, and coping would promote regular exercise, along with an improved diet and well-managed weight. More specifically, their model (Figure 1) suggested that changes in the aforementioned psychological factors would improve motivation, commitment, and other psychosocial resources that increase physical activity and exercise outputs. Baker and Brownell (2000) posited that improved mood would provide a healthier and stronger psychological climate leading to a stronger commitment toward behavior change. Baker and Brownell (2000) also suggested that improvements in body image, "... may be reinforcing and lead to a greater long-term exercise adherence, as well as increased confidence in one's ability to make positive changes" (p. 322). They further proposed that an increase in self-esteem "... may also allow an individual to view him or herself as a person able to make and commit to positive changes" (p. 322). Baker and Brownell (2000) asserted that confidence in one's ability to be physically active would lead to increased self-efficacy about exercise, also promoting that behavior.

Tenets of social cognitive theory (Bandura, 1998) and key elements of Baker and Brownell's (2000) model were utilized in the architecture of an exercise adherence intervention (i.e., "The Coach Approach") with adults (Annesi, 2011; Annesi & Gorjala, 2010; Annesi, Unruh, Marti, Gorjala, & Tennant, 2011). In corresponding studies of 24 to 26 weeks in length, in addition to providing access to an exercise facility, participants were provided classroom sessions that emphasized goal setting and progress tracking, mood improvement, and increased self-regulatory skills. Six, 45- to 60-min sessions, with goals of improving participants' exercise self-efficacy, body image, and mood, were administered over 6 months. Results from these studies demonstrated statistically significant increases in exercise outputs, and statistically significant improvements in the psychological constructs of mood, exercise self-efficacy, physical self-concept, and body area satisfaction. Corresponding research has not, however, been conducted in school settings with adolescents. Thus, the present study was modeled after studies that successfully increased physical activity and its proposed psychological predictors.

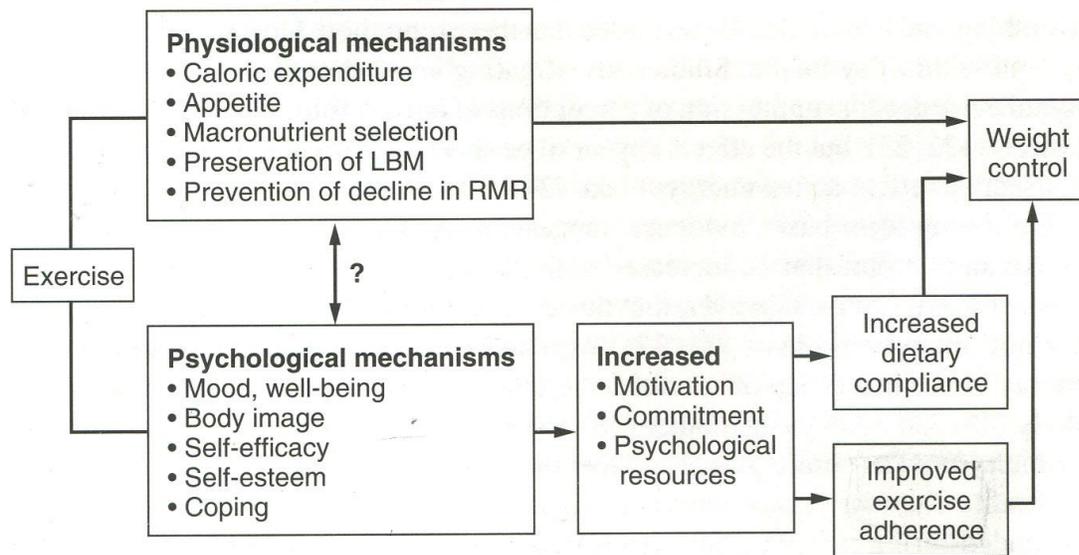


Figure 1: Baker and Brownell's model demonstrating the relationship between psychological mechanisms and physical activity. Reprinted, with permission, from C. W. Baker and K. D. Brownell, 2000, *Physical activity and maintenance of weight loss: Physiological and psychological mechanisms*. In *Physical activity and obesity*, edited by C. Bouchard (Champaign, IL: Human Kinetics), 315.

Because classroom health education curricula include many state-mandated topics that require coverage in brief timeframes, introducing a unit specifically designed to focus on the topic of exercise needed to be brief enough to incorporate into an existing schedule. For this study, the intervention was required to take place within the 8 weeks of classroom health education. We also needed to work within the number of current lessons that were previously allotted to the study of physical activity within the school's curriculum. We determined that the proposed psychological predictors of physical activity could be adequately addressed in six classroom lessons. Prior to investing considerable resources for a longer study and/or withholding the intervention in a comparison condition, we decided that a pilot study would be appropriate. Thus, the purpose of this study was designed to assess within-group changes in physical activity and the psychosocial variables of mood, body satisfaction, physical self-concept, and exercise self-efficacy over 5 weeks in a sample of ninth-grade boys and girls who were exposed to a unique, classroom-based health curriculum. We hypothesized that scores on physical activity would demonstrate a statistically significant increase over the length of the study, and that statistically significant improvements in the psychological variables of mood, body satisfaction, physical self-concept, and exercise self-efficacy would significantly predict increases in physical activity. Because the effectiveness of targeting psychological predictors of physical activity within a classroom-only intervention has not been previously tested, this research could provide initial data on the efficacy of a shortened curriculum-based behavior-change component for increasing physical activity in high school students. This study would also serve to

estimate the relative effects of changes in theory-based psychological variables (in which the present intervention was based) for predicting increased physical activity in that age group and evaluate the need for more comprehensive replications.

Method

Participants and Setting

This study was completed in an urban high school in the northeast United States. The school had a population of approximately 900 students (72% Hispanic, 16% White, 8% African American, and 2% Asian or other; National Center for Education Statistics, 2014). The school district had 60% of its students eligible for the free or reduced-price lunch program compared to its state average of 27% (Great Schools, 2008). Thus, the school was in a lower to lower-middle socioeconomic region.

An a priori power analysis was conducted to determine the minimum number of participants needed for this study. A main focus of the investigation was the association of changes in mood, body satisfaction, physical self-concept, and exercise self-efficacy with physical activity change. Thus, anticipating a moderate effect size ($f^2 = .15$), with four predictors, the minimum sample size required was 84 (Cohen, 1988).

There were approximately 245 students in the selected school enrolled in ninth grade at the time of this study. The guidance department schedules all students for physical education class for one class period per day for the entire year (four semesters of 10 weeks). The physical education supervisor then assigns students from grades 9, 11, and 12 to one of the four semesters (10 weeks) of health education based on teacher and classroom availability. Students are then assigned to a specific health education class based on grade level and physical education class meeting time. Health education classes are assigned throughout the entire school year. During the semester of classroom health education, students do not attend physical education class. The first semester (which was the time period for this study) included five classes of ninth-grade health education, which served as naturally formed groups to receive the six-lesson intervention. Class schedule changes, absences, student transfers, and dropouts resulted in 107 students participating in the study. Three participants were not included due to their lack of skills in the English language. The final sample size for this study was 104 (53 girls and 51 boys; overall $M_{\text{age}} = 14.4$ years, $SD = 0.6$). Thus, adequate statistical power to complete the planned analyses was present.

Classroom Health Curriculum

Lessons were developed to increase physical activity of the participants by focusing on the proposed psychological predictors of physical activity: mood, body satisfaction, physical self-concept, and exercise self-efficacy. These social cognitive theory-based lessons included instructional materials commonly available to school districts along with material based on The Coach Approach. The school's health education teachers also participated in the development of the lessons that were unique to this investigation. The 40-min lessons were applied in a format that was practical for a standard high school environment. The six lesson topics were (a) physical activity and mental health, (b) physical activity and stress reduction, (c) physical activity and physical self-concept, (d) physical activity and body image, (e) exercise self-efficacy, and (f) barriers to physical activity and goal setting. Based on the taxonomy of behavior-change techniques developed by Abraham and Michie

(2008), the lessons (a) provided information on consequences of particular behaviors, (b) prompted intention formation, (c) prompted barrier identification, (d) provided general encouragement, (e) set graded tasks, (f) provided instruction, (g) modeled and demonstrated correct behavior, (h) facilitated goal setting, (i) provided instruction in self-monitoring behavior, (j) provided contingent rewards, (k) prompted practice, (l) planned social support or social change, (m) prompted self-talk, and (n) facilitated time management. General instructional techniques included teacher lectures, readings and review questions from the district-approved textbook, small group activities, individual worksheets, and class games/activities.

Measures

Physical Activity

The Godin Leisure-Time Exercise Questionnaire Part 1 (Godin, 2011) is a self-report of physical activity from the previous week. Participants are asked to report how many sessions per week they were physically active for more than 15 min at a strenuous (e.g., running), moderate (e.g., fast walking), and mild (e.g., easy walking) physical activity intensity. Responses to the questions are transposed into estimates of metabolic equivalents of tasks (METs - a measure of intensity of physical activity; Ainsworth et al., 2000) by multiplying responses by 9, 5, and 3 METs and then summing those scores. For 11th-grade students, test-retest reliability over 2 weeks was reported to be .91 (Sallis, Buono, Roby, Micale, & Nelson, 1993). Construct validity was supported by statistically significant correlations (.32 and .39) between Godin Leisure-Time Exercise Questionnaire scores and heart rate monitor results (Sallis et al., 1993), as well as peak volume of oxygen uptake measurements (.56; Jacobs, Ainsworth, Hartman, & Leon, 1993).

Mood

The Brunel Mood Scale (Terry, Lane, Lane, & Keohane, 1999) measured overall mood. It was originally developed for use with children, but has been validated and is also used with adults (Terry, Lane, & Fogarty, 2003). The self-report questionnaire has 24 items organized into six subscales with four items each. The six subscale headings are anger, confusion, depression, fatigue, tension, and vigor. Participants respond to the 24 items by indicating to what degree they have experienced a descriptor of a mood state (e.g., "unhappy," "anxious") on a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). For this research we used the scale's measure of total mood distress, which aggregates the 24 items of its six subscales into a final score. Thus, the score on the Vigor subscale is subtracted from the sum of the other five subscales, which can be either a positive or negative number. The score range is -16 to 80, with a lower score indicating a better mood. The response timeframe used for this study was "How you felt over the past month." The Brunel Mood Scale demonstrated factorial and criterion validity in school children and young athletes and construct validity in the 11- to 18-year-old age group (Terry et al., 1999). Internal consistency was reported at $\alpha = .76$ to $.95$.

Body Image

The Body Areas Satisfaction Scale of the Multidimensional Body-Self Relations Questionnaire is a 9-item self-report inventory (Cash, 2000). It measures body image from perceptions of areas of the body (e.g., "face," "hair," "lower torso") on a scale ranging from 1 (*very dissatisfied*) to 5 (*very satisfied*). The score range is 9 to 45, with a higher score indicating a better body image. Internal consistency of the Body Areas Satisfaction Scale for females was reported at $\alpha = .73$, and for males at $\alpha = .77$ (Cash, 2000). Test-retest reliability was .74 for females and .86 for males (Cash, 2000).

Physical Self-Concept

The Physical Self-Concept subscale of the Tennessee Self-Concept Scale 2nd edition measures an individual's view of his or her body, state of health, physical appearance, skills, and sexuality (Fitts & Warren, 2003). Participants respond to 12 items on the scale ranging from 1 (*always false*) to 5 (*always true*) to items such as "I take good care of myself physically" and "I am not good at games and sports" (Fitts & Warren, 2003). The score range is 12 to 60, with a higher score indicating better physical self-concept. Internal consistency for the Physical Self-Concept subscale was reported at $\alpha = .93$ for ages 13 to 18 and test-retest reliability over 1 to 2 weeks was .79 for ages 14 to 50 (Fitts & Warren, 2003).

Exercise Self-Efficacy

Exercise Barriers Self-Efficacy Scale for Children is a self-report survey that measures "the degree one believes he or she possesses the ability to overcome social, personal, and environmental barriers to participating in physical activity" (Annesi, Westcott, Faigenbaum, & Unruh, 2005, p. 470). Each item begins with the phrase, "I am sure I can exercise 3 or more days per week if" Items conclude with phrases such as "exercise was not fun," "I had a lot of homework," and "I was bored by the exercise program." Participants respond to 10 items ranging from 1 (*not at all confident*) to 5 (*definitely confident*). The score range is 10 to 50, with a higher score indicating greater exercise self-efficacy. Internal consistencies averaged $\alpha = .79$, and test-retest reliability over 1 week was .77 (Annesi et al., 2005).

Skewness values for all measures were found to be $<3 SE$, and kurtosis values were found to be $<10 SE$, indicating that there were no serious violations of normality in the distribution of the data (Kline, 2011).

Procedure

Classroom health teachers distributed a packet containing the five measurement questionnaires at the beginning of the first health education class (Week 1), and students completed the questionnaires during class time. An identical packet was again administered during the last class at the end of Week 5. The packets included the validated surveys described above to measure physical activity, mood, body satisfaction, physical self-concept, and exercise self-efficacy. Six 40-min classroom health lessons were taught during regular class time over a 5-week period. The six lesson topics and their administration times were Week 1: Physical activity and mental health, Week 2 (first class in that week): Physical activity and stress reduction, Week 2 (second class in that week): Physical activity and physical self-concept, Week 3: Physical activity and body image, Week 4: Exercise self-efficacy, and Week 5: Barriers to physical activity and goal setting. The lessons were taught on the first or second day of health education class of each of the 5 weeks of the study, with the remaining class days of the week addressing health topics unrelated to physical activity.

Data Analysis

Data were analyzed using Statistical Package for the Social Sciences version 16.0 (SPSS, Inc.). Statistical significance was set at $\alpha = .05$, two-tailed, throughout. Because factors such as physical activity volume, mood, and body image could differ by sex in adolescents (Furnham, Badmin, & Sneade, 2002; Troiano et al., 2009), analyses were conducted to account for such differences in boys and girls. First, a series of 2 (Sex) \times 2 (Pre-Post Test Score) mixed-model repeated measures ANOVAs were computed to assess if statistically significant changes in physical activity, exercise

self-efficacy, mood, body image, and physical self-concept occurred over 5 weeks overall and then whether those changes significantly differed by sex. Effect sizes for ANOVAs were estimated by partial eta-squared (η^2_p), and for within-group changes by Cohen's d : $(Mean_{Week\ 5} - Mean_{Week\ 1})/SD_{Week\ 1}$. By convention, small, moderate, and large effect sizes are .01, .06, and .14 for η^2_p , and .20, .50, and .80 for Cohen's d (Cohen, 1992).

Next, using aggregated data, a multiple regression analysis with simultaneous entry of change scores on psychological variables—mood, body satisfaction, physical self-concept, and exercise self-efficacy—as predictor variables for change in physical activity was computed. Its purpose was to assess if changes in the four psychological variables accounted for a statistically significant portion of the variance in change in physical activity. Based on recent research (Annesi & Johnson, 2013; Annesi & Porter, 2013; Teixeira et al., 2010) and previous suggestions (Glymour, Weuve, Berkman, Kawachi, & Robins, 2005), change scores were derived through subtraction of a measure's score total at baseline from its corresponding score total at Week 5, unadjusted for its baseline value.

Results

Overall, there was a statistically significant increase in physical activity volume over 5 weeks, $F(1, 102) = 8.93, p = .004, \eta^2_p = .080$. However, there was no statistically significant difference by sex, $F(1, 102) = 0.05, p = .816, \eta^2_p = .00$. For mood, there was no statistically significant change overall, $F(1, 102) = 0.03, p = .855, \eta^2_p = .00$, nor a significant difference in change by sex, $F(1, 102) = 0.10, p = .755, \eta^2_p = .00$. For body satisfaction, there was no statistically significant change overall, $F(1, 102) = 2.47, p = .119, \eta^2_p = .02$, nor a significant difference in change by sex, $F(1, 102) = 0.95, p = .333, \eta^2_p = .01$. For physical self-concept, there was no statistically significant change overall, $F(1, 102) = 2.02, p = .159, \eta^2_p = .02$, nor a significant difference in change by sex, $F(1, 102) = 1.82, p = .180, \eta^2_p = .02$. Finally, for exercise self-efficacy, there was no statistically significant change overall, $F(1, 102) = 0.53, p = .470, \eta^2_p = .01$, nor significant difference in change by sex, $F(1, 102) = 1.75, p = .189, \eta^2_p = .02$. Table 1 displays data at baseline and Week 5 for boys, girls, and the aggregated data, along with change scores and corresponding effect sizes (Cohen's d).

Table 1: Changes in Physical Activity and Psychological Variables From Baseline to Week 5

	Baseline		Week 5		Change From Baseline to Week 5		<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i> _{change}	<i>SD</i>	
Physical activity							
Boys	57.53	25.98	63.73	26.94	6.20	22.91	.24
Girls	45.00	26.93	52.25	24.63	7.25	22.95	.27
Aggregated	51.14	27.08	57.88	26.30	6.37	22.83	.23
Exercise self-efficacy							
Boys	31.82	8.88	30.53	8.63	-1.30	7.55	-.15
Girls	28.96	7.28	29.34	6.44	0.38	5.18	.05
Aggregated	30.37	8.19	29.92	7.58	-0.44	6.47	-.05
Mood							
Boys	10.35	11.99	10.47	12.21	0.12	9.54	-.01
Girls	17.40	14.23	16.94	13.67	-0.37	9.07	.03
Aggregated	13.94	13.69	13.77	13.32	-0.17	9.26	.01
Body image							
Boys	33.14	5.64	34.18	5.93	1.04	3.47	.18
Girls	32.34	6.29	32.58	6.93	0.24	4.74	.04
Aggregated	32.73	5.96	33.37	6.48	0.64	4.16	.11
Physical self-concept							
Boys	50.43	7.04	51.92	6.36	1.49	5.12	.21
Girls	52.00	6.54	52.04	8.41	0.04	5.81	.10
Aggregated	51.23	6.80	51.98	7.44	0.75	5.51	.11

Note. Physical activity is expressed as METs (metabolic equivalents of tasks) per week. Boys $n = 51$; Girls $n = 53$; Aggregated $N = 104$. M_{change} = mean change of scores over 5 weeks; d = Cohen's measure of effect size.

The multiple regression analysis, predicting change in physical activity from changes in the four psychological variables of mood, body satisfaction, physical self-concept, and exercise self-efficacy, explained 6% of the variance but was not statistically significant (Table 2).

Table 2: Results of a Multiple Regression Analysis Predicting Change in Physical Activity ($N = 104$)

	β	R	R^2	t	F	p
Model		.25	.06		1.61	.18
Δ Exercise self-efficacy	.13			1.36		.18
Δ Mood	.10			1.09		.31
Δ Body image	.14			1.40		.16
Δ Physical self-concept	-.15			-1.46		.15

Note. The Delta symbol (Δ) denotes change in score from baseline to Week 5; β denotes standardized beta.

Because, in post hoc follow-up analyses, statistically significant changes were found for the boys in body image, $t(50) = 2.14, p = .04$, and physical self-concept, $t(50) = 2.08, p = .04$, those scores were simultaneously entered into a second multiple regression equation predicting change in physical activity. Results indicated that a nonstatistically significant 7% of the variance in physical activity was accounted for by change in body image and physical self-concept (Table 3).

Table 3: Results of a Multiple Regression Analysis Predicting Physical Activity by Changes in Body Image and Physical Self-Concept in Boys ($n = 51$)

	β	R	R^2	t	F	p
Model		.26	.07		1.75	.19
Δ Body image	.25			1.74		.09
Δ Physical self-concept	.13			0.95		.35

Note. The Delta symbol (Δ) denotes change in score from baseline to Week 5; β denotes standardized beta.

Discussion

This 5-week pilot study assessed changes in physical activity and the psychosocial variables of mood, body satisfaction, physical self-concept, and exercise self-efficacy in high school students after exposure to six classroom health education lessons based on tenets of social cognitive theory. As hypothesized, there was a statistically significant increase in physical activity over the course of the study. This is consistent with previous research with adults that focused on the same psychological variables and changes in physical activity behavior (Annesi, 2011; Annesi & Gorjala, 2010; Annesi et al., 2011). Although other interventions designed to increase physical activity commonly included actual administration of exercise activities as part of the intervention (Stice et al., 2006), these findings support the potential efficacy of interventions administered specifically within a classroom setting. This is important for classroom health educators and for developers of health curricula to consider as they develop lesson plans, unit plans, and textbook chapters as a viable opportunity to increase physical activity behavior outside of physical education classes.

Overall, changes in exercise self-efficacy, mood, body image, and physical self-concept were not statistically significant. Results of a multiple regression analysis showed that the changes over 5 weeks in the four psychological factors that were assessed did not predict a statistically significant amount of the change in physical activity. This failed to support the model proposed by Baker and Brownell (2000). The results only partially supported related research conducted with adults (Annesi, 2011; Annesi & Gorjala, 2010; Annesi et al., 2011). Several issues may contribute to explaining this. For example, our focus was on four social cognitive variables that were the bases of previous behavioral interventions with adults, but there may be others that might be especially important to consider for adolescents (e.g., social support to be physically active, attitude toward physical activity; Petosa, Hertz, Cardina, & Suminski, 2005). The construct of vicarious reinforcement, which focuses on peer influence, has also been suggested as a target for future physical activity interventions in teens (Ginis, Nigg, & Smith, 2013). In addition, this study was conducted over 5 weeks, whereas similar research with adults had been conducted over 6 months. Because interventions lasting 6 months are not practical for school-based application, perhaps increasing the duration from the 5 weeks that we employed to 10 or 15 weeks might provide enough time for significant changes to be detected in targeted psychological variables, but remain within the practical constraints of a school-based study.

Moreover, research on which this study was based (Annesi, 2011; Annesi et al., 2011) included only sedentary individuals. Based on inspection of participants' MET values at baseline and the considerable dispersion in those data (Table 1), it was clear that participants in this study ranged from precontemplation and contemplation (not yet incorporating physical activity into their lifestyles) to the maintenance and termination (regular physical activity has been present for at least 6 months) stages of the transtheoretical (stages-of-change) model for physical activity (Prochaska, DiClemente, & Norcross, 1992). It is likely that the psychological variables of interest changed at different degrees over the length of the study based on participants' stage of change. For example, self-efficacy and mood improvements could be quite pronounced, even over just several weeks, for individuals initiating physical activity (moving from the contemplation stage through to the action stage of the transtheoretical model; Annesi, 2004). However, they might require many months or longer for even minor improvements to occur when physical activity is already frequent because substantial changes might have already happened when the behavior was initiated. Difference in self-efficacy based on transtheoretical stage for physical activity was previously found in both children (Annesi, Faigenbaum, & Westcott, 2010) and adults (Marcus, Selby, Niaura, & Rossi, 1992), and there were no additional improvements in mood identified after an initial 12 weeks of physical activity (Annesi & Mareno, 2014). Self-concept and body image changes might be influenced by ceiling effects in individuals who are physically active (enabling little improvement) and, conversely, might demonstrate pronounced effects in primarily new exercisers. Those already feeling good about themselves and their bodies may not improve much. These issues could have affected both the significance of changes in exercise self-efficacy, mood, physical self-concept, and body image and their relationships to physical activity change. Although the psychological constructs addressed would be similar to that of social cognitive theory (Bandura, 1986), use of the transtheoretical model in future research might contribute to tailoring health education lessons based on the varied needs of students. Treatment processes for increasing physical activity that are sensitive to transtheoretical stages have previously been suggested (Spencer, Adams, Malone, Roy, & Yost, 2006). Although logistically challenging, future research should consider partitioning health education classes based on the transtheoretical stages of students (which is easily assessed; Annesi et al., 2010). This might enable a more viable evaluation of social cognitive theory as a guiding paradigm and also allow for adaptation of the curriculum based on the starting point of students.

Other limitations of this research should also be considered. Many are a result of the constraints present when conducting research in field or applied settings. For example, research undertaken in a school setting typically must be completed without major disruption to the classroom environment. The study's lack of a control group minimizes the strength of the results, but was appropriate for this pilot investigation. However, replications that are longer in duration with a more comprehensive curriculum should consider incorporating a comparison group. Also of possible concern was the use of a convenience sample. Although this sample was determined by placement in classes by the school's guidance department, and thus not considered random, it is likely that it represented a cross section of ninth graders. The sample used in the study was somewhat small and included only participants between the ages of 14 and 16. The demographic make-up of the sample was predominantly Hispanic American and was from a low-income urban school district. Thus, the results from this rather specific sample type may not generalize to other samples or adolescents as a whole. Additionally, for this study it was determined that it would be appropriate to have the health education teachers instruct the six lessons, administer the self-report questionnaires as part of the unit on physical activity, and collect data as part of the school's approved curriculum. While this led to minimal disruption to the students and teachers, it limited oversight of delivery of the lessons. It is also

possible that perceived expectations from the participants (e.g., halo effect, Rosenthal effect, demand characteristics; Morgan, 1997) biased responses. However, the completion of this research in a practical setting also served to improve the practicality of its findings for real-world application within high schools, and that could be considered an advantage (Glasgow & Emmons, 2007). Assessment of change scores had the disadvantage of inflating measurement error associated with the surveys by combining error from two administration times (Nunally & Bernstein, 1994). However, practically accounting for the dynamic process of change was an important aspect of this research.

Summary

This study evaluated the effects of a behaviorally based health education component on the physical activity of ninth-grade students involved in classroom-only lessons. Although this was a brief study, it demonstrated a statistically significant improvement in physical activity behavior, but not in all of the psychological variables of interest. Future similar studies might show more pronounced results for increasing physical activity through psychological mechanisms if they are focused on theory-based variables that are especially important to adolescents. Future studies should also consider lengthening the intervention time. Participants' initial involvement with physical activity might also be considered. Results from this study support integration of specifically directed health education lessons as a vehicle for increasing the physical activity of high school students. As school leaders continue their efforts to positively affect both the health and academic performance of their students, results from this and other studies that address the role that increased physical activity can play will, hopefully, impact their decisions to incorporate theory-based behavior-change methods into classroom settings. Thus, extensions of this research are warranted.

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