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ASSESSMENT

Assessing Student Knowledge and Incorporation of Smart Technology Into Daily Physical Activity

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Abstract

This study describes high school students' use of smart technology to enhance leisure-time physical activity. Participants included 109 students who completed an informational survey comprised of questions examining non-school sport and physical activity hours, daily video game hours, and use of Kinect active video games and smartphone apps. Students engage in 1.99 hr/week of physical activity (SD = 1.13), play video games an average of .46 hr/day (SD = .69), and use 1.21 active video games (SD = 1.43) and .52 smartphone apps (SD = .75). Results show that students are minimally familiar with active video games and smartphone apps, but fail to meet physical activity recommendations set by the American College of Sports Medicine. Additionally, students can benefit immensely from structured instruction on health benefits and incorporation of such technology. Recommendations for application include explicit classroom instruction, teacher encouragement, and reinforcement throughout coursework.

The long-term health consequences of youth physical inactivity serve as a significant public health concern (Tremblay, LeBlanc, Kho, Saunders, & Larouche, 2011). As the prevalence of obesity in America has reached epidemic proportions, 33% of youth are now considered to be either overweight or obese (Centers for Disease Control and Prevention, 2012). For positive health outcomes, it is recommended they get at least 150 min/week of moderate-intensity

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exercise. This can be met through 30–60 min of moderate-intensity exercise 5 days/week or 20–60 min of vigorous-intensity exercise 3 days/week (American College of Sports Medicine [ACSM], 2011). Eighty percent of youth, however, do not meet these recommendations (Hallal, Anderson, Bull, Guthold, & Haskell, 2012). Inadequate energy expenditure is just one contributing factor, but can lead to increased risk for obesity, cardiovascular disease, diabetes, and varying forms of cancer (Bassett, Wyatt, Thompson, Peters, & Hill, 2010; Friedenreich, Neilson, & Lynch, 2010; Pinto-Pereira, Ki, & Power, 2012), which thus represent significant concerns relative to morbidity and early mortality.

Although physical activity (PA) and exercise decline dramatically during adolescence (Troiano, Berrigan, Dodd, Masse, & Tilert, 2008), today's youth spend more than 7 hr/day (Marshall, Gorely, & Biddle, 2006) using some form of media (e.g., televisions, video games, computers, tablets, smartphones, and iPods). It is no surprise that technology plays a significant role in the daily life of adolescents (Rideout, Foehr, & Roberts, 2010). However, those engaging in more than 4 hr/day of screen-based activities exercise less than the national recommendations (Bowman, 2006). In fact, a positive correlation exists between increased hours in front of screen-based media and sedentary lifestyles (Ford, Kohl, Mokdad, & Ajani, 2005; Ford et al., 2010; Foster, Gore, & West, 2006; Hu, 2003). Even more, it has been projected that screen time for youth will only continue to rise (Marshall et al., 2006).

Although the damaging health effects of physical inactivity within this age group are difficult to demonstrate in the short term (Gorely, Marshall, Biddle, & Cameron, 2007), the need to understand more about the role of smart technology on the lifestyles of youth has been broadly acknowledged (Gordon-Larsen, McMurray, & Popkin, 2000). Several studies have shown a negative association between age and PA during adolescence (Borraccino, Lemma, & Iannotti, 2009; Taveras, Field, & Berkey, 2005). As age increases, PA decreases; coincidently, at the same time screen media exerts a greater sedentary influence on their daily lives (Strasburger, Jordan, & Donnerstein, 2010; Tremblay, Colley, Saunders, Healy, & Owen, 2010). Additionally, previous research has shown that high levels of habitual sedentary time, especially screen-based activities, are

associated with poorer measures of body composition, decreased fitness, lower self-esteem, and reduced pro-social behavior (Tremblay et al., 2011). For these reasons, better strategies that improve PA levels among youth need to be developed, and incorporating activities using smart technology may be an effective way (Matherson, Bryant, Wright, Inman, & Wilson, 2008). Providing fun or enjoyable experiences is one of the most effective strategies for increasing PA levels in adolescents (Weiss, 2000), and with today's youth, discovering activities that are "fun" often includes involving those utilizing smart technology.

This study describes high school students' use of smart technology to enhance leisure-time PA. Two hypotheses were developed: (a) students would use at least one smartphone app or Kinect active video game (AVG) regularly to enhance their PA, but (b) fail to meet the ACSM daily PA recommendations.

Method

Participants

Participants in this study included 109 high school (68 male, 41 female) students enrolled in four basic conditioning physical education classes at a large suburban high school. Participants ranged in grade level from ninth (freshman) to 11th (junior), with 50 freshman, 43 sophomore, and 16 junior students. The conditioning physical education class at this high school serves as the introductory course for the programming principles of cardiovascular, muscular strength, and endurance training. Each course met twice weekly for 55 min over 12 weeks (quarter system).

Research Design

The university institutional review board approved this research. Before data collection, parental consent was obtained, followed by participant assent. One hundred twenty high school students were recruited for this study, 11 of whose parents chose not to provide consent. All 109 of the remaining students elected to participate in the study. Participants were asked to complete a survey specifically designed for this study, which was comprised of questions examining (a) the type and average number of weekly hours of leisure-time

PA, (b) daily hours of video game play, and (c) use of Kinect AVGs and smartphone apps. The AVGs evaluated in this study included *Wii Fit*, *Nike Training*, and *Zumba Fitness Rush,* and the three smartphone apps were MapMyRun, Nike Training, and Adidas MiCoach. Immediately following survey completion, participants were debriefed. All participants were instructed to download, were provided direct classroom instruction, and received supervised practice with each of the Kinect games and smartphone apps included in the survey.

Research Survey

The survey used for this research was designed specifically for this study and consisted of eight questions seeking demographic information (gender and year in school), PA patterns, and use of innovative technology (smartphone apps and Kinect AVGs) from participants. Survey questions were "check the appropriate box" or list format and can be found the Appendix. For the fifth survey question, the categories were developed from current PA recommendations (e.g., 0 = sedentary, 1–3 = low–moderate PA, 4–6 vigorous PA, and 6+ = highly vigorous PA), whereas categories for the sixth survey question were designed to negatively correlate to items in the fifth question. For instance, it was assumed that if a student reported 0 weekly PA hours, he or she would likely report higher daily video game hours (i.e., 4 or more), whereas a student who reported higher weekly PA hours (i.e., 6 or more) would report lower daily video game hours (e.g., 0).

Results

Data were analyzed using SPSS version 22. Descriptive statistics revealed that students engaged in 1.99 hr/week of leisure-time PA (SD = 1.13). Further, students played an average of .46 (SD = .69) daily video game hours, used 1.21 Kinect AVGs (SD = 1.43) to increase PA, and used .52 smartphone apps (SD = .75) to enhance the physical activities they engage in each week.

Discussion

Results from this study supported both hypotheses. First, students used at least one Kinect AVG to increase PA on a regular basis.

Although this does not seem significant, a large body of research suggests that sedentary screen-based activities (i.e., video games) negatively influence overall PA levels and energy expenditure of youth (Goldfield, Kenny, & Hadjiyannakis, 2011; Schneider, Dunton, & Cooper, 2007). More recently, however, studies have examined the influence of AVGs on youth PA, and findings reveal that for youth who would otherwise be involved in sedentary leisure-time activity, AVGs positively influence PA patterns (Gao, Chen, Pasco, & Pope, 2015; Smallwood, Morris, Fallows, & Buckley, 2012). Thus, if students find even just one game they find enjoyable and spend their leisure-time hours engaging in such, overall activity can be increased in those who would otherwise be sedentary. Ideally, however, students would find more than one game of interest, as variety has been found to maintain interest and enjoyment longer and, as such, has the potential to stimulate long-term behavior change more significantly. Furthermore, for youth who become interested in increasing PA through the use of AVGs, the goal would be a move toward traditional forms of activity over time (e.g., jogging, muscular endurance, and strength training). Initially, students may be motivated to beat others through multiplayer competition or from social media reinforcement, but as physical competence increases and students learn skills in a comfortable environment (at home or in a classroom), motivation to participate would ideally transition from extrinsic to intrinsic with increased hours spent engaging in more active lifestyles that include traditional forms of PA (e.g., walking, jogging, recreational sport, spontaneous play).

Students in this study, however, reported using less than one smartphone app to enhance the physical activities they engage in. These findings were not as expected, as we hypothesized students would use smartphone apps on a regular basis. The app used most widely was MapMyRun, whereas the one used least regularly was Nike Training. Both apps are free and compatible with both iOS and Android, but it makes sense that students used MapMyRun significantly more than other apps. The MapMyRun app has been advertised as the number one running app since its development. Furthermore, it does not require training equipment, can be used while engaging in a simple and low-cost activity (i.e., running), and requires little data entry. Nike Training Club, on the other hand,

assumes some knowledge of varying types of training (cardiovascular, muscular strength, and endurance) or the motivation to learn new skills. It also it requires equipment or access to a gym and is much more complex to use (data entry and tracking). Given that the participants of this study were high school students, it cannot be assumed that all had motivation to learn new workout programs. Furthermore, we examined app use in relation to leisure-time PA. If students did not have a gym membership or home workout equipment, this may have inhibited their ability to complete workouts designed by the Nike Training Club app. Additionally, the app contains a lot of instructional information, explicit demonstrations, and several platforms to sync data for tracking, but it may contain too much information in which high school students are not interested, therefore, hindering its use.

Our results also show that high school students do not meet the recommended daily PA guidelines. The current recommendation is for youth to get at least 150 min/week of moderate-intensity exercise, which can be met through either (a) 30–60 min of moderate-intensity exercise 5 days/week or (b) 20–60 min of vigorous-intensity exercise 3 days/week (ACSM, 2011). It may be assumed that students get an adequate amount of PA through physical education during the school day, but research has shown the opposite (Dudley, Goodyear, & Baxter, 2016). Physical education provides a vehicle to obtain optimal levels of moderate to vigorous PA during school for adolescents. Less than 8% of public schools in the United States, however, offer daily physical education (Lee, Burgeson, Fulton, & Spain, 2007). Additionally, it is noted that students should spend 50% of class time in moderate to vigorous PA (Centers for Disease Control and Prevention, 2009). For numerous reasons, few students meet these recommended levels (Nader, 2003), and thus, the amount of PA youth obtain during leisure-time hours is much more significant. Our results show that students are familiar with AVGs, but lack knowledge in using smartphone apps appropriately to facilitate and enhance PA. Furthermore, our findings suggest that students can benefit immensely from structured instruction on benefits and proper incorporation of such technology to be used outside of school hours. We recommend (a) explicit classroom instruction, (b) teacher encouragement, and (c) reinforcement throughout coursework.

Recommendations for Explicit Classroom Incorporation

A variety of strategies can be used for implementing AVGs and smartphone apps into the academic curriculum. First, teachers who have access to multiple Kinect sensors can incorporate AVGs into classrooms lessons in several ways including (a) timed station work, and (b) large group simulations.

First, lessons can be designed so that small groups of students interact directly with the Kinect sensor and others follow along in simulation exercises (Martin, Ameluxen-Coleman, & Heinrichs, 2015). In this format, the target student, or group of students in party mode, would interact directly with the Kinect sensor and receive performance feedback while the rest of the class would indirectly follow. Every few minutes, students would rotate so that all have the opportunity to challenge themselves with the Kinect sensor, and as a result, all students have the opportunity to master skills, whether the focus is health or skill fitness components. The advantage of this pedagogical strategy is that all students have the opportunity to meet the goals of MVPA and they receive direct performance feedback (Trout & Christie, 2007).

Second, timed station work could be organized so that each would focus on specific fitness components, and students would work in small groups and then rotate as directed (Martin et al., 2015). An advantage of this learning format is that teachers organize groups so that all students practice specific aspects of fitness during designated class periods or for specified durations in each class.

Smartphone apps can be incorporated into daily lessons in several ways. First, teachers can display apps through an HDMI input or wireless connection to a projector within a classroom or gym to lead the class through lessons. Apps can then be used as an instructional tool for demonstration and active practice with verbal cues for students to follow on screen. An advantage of this format is that the teacher has the ability to provide modifications for students who benefit most.

Teachers can also implement smartphone apps into classroom lessons by providing small groups of students with timed sessions to work together in an active manner through dance sessions, exercise routines, and other active games. Groups could be tasked with beating previous "best" times while learning to cooperate, and thus,

increase motivation in a fun and action-oriented environment (Martin et al., 2015). The teacher would serve as facilitator in this format by incorporating and reinforcing short activity periods into classes throughout the academic year.

Teachers can also incorporate smartphone apps into classrooms by dividing students into small groups that are instructed through lessons and then provided problem-solving practice. For example, for specific apps, groups can be assigned problem-solving tasks that focus on behavior modification, goal assignment, and progress evaluation.

Meeting Specific Developmental Needs

Based on previous research investigating the developmental needs of youth for PA, we recommend instruction be focused on skill development, fitness, and success (Weinberg & Gould, 2015). In-class strategies for skill development should utilize contingent feedback, demonstration, and individual practice. Specifically, the focus should be on teaching and practicing skills while offering developmentally appropriate modifications as needed. When teachers provide feedback, a positive approach and instruction emphasizing what students have done correctly is most effective. When teachers focus on catching students doing things right, provide plenty of encouragement, and reward correct technique, student motivation for learning new skills and long-term commitment increases. For fitness, we recommend that teachers focus on teaching students how to monitor their own fitness effectively. Purposeful lessons designed to increase fitness are most effective. For example, teachers should implement units that define varying components of fitness and teach proper methods for measuring and monitoring. In terms of the developmental need for success, teachers should incorporate in-class strategies that help students define winning with a mastery orientation, such achieving one's own goals and standards for improvement. Additionally, teachers can create environments that help reduce fear of trying new skills, by using encouragement and reinforcement through coursework.

Recommendations for Teacher Encouragement and Reinforcement Through Coursework

The type of feedback provided strongly influences whether students will be motivated to try new skills. Research indicates that social support, regular performance feedback, and positive reinforcement influence motivation (Cress et al., 2005). Social support from others, specifically teachers and peers within an academic setting, is associated with long-term adherence. Examples include exercising in groups or with friends and regular follow-ups that evaluate progress toward goals. In an academic setting, assignments developed as supplemental, home-based activity sessions for which students report physical activities in class would provide opportunities for students to evaluate progress and for teachers to provide individualized goal-oriented feedback throughout the curriculum. Individualized feedback is more meaningful and is based on the current ability and goals of each student. Additionally, goal-oriented feedback helps facilitate long-term maintenance and intrinsic motivation by helping students develop realistic expectations of their own progress. By providing such feedback throughout the academic year, teachers would reinforce a well-established principle for increasing intrinsic motivation, but deliver feedback through a mode that is more relevant to the high school population and thus may be more significant.

Conclusion

The goal of our research was to describe high school students' use of smart technology relative to leisure-time PA. We developed two hypotheses and found support for both. First, we found that students use AVGs to increase PA. Students have limited experience using smartphone apps to enhance their PA, however, and lack specific knowledge as to how to use the technology effectively. Second, students continue to fall short of meeting the recommended hours for daily PA set by the ACSM. Our recommendations are focused on increasing student leisure-time PA, with an emphasis on applying knowledge within the academic curriculum. We recommend explicit classroom instruction, teacher encouragement, and reinforcement throughout coursework.

This article adds support to the notion that smart technology can be used creatively as a way of enhancing PA of youth. We conclude, however, that if youth are to increase leisure-time PA, principles of training and appropriate uses of technology must be taught within the academic curriculum and directly reinforced by teachers during the school day.

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Appendix
Research Survey

1. What is your gender?

   _____ female _____ male

2. What year in school are you?

   _____ freshman _____ sophomore

   _____ junior _____ senior

3. List **all sports** you participate in (club and/or recreational):

4. List **all types of physical activity and exercise** you participate in (after school):

5. How many **hours each week** do you participate in physical activity, exercise, or sport outside of school hours:

   _____ 0 _____ 1–3 _____ 4–6 _____ more than 6

6. How many **hours each day** do you play video games:

   _____ 0 _____ 1–3 _____ 4 _____ more than 4

7. Have you played the following video games to increase your physical activity? **Check all that apply and the number of days per week for each.**

   _____ *Wii Fit* _____ *Nike Training Kinect*

   _____ *Zumba Fitness Rush* _____ Other: write them in here:

8. Have you used the following apps? **Check all that apply and the number of days per week for each.**

   _____ MapMyRun _____ Adidas MiCoach

   _____ Nike Training _____ other: write them in here: