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## **Integration of Active Video Games in Extracurricular Activity at Schools**

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### **Abstract**

Active video games require players to be physically active. Dance Dance Revolution (DDR) is an interactive dancing game that requires fast-foot movement coordinated with energetic music and visuals. The Wii and Xbox Kinect games have also become good active video games for the promotion of physical activity participation. These games are much more interactive than traditional games because more body movements are added to the video game experiences. Active video games, if applied in extracurricular settings, will be helpful in maximizing the opportunity for children to be active. As such, this article discusses the health benefits of these active video games, and how to integrate these games into after-school physical activity programs. Additionally, the article also provides strategies for the implementation of DDR, Wii and the Xbox to stage the games, establish competitive/non-competitive physical activity atmospheres, promote teamwork, and improve student physical activity levels.

**Keywords:** *Dance Dance Revolution, physical activity, school children, Wii, Xbox Kinect*

### **Introduction**

Regular participation in physical activity has a significant positive influence on children's health and well-being which, in turn, has significant consequences for both individuals and society as a whole (National Association for Sport and Physical Education [NASPE], 2005). However, young people's physical activity levels have been lower than recommended for good health (Biddle, Gorely, & Stensel, 2004). Americans, even students engaged in physical education classes at school, are largely physically inactive. This fact is

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critical because physical inactivity is the fourth major risk factor for mortality and is a contributing factor in the development of breast cancer, cardiovascular disease, and diabetes (World Health Organization [WHO], 2014). Unfortunately, it is reported that only 29% of high school adolescents met the physical activity guideline of 60 minutes per day of moderate-to-vigorous physical activity and that 15.2% of high school kids did not participate in 60 minutes or more of moderate-to-vigorous physical activity on any day during the last 7 days (CDC, 2013). More troubling is the fact children's physical activity levels tend to decline during the developmental years (Parish & Treasure, 2003). Thus, it is essential to develop physical activity intervention strategies to boost physical activity levels among children and adolescents.

Schools are often the most ideal settings for the promotion of physical activity since most children can be reached. However, researchers indicate that physical education classes cannot solely provide sufficient activity for children and adolescents to meet the health-related recommendation of 60 minutes or more of moderate-to-vigorous physical activity engagement on a daily basis (Biddle et al., 2004). Therefore, great effort has been made to provide physical activity in other venues such as extracurricular physical activities (Jago & Baranowski, 2004). Indeed, research does indicate that the majority of physical activity engagement of children and adolescents occurs outside of physical education classes (Morgan, Pangrazi, & Beighle, 2003). In this accord, the extracurricular activity program represents an important school-based activity for the promotion of children's physical activity.

In general, the extracurricular physical activities offered at schools tend to be interscholastic sports programs. However, using a sport program model for extracurricular physical activity has limitations such as gender differences, different skill levels, requirements of uniforms and equipment, involvement inequity, safety issues, and lack of coaches (Brustad, Vilhjalmsson, & Fonseca, 2008). As such, it has been suggested that schools expand methods to promote students' physical activity (CDC, 2009a).

The preceding plea has been made as activities that require very little movement like playing sedentary video games and watching a wide array of television shows seem to dominate children's free time outside school. These activities are easy to perform and entertaining, but unhealthy when engaged in on a regular, prolonged basis (Anand, 2007). To address these concerns, companies, organizations, and governments have worked diligently to help youth understand the importance of participating in regular physical activity. In addition, scholars have suggested that innovative physical activity programs incorporating active video games (AVG) can serve as an entertaining means to promote youth's daily physical activity levels (Epstein, Beecher, Graf, & Roemmich, 2007; Gao, Podlog, & Huang, 2013a).

AVG are a new generation of games integrating body movement and exercise with computer technology. There are several benefits of using AVG as a means to promote physically active lifestyles in children and adolescents. To begin, some AVG have been effective tools in increasing children's energy expenditure (Epstein et al., 2007) and are reported to elicit positive health behaviors - especially for sedentary children (Zhu, 2008).

Further, AVG can provide opportunities for children who enjoy video games to engage in physical activity and possibly improve their health as well. For example, Dance Dance Revolution (DDR) is an interactive dancing game requiring fast-foot movement coordinated with energetic music and visuals and has already been applied in some American physical education programs as part of the curriculum (Gao, 2013). With a built-in workout mode that allows players to track how many calories they burn as they play, DDR is considered a good aerobic exercise to counter childhood obesity. Various other Wii games (e.g., Wii Fit, Wii Fit Plus, Wii Just Dance and Wii Cardio Workout) are also good AVG types to promote children's physical activity. The combination of the Wii Remote and the sensor bar allows the games to be much more interactive and adds a physical element to the video game experience. Given its appeal to children and the benefit of helping develop balance and core strength as well, the Wii is another gaming console which has been integrated into the classroom as part of the physical education curriculum (Gao, 2013). Thus, the purpose of this article was to describe some examples of AVG, explain the health benefits of these games and discuss the feasibility of using AVG in physical activity promotion. Finally, ways to integrate the games into extracurricular physical activity programs will be discussed.

### **What Are the Active Video Games?**

One of the main features of AVG is the requirement of body movements that capture children's interest in physical activity and increase physical activity engagement to health-enhancing levels. While there are numerous AVG, a few games (DDR, Xbox and Wii games) have been popular for implementation into school settings. As such, these games will be introduced below.

#### **Dance Dance Revolution**

DDR is a long-standing music video game series developed by the Konami Company in Japan in 1998 of which was released in North America and Europe in 1999. When playing DDR, students stand on a dance pad with arrows laid out in a cross formation. Children step on the arrow corresponding to that displayed on the screen resulting in the synchronized movement of their feet to the music. Students are judged by how well dance steps coordinate with the on-screen arrows and are allowed to choose more music to dance to if they receive a passing score. DDR has been widely recognized for its fitness benefits, and has been adapted by many schools in the nation and incorporated as part of the physical activity and health curriculum (Gao et al., 2013a; Gao, Zhang, & Stodden, 2013b).

#### **Wii Gaming Console**

The Wii gaming console (Nintendo, Kyoto, Japan) provides a variety of AVG to promote children's physical activity. A distinguishing feature of this game console is its use of the wireless controller (i.e., the Wii Remote) which can be used as a handheld pointing device assisting in the detection of movement in three dimensions. Specifically, the Wii console uses a sensor bar which is placed either above or below the screen tracking the movements of the controller while the individual plays the game. The combination of the Wii Remote and the sensor bar allow games to be much more interactive and adds a distinct physical element to the video game experience. In Wii tennis, for example, users swing the Wii Remote as if it was a tennis racket. Sensors in the controller transmit those motions

wirelessly to the game console, engaging the in-game characters in the same swinging speed and arc of the human player and sending the ball back over the virtual net. The controller takes many forms, from a basic wand-like remote to golf clubs, fishing rods, or a fitness pad that senses the position and balance of a user. In general, the Wii Sports and Wii U games include baseball, boxing, bowling, golf and tennis games while the Wii Fit games include more than 40 activities such as soccer, yoga, skiing, strength training, balance, and aerobics.

### **Xbox Kinect Gaming Console**

Xbox Kinect (Microsoft, Redmond, WA) was introduced in 2010 featuring a unique interface which utilizes a motion camera to detect a player's movement. This enables individuals to interact with the game without the need for a remote controller. The Kinect sensor interprets certain gestures of users in three dimensions, making engagement in gameplay possible with just a hand or arm motion. Some examples of Kinect games include Kinect Adventures and Kinect Sports. Kinect Adventures has been the best-selling game on the Xbox 360 with over 24 million units sold globally (Makuch, 2013) and has mini games that last for about three minutes (e.g., River Rush, Reflex Ridges and Rally Ball). These mini games incorporate rafting, track-and-field, and handball concepts where users' appropriate head and limb motions and timing are required to earn and build points.

Kinect Sports includes games such as ten-pin bowling, boxing, track and field, table tennis, beach volleyball and soccer. Players can engage in gameplay by mimicking the movements performed in real-life sports while allowing for multiple players to play against each other and online. Additionally, Kinect Sports has featured voiceover recordings of famous announcers and several music tracks which are used during gameplay to emphasize when users score a goal, break a record, or win a game—ultimately assisting in increasing the focus of children on gameplay while also offering a possible motivational benefit to these children.

### **Health Benefits of Active Video Games**

Watching television, playing electronic games, and using computers are prevalent sedentary behaviors among young people who reportedly engage in an average of three hours and 45 minutes of these behaviors daily with the highest usage seen between the ages of 9 and 12 years (Biddle, Marshall, Gorely, & Murdey, 2003). More recently, it has been reported that a majority of children in the U.S. engage in approximately 5-7 hours of screen time daily (Kaneshiro, Zieve, & Black, 2013). Although, playing video games has been identified as one of the prominent sedentary behaviors among youth, a new generation of active video game consoles such as DDR, the Wii and the Xbox might provide a novel opportunity to turn a traditionally sedentary behavior into a physically active endeavor capable of improving health outcomes such as aerobic fitness.

Previous studies have reported the physiological benefits associated with playing DDR, the Wii, and similar AVG. Lanningham-Foster et al. (2006) found that energy expenditure more than doubled when participants played AVG such as DDR compared to playing sedentary video games. During a study conducted by Maddison and colleagues (2007), significant ( $p < .001$ ) increases in energy expenditure (129-400%), heart rate (43-84%), and activity counts (122-1,288 counts during AVG play versus 0-23 at baseline) were seen

when youth played AVG compared to baseline .

More recent studies have compared the benefits of AVG with those of traditional physical activity. Graf, Pratt, Hester, and Short (2009) indicated that children playing DDR or Wii Sports had energy expenditures equal to that of moderate-intensity walking. Similar results were found in research by Perron, Graham, Feldman, Moffett, and Hall (2011). This research examined whether playing Wii Fit and EA Sports Active (both using the Wii platform) assisted children in meeting recommended guidelines. The authors found heart rate measurements for both AVG reached moderate intensity (65-68% age-predicted  $HR_{max}$ ) and concluded that both AVG achieved adequate intensity to meet physical activity guidelines (Perron et al., 2011). Other researchers found significant reductions in body fat from pre- to post-intervention utilizing DDR (Trout & Zamora, 2007). These results also indicated consistent high levels of enjoyment over the eight week program.

Improvements in psychosocial constructs, such as enjoyment, while engaged in AVG is crucial as it has been found greater physical activity results from higher levels of intrinsic motivation and enjoyment arising from children's engagement in AVG (Gao et al., 2013a). Taken together, existing literature provides evidence that AVG offers health benefits equal to that of traditional light and moderate intensity physical activity. Moreover, AVG represent a fun and entertaining way for school children to develop healthy habits.

### **Possibility of Integration of AVG at Schools**

Extracurricular physical activities are essential for every school student and, thus, extracurricular physical activity programs that meet the needs and interests of all students must be encouraged and promoted. To promote physical activity in extracurricular activities, specific conditions should be established. The CDC (2009b) states that a variety of developmentally appropriate physical activity programs should be provided for all students, that students should be encouraged to engage in community-based physical activity programs, and that community resources should be used to support extracurricular physical activity programs. Researchers have also established similar criteria: the activity must be noncompetitive; the student must have a choice about whether or not to participate (i.e., provide an autonomy-supportive climate); physical activity must not require a great deal of mental effort; activities must vary from those that can be done alone, without a partner, to others which can be completed with teammates; students must understand and believe in the value of physical activity for health and general well-being; students must believe the physical activity will become easier and more meaningful if they persist; and that the physical activity should be implemented in such a manner that the student is not self-critical (Darst & Pangrazi, 1998). Active video games meet the aforementioned conditions as a result of their unique gameplay characteristics.

Active video games make physical activity fun and challenging for both high-skilled and low-skilled students. From our observations during many field experiments, the most desirable trait of AVG is that most children enjoy them so much they can be used as a reward (Gao et al., 2013a). Researchers (see Trout & Zamora, 2007) indicated that playing DDR is an enjoyable and challenging activity even after playing it three times per week for eight weeks. The Wii Sports and Xbox Kinect games have been a favorite of the gaming community since

their introduction (Magrino, 2011), garnering praise for both systems' ability to transform the gaming experience into physical activity engagement. As a result, thousands of school children are actively playing these games.

Further, when playing DDR, children can use "workout mode" to enable the use of a diary of calories burned and any self-reported changes in weight to be tracked over time—a convenient tool for students to use outside of PE class. Currently DDR has been the most widely used AVG in school settings (Gao, 2013; Miller & Carr, 2008), making DDR an excellent option for extracurricular physical activity. However, Wii Sports' variety of simulated sport play environments and Wii Fit's numerous workout options are also appropriate options for extracurricular physical activity. Taken as a whole, the preceding games allow children to choose various sports or activities to complete during one workout session and, if adapted to school-based extracurricular activities in the correct manner, can provide a viable means of increasing the physical activity participation of children.

### **Adapting AVG into Extracurricular Activities**

For health benefits, DDR, as well as games on the Wii and the Xbox, may be used as extracurricular activities in both competitive and non-competitive settings. Competitive settings are where children play AVG in competition against one another or computer-generated opponents. Non-competitive settings refer to an environment in which children do not have to compete against each other when playing AVG, but rather play for the purpose of increasing fitness or to learn certain motor skills. Specifically, non-competitive AVG can be thought of as a setting where children care more for improving competence rather than beating others.

#### **Intramural AVG Sports**

Regarding integration of AVG into competitive settings, AVG can be adapted into extracurricular activities in the form of intramural sports. Just like regular intramural sport activities, Kinect Sports and Wii Sports together offer nine different sport options such as bowling, boxing, track and field, table tennis, beach volleyball, soccer, baseball, tennis and golf of which multiple players can compete simultaneously. In addition, DDR or Xbox Dance Central can offer dance battles between two students. Schools can implement AVG championship tournaments with each of these different sport types to students who are interested in playing video games that incorporate physical activity.

For students who are confident in their DDR, Wii Sports, Kinect Sports or Dance Central skills, tournaments are a fun way to demonstrate physical competency. In DDR, students usually compete for higher scores or number of perfect step patterns. In the Wii Sports or Kinect Sports, intramural AVG can be delivered as an individual match pitting two human players against one another or in a team play format wherein two human players team up to play against two computer-generated opponents. Likewise, in bowling, students can register as a team of three or four and compete against other teams. Schools can organize tournaments of different levels (i.e., easy, intermediate, or hard difficulty levels) and various formats (i.e., team-based or individual competition).

To organize the tournament, teachers can serve as tournament program organizers and students can volunteer as administrative assistants. Each type of sports tournament can be

spread throughout the school year and decisions can be made regarding how many applicants would be adequate to implement a specific tournament. Since intramural AVG utilize advanced gameplay technology, it is advised that technology experts be onsite and prepared for any technical issues arising during the tournament. Additionally, a set of rules for the players needs to be established to prevent students from cheating (e.g., using wrist flick motion only during Wii play), and to limit opponents interfering with one another during gameplay. Finally, schools will need to decide whether they would use Wii sports, Kinect Sports or both as the funds required for the acquisition of one or both of these consoles varies and is an important consideration in regard to school budgetary concerns.

Overall, intramural AVG sports is distinguished from regular intramural sports programs in that students can learn and enjoy sport participation without facing the obstacles of gender differences, different skill levels, or safety issues as the games are designed to circumvent these factors. Thus, more students might consider participation in physical activity when these AVG are incorporated in an after school program.

### **AVG for Fitness**

AVG can be also be used as non-competitive extracurricular programs or clubs to promote students' healthy lifestyles through the introduction of fitness concepts. For example, The Wii Fit or Wii Fit Plus might best be used in the implementation of after school fitness programs. In Wii Fit, games such as yoga, strength training, balance, and aerobics are presented with a training instructor on the screen. When accompanied by a balance board, the board can measure the player's weight and provide accurate information on calories burned by calculating the exercise time and average METs for specific exercises. Therefore, children interested more in improving their strength and fitness rather than playing sports can benefit from Wii Fit. Moreover, since there are multiple levels and activities in Wii Fit, students are able to participate in the exercise of their choice at their own skill level.

During the implementation of the aforementioned fitness program, teachers should be aware of a few integration issues. First, a teacher or supervisor may want to set up some basic rules regarding time limits for gameplay (e.g. 20-40 minutes) and proper gameplay behavior to manage the program successfully. Second, teachers can educate students on basic strength or aerobic training at the beginning of the each session and set goals so that novice students can be motivated throughout the semester. If teachers are not available, a part-time instructor, community volunteer or parents can serve in this role. Finally, teachers also need to organize the initial format of the program and decide whether the program will be implemented on an individual level during a circuit system or during group exercise. When implementing a circuit system, specific fitness activities could be engaged in at designated stations allowing students to rotate from station to station, while group exercise would be the solution if there is higher demand (e.g., high number of kids) than supply (e.g., low number of game consoles). If the teacher decides to run the program in a group exercise format, different activities can be implemented on different days of the week such as yoga on Mondays, strength training on Tuesdays and so on.

Unfortunately, implementing the aforementioned AVG fitness club may encounter logistical issues such as limited dance pads in DDR and controllers for the Wii meaning only a specific number of kids will have the chance to play for live feedback. "Dry play" (i.e.,

students mimicking gameplay but not being tracked by the game console) is a possible solution for the remaining students wherein the children play on imaginary dance pads, rubber practice pads, and poly-spots during DDR gameplay or engage in freehand movements to mimic the live body movements needed to engage in Wii and Xbox Kinect play. Further, large projection systems are another effective way for dozens of students to follow along with the motions of gameplay simultaneously. In this manner, students still receive the full health benefit of the AVG aside from getting real-time feedback from the video game console. However, it is advised that after a round of gameplay (e.g., one song of DDR), students should rotate to allow for all children to receive real-time feedback regarding their body movements of which can aid in the promotion of motor skill competency. Of course, whatever rotation system works best for the activity and school can be employed.

A final alternative is to simply implement both AVG and traditional physical activity in one setting. Activities such as jumping rope, reading a physical education textbook, performing curl ups and push-ups can be completed by students when not engaged in AVG play. Students' performance during engagement in AVG and traditional physical activity can then be monitored and assessed based on their game score (i.e., during AVG play) or heart rate/step count data from a heart rate monitor/pedometer (i.e., during traditional PA) to determine whether or not they are in their target heart rate zone and/or acquiring a certain number of steps per day. Monitoring the preceding data will allow teachers to set individualized goals for each child of which provide the opportunity for greater health benefits.

### **Conclusion**

Although they will likely never act as a substitute for traditional physical activities, AVG can serve to capture students' interest in physical activity, increase their fitness and engage them in more difficult physical activities. By following the strategies discussed in this article, teachers and school administrators are encouraged to add DDR, the Wii and the Xbox as effective extracurricular activities. These AVG can be integrated into after-school activities in the form of tournaments and fitness clubs. Teachers, students and community volunteers can be actively involved in the implementation and management of the activities in order to promote physical activity in competitive or non-competitive settings.

Regardless, the primary purpose for using AVG in extracurricular physical activities is still the promotion of physical activity. In the future, it is likely additional software will emerge that focuses on even greater varieties of physical activity. It is at this point that AVG may serve more than one purpose in extracurricular physical activity programs—such as sport instruction (e.g., teaching proper kicking or swinging mechanics in soccer or baseball, respectively). Yet, it is cautioned that while the adoption trend of AVG among schools is positive overall, AVG can only supplement traditional physical activity. As such, for now, active video games should not replace traditional forms of physical activity and should be most focused on the reduction of sedentary behaviors. Overall, a mix of AVG and traditional physical activity will likely keep children's interest in the games and physical activity high and create more long-term awareness of the importance of physical activity engagement.



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