

# The Effects of Technology on Physical Education Classroom

## 採用科技對體育課的效果

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### Abstract

The obesity pandemic is sweeping the world at an alarming rate. Poor food choices and lack of activity in children are helping providing the building blocks for this issue. With the increase of video games and computers, it is important to identify ways to incorporate these into physical activity. The purpose of this study was to find out what differences and similarities exist in students' attitudes, motivation, and heart rate levels when participating in the use of Dance Dance Revolution (DDR) versus traditional dance. Although not statistically significant, results indicated that students had a higher overall self-rated perception of enjoyment, work effort, motivation, and performance during the DDR activities than during the traditional dance. With a Physical Education focus of attaining as much physical activity by our students as possible, outside of school, it is important to identify activities they enjoy significantly.

### 摘要

學童肥胖的問題愈來愈嚴重。本研究旨在探討採用科技遊戲來提升學生的運動量，結果顯示學生對活動的興趣是重要的。

### Introduction

Over the past decade, it has become apparent that childhood obesity is becoming a problem on a global scale that needs to be dealt with. A survey conducted by the Center for Disease Control between the years of

2003 and 2006 indicated that 17% of children ages 6-11 were defined as obese (Department of Health and Human Services, 2008). Poor food choices, lack of activity, and increased time during sedentary activities all play a part in the problem. Although all of these issues are important, one of the main components driving childhood

obesity is a lack of motivation (Hardus, van Vuuren, Crawford, & Worsley, 2003).

Since children spend a majority of time in school between the ages of 5 and 18 years old, the physical education classroom provides an important setting for students to learn and practice healthy activities that can be utilized over the course of a lifetime (Hill & Wyatt, 2005). Studies investigating student motivation in physical education have found that simple activity alone may not be totally responsible for motivating students. A study conducted by Garbers, Nelson, Rosenberg, and Chiasson (2006) found that motivational reminders and techniques were necessary for students to stay motivated while wearing pedometers. Another study performed by Xiang (2004) about running motivation found that students who were more motivated had a personal interest in running and thus, were more intrinsically motivated. Furthermore, Daniels (2004) found that technology was able to motivate students in other disciplines within the educational system. Multiple studies have been conducting utilizing pedometers as motivators to increase physical activity among participants, although not all of the results have similar findings. Some studies using pedometers like the ones conducted by Schofield, Mummery, and Schofield (2005) and Sidman, Corbin, and Masurier (2004) found an initial increase in physical activity, which was not maintained over a long period of time. Other studies such as ones conducted by VanWormer (2004) and Tudor-Locke (2001) found that pedometers were able to increase and maintain activity levels.

One of the fastest growing sectors in the entertainment industry, second only to music in profitability, is the video and computer game sector (Abelman, 2007). Graves, Stratton, Ridgers, and Cable (2007) found that an adolescents' energy expenditure was 51% greater during active gaming than during sedentary gaming. Similar results have been found by Sell, Lillie, and Taylor (2008) after conducting a study with college students participating in Dance Dance Revolution (DDR) sessions. Utilizing the same technological platform, the purpose of this study was to find out what differences and similarities existed on students' attitudes, motivation, and heart rate levels when participating in the use of Dance Dance Revolution (DDR) versus traditional dance.

## Methods

### Subjects

Thirty-three students from an elementary school in Alaska participated in the study. All 35 students in the 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> grades were eligible to participate in the study. Of those students, 33 students returned their parent consent forms, signed a child assent form, and were present for all days of the testing. Once the students returned both forms, height, weight, and age were recorded for every student. The mean and standard deviation descriptive statistics for males (N=16) were: 10.88 years old (SD= .89), 56.97 inches tall (SD=2.54), and 91.13 pounds (SD= 21.70). Female (N=17) statistics were as follows: 10.71 years old (SD= .85), 59.24 inches tall (SD= 2.54), and 104.88 pounds (SD= 23.23).

### Instruments

A review of literature failed to identify an instrument related to students attitudes and perceived exertion during exercise involving music. As such, the researchers constructed a survey from discussions that were held with elementary classroom physical education teachers and elementary classroom teachers dealing with physical education in the public schools. The researchers constructed a survey of four questions. The survey completed at the conclusion of every activity asked students four questions about their participation in the different activities. The participants answered the questions based on a four-point Likert scale in order to keep it relatively simple for the students. The following questions were asked of each student:

- Rate your work effort (how hard you worked) today.
  1. Didn't try at all,
  2. Worked a little bit,
  3. Worked pretty hard,
  4. Worked as hard as possible
- Did you enjoy the activity done in class today?
  1. not at all,
  2. Didn't care for it much,
  3. It was good,
  4. Enjoyed it a lot

- Did you feel the activity motivated you to work harder during class?

1. not at all,
2. Didn't care for it much,
3. It was good
4. Enjoyed it a lot

- Rate your performance (how well you did).

1. didn't perform well at all,
2. Performed average,
3. Performed very well,
4. Performed better than I ever expected.

The students' goal during all of the activities was to keep their heart rate within a healthy zone for optimal benefits. The students tried to keep their heart rates between 60 and 80 percent of their maximum heart rate. First, students found their maximum heart rate by using the formula:  $220 - \text{their age}$ . After establishing that, they multiplied the answer by .6 to find the lower heart rate in the zone and .8 to find the higher heart rate in their zone. Table 1 shows the desired heart rate zone for ages 9-13. Their goal was to keep their heart rate within that zone as long as possible during their time in class.

Results of the survey were then compiled into one score for each activity for each student. This score is called the Self Rated Performance (SRP) and is calculated by adding the responses from all four questions pertaining to the students' attitude, motivation, and effort. The minimum score could be four while the maximum score could be 16. After the completion of all the activities, students' data were immediately analyzed. First, Body Mass Index (BMI) was calculated [ $\text{BMI} = \frac{\text{weight in pounds}}{(\text{height in inches})^2} \times 703$ ] for every student. Next, students Self-Rated Performance (SRP) score was also calculated for every student to be used during analysis. Finally, using all of this information, descriptive statistics were calculated for males and females.

## Procedures

Each day, upon arriving to the physical education class, students immediately put on Polar E600 heart rate monitors. Each heart rate monitor was given a different number so students and the researcher could easily identify one student's heart rate monitor from another. Students were assigned a specific heart rate monitor to wear during the entire class period every day of the

study. Once students began the warm-up activity, the heart rate monitors were started. The same warm-up activity was done by all students on every day that the data was collected. This warm-up activity, which focused on the cardiovascular system, was conducted for the first five minutes of class every day.

In order to counterbalance the study, activity was done with different classes performing DDR and traditional dance on different days. For this study, the 5<sup>th</sup> grade class and one multi-age class (4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> graders combined) performed DDR during the first week of the study (three days a week, 30 minutes a day). Also during the first week, the 4<sup>th</sup> grade class, 6<sup>th</sup> grade class, and the other multiage class performed traditional dance (three days a week, 30 minutes a day). The classes then performed the other activity during the second week of research.

While students were participating in the DDR, one Nintendo Wii Console was set up, projecting the image onto a projector screen in the gymnasium. The students were then lined up in four rows with the first person in every row playing on the game pads included with the game that were connected to the console to monitor their activity. The rest of the students were performing the dance using Geo Pads, which look similar to the actual game mats, but are not connected to the game. The game was set in the exercise mode, without the use of the hand remotes, and all limits turned off. After every song, which lasts between one to two minutes, the students rotated forward one mat in their own row so they would all have the opportunity to use the game pads that showed their particular movement and score on the screen. The DDR was performed for the remaining twenty-five minutes of each thirty minutes class. At the conclusion of their participation for the day, all students completed a survey about their attitudes and perceived exertion in relations to the dancing activity they completed that day.

In the other classes, students danced in the traditional way in a regular classroom setting. Students were instructed on how to perform different dance moves and combine them to music. During class students performed a dance to Men in Black, The Cha Cha Slide, and the Electric Slide. First, students would practice the first move without music, then with music. Then students would practice the second step without music, combine it

with the first step without music, and then practice the first two to music. This progression continued until the entire dance was done to music. Students were also encouraged to add in any type of movement along with the basic steps that made the dance more enjoyable and interesting to them. The dancing was done for the remaining twenty-five minutes of each thirty minute class.

After students were done with their respective dancing activity, they were instructed to stop their heart rate monitors. Stopping the monitors then allowed their heart rates to be recorded and electronically stored the measurements already taken. Once this was completed, the heart rate monitors were cleaned and stored away. After the monitors were put away, all students completed a survey about their attitudes and perceived exertion in relations to the dancing activity they completed that day.

**Data Analysis**

The Pearson’s Correlation was computed to find any type of correlation between the variables height, weight, BMI, dance heart rate, DDR heart rate, dance SRP, and DDR SRP. Then a Paired t-Test was done in order to find any significant differences that occurred between the means of DDR heart rates and dancing heart rates, as well as DDR SRP and dancing SRP. Finally, since the goal of students was to have their average heart rate for the class period fall within their determined optimal heart rate zones, a Chi-Square test was done in order to find out if the DDR or traditional dance had an effect

on students to stay within their heart rate zones. The level of significance for all tests done was set at  $p \leq 0.05$ .

**Results**

The descriptive statistics are presented on Tables 2 and 3. The descriptive statistics on the tables are separated by gender. Figures 1 and 2 show the mean SRP scores and mean heart rates of DDR and traditional dance. The bar graphs are not separated by gender. Although it is not a significant difference ( $p \leq 0.05$ ), the DDR heart rate and SRP score was higher than that of traditional dance.

The results from the Pearson’s Correlations (Table 4) test showed no significant relationships among the different factors involved in the experiment.

Results of the paired t-test, which compared the mean differences (Tables 5 and 6), showed no significant difference between recorded heart rates during traditional dance and Dance Dance Revolution ( $p=.352$ ). However, the SRP scores did differ significantly between traditional dance and DDR ( $p=.019$ ). The SRP score for DDR was 8.6% higher than the traditional dance SRP. Very similar results were found when comparing the differences of the outcomes of the two dance lessons across paired observations. Furthermore, the results of the Chi-Squared test (Table 7) shows that the type of activity had no affect on whether or not students were able to stay within their assigned heart rate zone. During traditional dance 25 students were within their zone while 26 students stayed within their zone during DDR ( $p=.769$ ).

**Table 1. Optimal Heart Rate Zones.**

| Age | 60%   | 80%   |
|-----|-------|-------|
| 9   | 126.6 | 168.8 |
| 10  | 126   | 168   |
| 11  | 125.4 | 167.2 |
| 12  | 124.8 | 166.4 |
| 13  | 124.2 | 165.6 |

**Table 2. Descriptive Statistics of Reported Variables for Females.**

|           | N  | Mean   | Minimum | Maximum | Standard Deviation |
|-----------|----|--------|---------|---------|--------------------|
| Age       | 17 | 10.71  | 9       | 12      | .85                |
| Height    | 17 | 59.24  | 55      | 63      | 2.54               |
| Weight    | 17 | 104.88 | 73      | 150     | 23.23              |
| BMI       | 17 | 20.94  | 15.40   | 27.5    | 3.64               |
| DDR HR    | 17 | 132.06 | 103.5   | 170     | 13.68              |
| Dance HR  | 17 | 128.62 | 104     | 152.5   | 11.50              |
| DDR SRP   | 17 | 13.47  | 7       | 16      | 2.83               |
| Dance SRP | 17 | 13.18  | 9       | 16      | 1.98               |

**Table 3. Descriptive Statistics of Reported Variables for Males.**

|           | N  | Mean   | Minimum | Maximum | Standard Deviation |
|-----------|----|--------|---------|---------|--------------------|
| Age       | 16 | 10.88  | 9       | 12      | .89                |
| Height    | 16 | 56.97  | 51      | 62      | 2.54               |
| Weight    | 16 | 91.13  | 57      | 133     | 21.70              |
| BMI       | 16 | 19.64  | 13.8    | 26.1    | 3.50               |
| DDR HR    | 16 | 135.22 | 111     | 158     | 12.46              |
| Dance HR  | 16 | 133.28 | 112.5   | 159     | 15.69              |
| DDR SRP   | 16 | 13.63  | 10      | 16      | 2.19               |
| Dance SRP | 16 | 11.13  | 4       | 16      | 3.40               |

**Table 4. Pearson’s Correlation for BMI, height, weight, DDR HR, Dance HR, DDR SRP, and Dance SRP.**

|           | BMI    | Height | Weight | DDR HR | Dance HR | Dance SRP |
|-----------|--------|--------|--------|--------|----------|-----------|
| Height    | 0.294  |        |        |        |          |           |
| Weight    | 0.894  | 0.682  |        |        |          |           |
| DDR HR    | -0.006 | -0.019 | -0.021 |        |          |           |
| Dance HR  | -0.132 | -0.321 | -0.265 | 0.237  |          |           |
| Dance SRP | 0.073  | -0.273 | -0.082 | 0.037  | 0.048    |           |
| DDR SRP   | -0.053 | -0.079 | -0.081 | 0.147  | 0.262    | 0.317     |

**Table 5. Paired T-Test for Dance SRP vs. DDR SRP.**

|            | N  | Mean   | StDev | SE Mean |
|------------|----|--------|-------|---------|
| Dance SRP  | 33 | 12.182 | 2.910 | 0.507   |
| DDR SRP    | 33 | 13.545 | 2.501 | 0.435   |
| Difference | 33 | -1.364 | 3.180 | 0.554   |

95% CI for mean difference: (-2.491, -0.236)

T-Test of mean difference = 0 (vs not = 0): t-value = -2.46 p-value = 0.019\*

**Table 6. Paired T-Test for DDR HR vs. Dance HR**

|            | N  | Mean   | SD    | SE Mean |
|------------|----|--------|-------|---------|
| DDR HR     | 33 | 133.59 | 13.00 | 2.26    |
| Dance HR   | 33 | 130.88 | 13.68 | 2.38    |
| Difference | 33 | 2.71   | 16.49 | 2.87    |

95% CI for mean difference: (-3.13, 8.56)

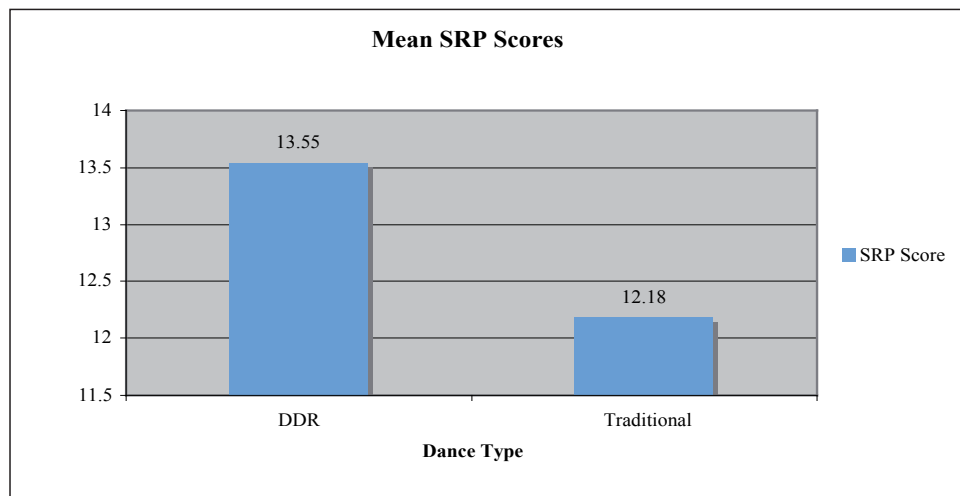
T-Test of mean difference = 0 (vs not = 0): t-value = 0.94 p-value = 0.35

**Table 7. Chi-Squared Test.**

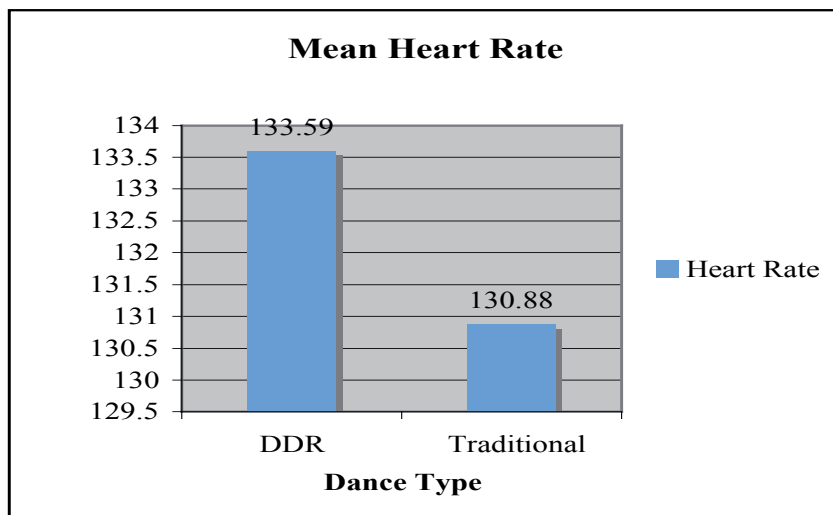
|       | In Zone              | Out of Zone        | Total |
|-------|----------------------|--------------------|-------|
| DDR   | 26<br>25.50<br>0.010 | 7<br>7.50<br>0.033 | 33    |
| Dance | 25<br>25.50<br>0.010 | 8<br>7.50<br>0.033 | 33    |
| Total | 51                   | 15                 | 66    |

Chi-Sq = 0.086, DF = 1, P-Value = 0.769

**Figure 1. Mean SRP Scores**



**Figure 2. Mean Heart Rates**



**Discussion**

The purpose of this study was to find out what differences and similarities exist in students’ attitudes, motivation, and heart rate levels when participating in the use of Dance Dance Revolution (DDR) versus traditional dance, although not statistically significant. Results indicated that students had a higher overall self-perception of enjoyment, work effort, motivation, and performance during the DDR activities than during the traditional dance. Sell, Lillie, and Taylor (2008) found that a positive attitude and self-perception of an activity will lead to the continuation of the activity which would promote DDR as a good platform to use in physical education classrooms.

One goal of physical education class is to find activities students can participate in over the course of their lifetime (Hill & Wyatt, 2005). If a student finds an activity they enjoy participating in, it may be more likely that they will continue to participate in it throughout their entire lifetime. Students found more enjoyment in DDR than traditional dance, therefore potentially increasing their chance of continuing to exercise outside the classroom. With the increased number of children owning gaming systems that include DDR and other exercise methods, gaming systems may be the exercise of the future. Results of the study indicated that the heart rates of students were not affected by the type of dance activity that was done but the survey further indicated that students felt more motivated, perceived they worked harder, enjoyed it more, and felt a level of success during DDR. If educators would like

students to do an activity that is enjoyable and maintains a healthy heart rate, then DDR could be a viable option.

Results showed no correlation between BMI, height, weight, heart rates, or SRP scores. These results suggest that either activity would be just as likely to be effective for any type of student. Physical attributes of the students involved in dance activities does not limit the benefits of dancing through traditional means or DDR. However, this may not be true for all types of physical education technologies available for educators to use.

**Future Research and Conclusion**

This study could be expanded by studying students’ heart rates and attitudes over an extended period of time. Students could start learning how to perform DDR at the beginning of the school year and practice all year. The heart rates and attitudes of students could be monitored throughout the school year to see if any change occurs once the students start getting better and doing DDR more often. The heart rates and SRP scores from the first day could be compared to those of the last day. A similar study could also be conducted utilizing fitness oriented video games offered by technological platforms like the Nintendo Wii Fitt, Microsoft Xbox, and Playstation 3. A longitudinal study could really show whether or not technology makes a difference in student activity levels, motivation, enjoyment, etc.

If funds are available, technology is an asset for students based on the numerous benefits it presents that can add variety and a variation to the traditional ways of learning certain skills. The students indicated in this

study that they enjoy it and thus may end up doing the activities outside of the physical education classroom. However, if technology is not an option for a school traditional dance does allow almost the same amount of students to stay within their desired heart rate zone. Educators need to focus on making the classroom climate enjoyable and motivational for students. The teachers approach to teaching any form of dance is essential to the enjoyment and participation of all students.

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