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PEDAGOGY

Effects of Music on Physical Activity Rates of Junior High School Physical Education Students

Lindsey Brewer, David C. Barney, Keven A. Prusak, Todd Pennington

Abstract

Music is an everyday occurrence in a person's life. Music is heard in the workplace, in homes, and in the mall. Music can also be heard as a person exercises. Therefore, the purpose of this study was to examine the effects of music on junior high students (n = 305) step counts and time in activity in junior high school physical education classes. In this study, students wore pedometers, and a 2 (conditions: with and without music) × 2 (activities: basketball and volleyball) crossover design was used. It was found that across all grades (7th, 8th, and 9th) and gender, more steps were taken with music in both activities versus without music. No significant differences were noted in time in activity between activities with music (2,839 steps taken in basketball) than without music (2,494 steps taken in basketball). Music is a tool that can assist junior high school physical educators in meeting the objectives of having students in physical activity for a majority of class time. It made students' physical activity experience enjoyable.

Lindsey Brewer is a PE teacher at Mapleton Junior High School. David C. Barney is an associate professor at Brigham Young University. Keven Prusak is an associate professor at Brigham Young University. Todd Pennington is an associate professor at Brigham Young University. Please send author correspondence to David_Barney@byu.edu

Music can be found in many facets of everyday living. People listen to music when driving around town, at their workplaces, and while shopping in the local mall. All human movement seems to be rhythmic in nature and tempo (Chen, 1985). Chen continued by stating, "We breathe in rhythm, walk and sleep in rhythm, as children we all move happily and unselfconsciously — just play some music with a definite beat and watch as little ones respond with the joy of moving in space" (p. 19). Another area in which music affects a person is during physical activity. Karageorghis and Terry (1997) found that music during physical activity (a) improves motor performance, (b) increases aerobic endurance, (c) enhances the exercise experience by serving as a distraction and lowering perceived effort, and (d) provides a positive environment to learn and practice skills. These types of responses to music have helped create a conceptual framework to help provide support for research, namely, (a) rhythm response, (b) musicality, (c) cultural impact, and (d) association (Priest, Karageorghis, & Sharp, 2004). Rhythm response refers to musical rhythm, most notably tempo. Tempo refers to the speed of the music as measured in beats per minute (BPM). Musicality refers to the responses to pitch-related elements such as harmony and melody. Cultural impact refers to the pervasiveness of the music within society. Association refers to extramusical associations such as emotions that a piece of music may evoke (Karageorghis, Jones, & Low, 2006). Karageorghis, Terry, and Lane (1999) presented this conceptual model using these four factors to predict the effects of asynchronous (i.e., absent of conscious synchronization between physical movement and accompanying musical rhythm such as background music) motivational music in the context of exercise and sport.

Researchers have investigated the effects of music within the physical activity setting. For example, Karageorghis et al. (2006) investigated the link between exercise intensity and music tempo and music tempo preference. College-aged students were to pick their top three artists for use in the study and then walk on a treadmill at levels of intensity while wearing a heart rate monitor and listening to the selection of music. Results indicated that the college-aged students preferred fast tempo music and that the fast tempo music accompanied increased workload intensity. In a similar study, Copeland and Frank (1991) compared college-aged students walking on a treadmill, listening to soft/slow tempo music and upbeat/

fast tempo music. They found that the students listening to the soft/slow tempo music generally exhibited a lowered heart rate compared to an exercise group that listened to upbeat/fast tempo music.

Much of the research dealing with the effects of music on physical activity has been conducted in laboratories or in fitness clubs. Another context in which music research has occurred is the physical education (PE) setting. Deutsch and Hetland (2012) examined fourth and fifth grade students' scores and effect of music, perceived enjoyment, and perceived work effort throughout the PACER (Progressive Aerobic Cardiovascular Endurance Run) test in elementary PE classes. For this study, students experienced one of three variations provided by the PACER CD: Version "A" with a high tempo background music, Version "B" with a mild tempo background music, and Version "w/o" that included no music. After completing the PACER test, students filled out a survey regarding the effort they gave, if they enjoyed the music that played during the PACER test, if the music motivated the student during the test, and their rating of their performance. Deutsch and Hetland found that the students generally scored higher on the PACER test when one of the two music versions was played during the test. They went on further to suggest that the female students performed better with the Version "A" (faster tempo) music. The male students performed better in the PACER test with the Version "B" (mild tempo) music. The results from the survey after the PACER test showed that students had a better attitude toward the PACER test when music was played.

In another study in a PE setting, Barney and Prusak (2015) investigated the effects of music on physical activity of elementary children during PE lessons. For this study, 115 third, fourth, and fifth graders participated in two Frisbee lessons and two walking activities lessons. One lesson for both activities had music, and the other two lessons had no music playing. Barney and Prusak found that the students were more active (higher step counts) in both lessons with music playing. Another finding from this study was that the students preferred fast tempo music, and when the fast tempo music was playing, the workload intensity increased.

Finally, in a PE setting, Ward and Dunaway (1995) investigated the effects of contingent music on laps run in a high school PE class. For this study, the researchers used a high school PE class of 36 stu-

dents. They randomly selected four students to observe their running of laps during class. They found that the number of laps ran increased from 1 lap to nearly 3 laps/min when music was played for the four students, thus representing an increase in the exercise pattern of .5 mile/lesson.

These research studies have shown that music can positively affect student output in a PE class. With the results from these studies in a PE setting, additional research is needed to investigate the effects of music on different student populations in a PE setting. Thus, the purpose of this study was to examine and report the effects of music in junior high PE classes. The researchers hypothesized that playing music during PE classes would increase steps taken and increase time in activity, compared to no music resulting in lower steps counts and lower amounts of time in activity. They also hypothesized that students' level of enjoyment with music playing during activities would be higher than without music playing.

Method

Participants and Setting

For this study, 305 junior high school students (151 males, 154 females) from eight intact seventh, eighth, and ninth grade classes (ages 11–15), separated by grade and gender, participated. The school's classes ran on a block schedule, A-day/B-day, with class lasting approximately 80 min from bell to bell. The participants were middle class socioeconomic status, with 88.8% of the students being Caucasian (USA School Info, 2013). The two teachers (one male, one female) who participated in this study averaged 15 years of teaching junior high school PE.

Procedures and Data Collection

The university institutional review board (IRB) and the school district approved of the study. Parental and student consent was also secured. Researchers attended the school for 1 day and instructed the students in how to wear, use, and read a pedometer properly, to ensure reliable data collection. Students were instructed that upon entering class they were to get a pedometer and secure it to the waistband of their shorts. Students were further instructed that after class announcements, after warm-up activities, they were to reset their

pedometers back to 0 for correct data collection. Then at the conclusion of the class activities, the students were to record their number of steps, time in activity, and level of enjoyment during the lesson on the student record sheet. A student record sheet was created for each student. Students had a place to record number of steps, time in activity, and level of enjoyment on their record sheet. The researchers created one statement on the student record sheet to rate their level of enjoyment during the activities, on a scale of 1 to 5 (1 = *lowest level of enjoyment,* 5 = *highest level of enjoyment*).

The music selection used for this study consisted of popular, upbeat, fast tempo, 120–160 BPM songs suggested by junior-high-aged students. The researchers had easy access to junior high students and thus asked them to list the songs they enjoy working out to. The students polled to help the researchers in selecting music were not involved in the data collection of the study. After compiling a list of 40 songs, the researchers listened to the songs and narrowed them down to school-appropriate songs that fit the tempo requirement. The songs that fit the requirements were made into a playlist that could be played through an iPod or CD player over a loud sound system.

Prior to data collection, the classroom teachers who participated in this study received training from the researchers on the lessons that were taught for the study. The lessons were restricted by the researchers in content and time to create a controlled environment for the study. The lessons were restricted to 40 of the 65 min of actual gym time. By using only two thirds of the class time, teachers had a buffer at the beginning and at the end of the class periods for regular class procedures and data collection. Following training, the classroom teachers began by teaching the designed lessons for basketball and volleyball for both conditions (music/no music). An example of a lesson taught by the junior high school physical educators included 8 min of station work, 30 min of game play (5 vs. 5), and 2 min to record pedometer data. This occurred for the basketball and volleyball lessons. The teachers taught the lesson for basketball for 2 days (two lessons) for each group using both conditions (music/no music), with data collection at the end of each lesson. The second round of data collection for volleyball occurred the following week using the same design as basketball (2 days and two lessons). The

students again recorded pedometer data, step counts, and time in activity at the end of each lesson. The students in this study participated in all the basketball and volleyball lessons.

Pedometer Instrument

The Yamax Digi-Walker LS 2525 was the pedometer used to collect student step counts and time in activity. The pedometer model records step counts, distance covered, calories burned, and time students were in activity. The pedometer also has a clock that runs when the student is in movement and stops when the student is not moving (standing). Time in activity is recorded in hours, minutes, and seconds. This pedometer was found reliable from previous research (Barney, Mauch, & Pleban, 2008).

Data Analysis

SPSS 21.0 was used to analyze the data. For this study, a 2 (conditions: music/no music) × 2 (activities: basketball/volleyball) within and within repeated-measures ANOVA was used for this study. Multiple measures (MANOVA) were also used to further test for significant differences. Post hoc comparison (Tukey's Honest Significant Difference, HSD) tests were run to reveal significant differences in step counts and time in activity, between activities with and without music.

Results

Descriptive Statistics

For this study, means, standard deviations, and effect sizes for steps taken and time in activity are shown for females in Table 1, males in Table 2, and combined genders in Table 3. All mean differences between conditions, music/no music, are in the anticipated direction. That is, the music condition demonstrated increased number of steps and time in activity.

Table 1
Descriptive Statistics for Females in Their Respective Grades for Step Counts and Time in Activity for Study 1

Activity/ Condition	Grade			
	7 (*n* = 75) *M* (*SD*)	8 (*n* = 76) *M* (*SD*)	9 (*n* = 3) *M* (*SD*)	All (*n* = 154) *M* (*SD*)
		Step Counts		
VB Music	1671 (644)	1718 (693)	1462 (574)	1690 (664)
VB No Music	1287 (627)	1492 (528)	874 (111)	1382 (586)
BB Music	2897 (979)	2777 (837)	2955 (471)	2839 (905)
BB No Music	2600 (832)	2388 (808)	2524 (805)	2494 (821)
		Time in Activity		
VB Music	18.2 (5.8)	18.7 (6.5)	16.6 (6.1)	18.4 (6.1)
VB No Music	15.3 (7.3)	16.8 (5.2)	11.5 (2.1)	16 (6.4)
BB Music	28.7 (7.4)	27.3 (6.2)	28 (4.2)	28 (6.8)
BB No Music	25.6 (5.7)	24.8 (7.4)	25.6 (7.7)	25.2 (6.6)
		Level of Enjoyment		
VB Music	4.58 (.64)	4.47 (.72)	4 (1)	4.51 (.69)
VB No Music	4.1 (.91)	3.81 (1.02)	3 (-)	3.94 (.97)
BB Music	4.31 (.77)	3.95 (.92)	5 (-)	4.14 (.86)
BB No Music	3.92 (1.01)	3.34 (1.04)	3.33 (1.15)	3.62 (1.06)

Note. VB = volleyball; BB = basketball.

Table 2
Descriptive Statistics for Males in Their Respective Grades for Step Grades for Step Counts for Study 1

Activity/ Condition	Grade 7 (*n* = 80) *M* (*SD*)	8 (*n* = 69) *M* (*SD*)	9 (*n* = 2) *M* (*SD*)	All (*n* = 151) *M* (*SD*)
		Step Counts		
VB Music	3264 (1143)	3046 (771)	3788 (1296)	3174 (995)
VB No Music	3086 (1064)	3176 (921)	3454 (1434)	3133 (998)
BB Music	3116 (753)	3282 (767)	3673 (241)	3199 (758)
BB No Music	3127 (826)	2804 (645)	3098 (-)	2979 (760)
		Time in Activity		
VB Music	31.9 (8.3)	28.8 (5.4)	36 (8.4)	30.6 (7.3)
VB No Music	29.7 (8.4)	32 (7.8)	34 (8.4)	30.8 (8.1)
BB Music	27.8 (5.3)	29.8 (7.2)	35 (-)	28.8 (6.3)
BB No Music	28 (6.4)	26.5 (5)	28 (-)	27.3 (5.8)
		Level of Enjoyment		
VB Music	4.11 (1.04)	4.29 (.9)	3 (-)	4.18 (.98)
VB No Music	4.13 (1.03)	3.78 (1.12)	2.5 (.7)	3.95 (1.09)
BB Music	4.34 (.82)	4.11 (1.08)	4 (-)	4.23 (.94)
BB No Music	4.21 (.93)	3.98 (1.04)	3 (-)	4.09 (.99)

Note. VB = volleyball; BB = basketball.

Table 3
Descriptive Statistics for Step Counts, Time in Activity, and Combined Gender and Grade From Study 1

Activity/ Condition	*M*	*SD*	*N*
	Step Counts		
VB Music	2393	1118	268
VB No Music	2227	1193	259
BB Music	3012	855	285
BB No Music	2728	827	271
Total	2600	1050	1083
	Time in Activity		
VB Music	24	9	268
VB No Music	23	10	259
BB Music	28	6	285
BB No Music	26	6	271
	Level of Enjoyment		
VB Music	4.3	.8	268
VB No Music	3.9	1	259
BB Music	4.1	.9	285
BB No Music	3.8	1	271
Total	4.1	.9	1083

Note. VB = volleyball; BB = basketball.

MANOVA Omnibus Test

Also in this study, a MANOVA omnibus test indicated significant differences between conditions (music/no music), λ (3, 1057) = .222, $p < .001$; activities (basketball/volleyball), λ (9, 2572) = .97, $p < .001$; gender, λ (3,1057) = .932, $p < .001$; and grade, λ (6, 2114) = .975, $p < .001$.

A significant interaction effect was found between gender and activity, λ (9, 2572.61) = .966, $p < .001$, and between grade and activity, λ (18, 2990.13) = .971, $p < .05$. No significant interaction effects

were found between gender and grade, λ (6, 2114) = .991, $p > .05$, or among gender, grade, and activity, λ (18, 2990.13) = .984, $p > .05$.

Follow-up ANOVAs indicated a significant gender effect in steps taken, $F(1, 1059) = 68.687$, $p < .001$; time in activity, $F(1, 1059) = 61.234$, $p < .001$; and level of enjoyment, $F(2, 1059) = 12.205$, $p < .001$. Follow-up ANOVAs indicated a significant activity type effect in steps taken, $F(3, 1059) = 7.291$, $p < .001$; time in activity, $F(3, 11059) = 5.234$, $p < .001$; and level of enjoyment, $F(3, 1059) = 4.543$, $p < .001$. Results also indicated an interaction between gender and type of activity, $F(3, 1059) = 8.013$, $p < .001$, with boys taking more steps than girls did in both activities. Further, boys spent significantly more time than girls did in activity, $F(3, 1059) = 10.952$, $p < .001$, in volleyball. Last, there was a significant interaction between grade and activity type, $F(6, 1059) = 2.313$, $p < .05$, with seventh grade students showing the highest levels of enjoyment.

Post Hoc Comparisons: Tukey's HSD

In this study, a Tukey's HSD test revealed significant differences in step counts and time in activity between activities with and without music. Basketball with ($M = 3012$, $SD = 85.9$) or without ($M = 2728$, $SD = 827.2$) music resulted in more steps than did volleyball with ($M = 2393$, $SD = 1118.3$) or without ($M = 2227$, $SD = 1193.7$) music.

Results indicate a similar pattern with time in activity. Basketball with ($M = 28.4$, $SD = 6.5$) or without ($M = 26.2$, $SD = 6.3$) music resulted in more time in activity than did volleyball with ($M = 24.2$, $SD = 9.0$) or without ($M = 23.1$, $SD = 10.4$) music. Also, basketball with music ($M = 28.4$, $SD = 6.5$) resulted in significantly more time in activity than did basketball without music ($M = 26.2$, $SD = 6.3$). Last, results indicate that level of enjoyment was higher in volleyball with music ($M = 4.3$, $SD = .86$) than either volleyball ($M = 3.9$, $SD = 1.0$) or basketball without ($M = 3.8$, $SD = 1.1$) music.

Discussion

The purpose of this study was to examine and report the effects of music in junior high school PE classes. The researchers investigated popular music on physical activity rates (steps counts and time in activity), via pedometers, of junior high PE students. From this study, the data indicate that significant differences were noted between gender and activity type causing that the activities with music

to increase steps taken and time in activity. It was found that the activities with music increased steps taken and time in activity for both males and females. The findings from this study concur with the study conducted by Barney and Prusak (2015). In their study with elementary-aged students in a PE setting, they found that when music was being played in the class activities, student step counts significantly increased in the activities for both genders. The activities used in the Barney and Prusak study were walking and Frisbee activities. The results from both of these studies strongly imply that music can positively affect student activity, despite gender, in PE class. Thus, aside from the inherent differences in basketball and volleyball, music positively affected the steps taken and time in activity.

It can be inferred that significant differences in step counts were found between activity types because, by nature, basketball requires higher intensity or more movement to participate and thus more steps were found in basketball compared to volleyball whether or not music was played. Significant differences in step counts, however, were noted between basketball with music and without music. This suggests that music does play a role in increasing step counts. Similar to the results in Barney and Prusak's (2015) study, the results in this study showed that music had a more pronounced effect on basketball than on volleyball in steps taken because it was a higher intensity activity. It appears music affects higher intensity activities more so than it does less intense activities. This may have occurred because the music played was of a fast tempo, which is similar to the fast-paced nature of the sport of basketball.

For comparisons between activity types, significant differences were noted in time in activity between volleyball with music and basketball with music, between volleyball without music and basketball with music, and between volleyball without music and basketball without music. These significant differences may be explained by the nature of basketball compared to the nature of volleyball. Basketball, regardless of music or no music, is more intense and requires more movement by nature, as there are few moments of pausing within the game. On the other hand, volleyball is less intense by nature, as it includes many built-in pauses throughout the game when the volleyball is chased down, when the ball is on the other side of the net, in between serves, or simply when the game does not require everyone to move, as only three touches are allowed per side.

Previous research studies have revealed that the fast tempo music (120–160 BPM) increases workload intensity (Priest et al., 2004; Karageorghis et al., 2006) and increases the time a person works out (Elliott, Carr, & Savage, 2004; Macone, Baldari, Zelli, & Guidetti, 2006). Barney, Gust, and Liguori (2012) found similar results with college-aged students. The researchers studied college students who listened to their MP3 player while they worked out at the campus fitness center. For this study, students were surveyed. The college students were asked what type of music they listened to while they worked out, what mode of exercise they participated in while they worked out, why they listened to an MP3 player when they worked out, and the frequency of the students' workout with music. The college students perceived that the MP3 player helped them to work out more frequently, more intensely, and for longer durations. The results from this study, along with other studies, make a strong case for physical educators to implement music during their lessons for the purpose of increasing physical activity.

One last finding from this study was the level of enjoyment the students experienced as they participated in both activities as music was being played. Both the male and female students felt that the music made their experience of participation more enjoyable. Digelidis, Karageorghis, Papapavlou, and Papaioannou (2014) studied the effects of music on lesson satisfaction and on four types of motivation of high school students. They found that high school students had lower levels of satisfaction with the lessons when no music was played. The researchers concluded that when music is played during the lessons it creates a pleasant atmosphere and thus is likely to motivate students to engage in the task with greater intensity.

Another variable that indicated student level of enjoyment was the number of steps the students took during both activities. Students took more steps in both activities as music was being played as previously mentioned. The researchers observed that during the collection of the volleyball data, students would move to the music in between points. It was also noted that students would ask both physical educators to play music on the days music was not played when they played both activities. The data and the types of observations from the researchers coincide with the conceptual framework dealing with music in a physical activity setting (Karageorghis et al.,

1999). The junior high school students were affected by the rhythm rate; the tempo of the music increased their activity.

Conclusions

The findings from this study help increase and strengthen the literature for the betterment of increasing physical activity in junior high school PE classes. The results of this study appear to coincide with the tenets of Karageorghis et al.'s (2006) conceptual theory regarding music and physical activity. The conceptual theory for these studies states that music can affect a person's physical activity. The areas in which music can affect physical activity are (a) rhythm response, (b) musicality, (c) cultural impact, and (d) association. Because of the type of music (rhythm response) used in this study, most notably the tempo or speed of the music, students' steps and time in activity increased. These results are in agreement with previous research findings that music increases student output during physical activity (Barney & Prusak, 2015; Deutsch & Hetland, 2012; Karageorghis et al., 2006).

The findings from this study bare the fact that students who played during game play with music playing had significantly more steps and more time in activity than did student who played during game play with no music. Having students in activity for more than half the class period is an objective that physical educators want to achieve (Malina, 1996). Music is a tool that can assist physical educators in meeting the objective of having students in physical activity for a majority of class time. The findings from these studies should hint to physical educators at all levels of implementing music in game play situations during class. Chen (1985) said, "Just play some music with a definite beat and watch as little ones respond with the joy of moving in space" (p. 19). Even though Chen is singling out small children, the same can apply to any person of any age. Music can move us, and this can also apply to music being played during junior high PE classes and game play in college basketball classes.

Study Limitations

The investigators have noted a number of limitations placed upon the study. For this study, the participants came from one junior high school. Because the participants came from one school, it may

not allow a representative sampling of junior high school students in other junior high schools or in other geographic regions, thus limiting the generalizing of the findings. In addition, the participants came from segregated classes, all male and all female classes, as compared to nonsegregated classes.

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