The Physical Educator Vol. 82 • pp. 753–762 • 2025
https://doi.org/10.18666/TPE-2025-V82-I6-12835

PHYSICAL ACTIVITY

Effects of Music on Physical Activity Rates and Enjoyment of High School Physical Education Students

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Abstract

Music is a daily influence in our lives. One aspect of music is being used in a physical activity (PA) setting. One specific area where music is being used is in K-12 physical education (PE) classes. Previous research has been conducted in elementary and junior high school PE. For this study, the effect on high school PE students' PA was investigated when music was played and when it was not. For this study, 75 high school students (49 males and 26 females) participated. Participants wore pedometers to measure steps taken and time in activity. Student enjoyment in the activities was also measured. The participants participated in two activities: pickleball and badminton. Generally, it was found that high school students took more steps and had more time in the activity when music was playing. This study is the third study dealing specifically with K-12 PE, investigating music's effect on PE students' rates of PA.

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Introduction

Music is all around us in our daily activities. We hear music in the workplace setting, as we shop in our local mall, and in physical activity (PA) settings. A large body of literature has dealt with music's effect on physical activity (PA), touting its benefits (Priest-Lee et al., 2004). Research on music in PA has established a conceptual framework to better support the effect of music on participants. Four tenets make up this framework: (a) rhythm response, (b) musicality, (c) cultural impact, and (d) association. Rhythm response refers to musical rhythm, most notably tempo. Tempo refers to the speed of music as measured in beats per minute (BPM). Musicality refers to the pervasiveness of music within society. Association refers to extramusical association, such as emotions that a piece of music may evoke (Karageorghis et al., 2006). Also, from the literature, it has been found that music during PA (a) improved motor performance, (b) increased aerobic endurance, (c) enhanced the exercise experience by serving as a distraction and lowering perceived effort, and (d) provided a positive environment to learn and practice skills (Karageorghis & Terry, 1997). These findings are highly encouraging and helpful for health and fitness individuals as well as K-12 physical educators.

The research concerning music in the K-12 PE context has studied the effects of music as a classroom management tool in elementary PE. Barney and Prusak (2022) studied music as a management tool in elementary PE. For this study, a school administrator, a PE teacher, and 17 elementary-aged students were interviewed. Interview data revealed that music served as a good start and stop signal for the students; students preferred the music over the PE teacher's loud voice or whistle, and music helped them focus on the PE teacher's instructions. From these themes, interview statements were, "When the music stops, we freeze. If we have equipment, we put it down as we freeze;" "I like the music so much more. I don't like the whistle;" and "Miss L. tells us what she wants us to do when the music stops. She doesn't want to waste time, and we move from one activity to another quickly."

Another study investigating music in the K-12 PE context examined the effect of two conditions—those with and without the incorporation of music—on the PE environment and student moods

(Barney et al., 2021). For this study, 948 junior high school PE students (501 males and 447 females) were surveyed after participating in basketball game play with music playing and no music. The findings from this study suggest that music incorporated in the PE context can positively affect student moods. More specifically, music was found to positively reduce students' tension, anger, fatigue, depression, and confusion. Also, students left class with more vigor, and their self-esteem was positively affected. These results translate into junior high school students going to their other classes after PE class being more responsive to the lessons they will be taught.

The nature of PE classes is to provide the K-12 student the opportunity to be physically active in their class activities (Pangrazi, 2003). Here, music serves as a valuable tool in increasing the physical activity rates of K-12 students. For example, Barney and Prusak (2015) examined the effects of using music on the PA rates, using pedometers, of elementary school children during entire PE lessons. For this study, third-, fourth-, and fifth-grade students participated in two class activities (walking activities and Frisbee). For each activity, the students participated in one lesson when music was playing and a second lesson with no music playing. It was found that students were more active (with higher step counts and longer time spent in activity) in both lessons with music playing. A second study of a similar nature investigated junior high school students' PA rates (Brewer et al., 2016). For this study, junior high school students participated in two lessons (basketball and volleyball), one lesson with music and the second lesson with no music playing in both activities. The data from this study indicated significant differences between activities with music playing and those without music playing. Step counts and time in activity were higher than when music was not playing. The results from both studies strongly imply that music can positively affect student activity during PE class. With these two studies investigating PA rates of elementary and junior high school students, this provides an opportunity to study the effects of music on high school PE students' PA rates. Thus, the purpose of this study was to better understand the effects of using music on high school PE students' PA rates in two lessons in pickleball and badminton, and enjoyment with music.

Methods

Participants and Setting

Participants for this study were 75 high school students (49 males and 26 females) from three intact classes (ages 15-18) separated by gender. The school's classes ran on a block schedule, with A-day and B-day, each consisting of class periods lasting approximately 60 minutes from bell to bell. The participants were predominantly middle-class, comprising 72.8% Caucasian and 21.3% Hispanic individuals (USA School Information, 2023). The teacher who participated in this study has taught high school PE for six years. The university institutional review board (IRB) and the school district approved to conduct the study.

Procedures and Data Collection

Students participated in a total of four lessons during the collection of data. During the first part of the lesson, the students were introduced to the pedometer, shown how to wear it (Vincent & Pangrazi, 2002), and shown how to reset the pedometer to "0" and put it on for the class activities. On the days of data collection, students repeated these procedures. Once all students had completed these procedures, the PE teacher would begin the lesson. When the lesson was finished, students would record the number of steps, the time in the activity, and the enjoyment of the activity. Only the PE teacher and researchers had access to the students' data. Pedometer data were collected from three intact classes for the pickleball and badminton lessons. On the days when music was used, the PE teacher would play music throughout the lesson except when giving instructions. Instructions were designed to be kept to a minimum, and then the music was immediately turned back on. Instructions were also designed to be consistent across conditions. The music used in this study consisted of popular, upbeat tempo (120 to 160 beats per minute) songs suggested by the PE teacher and researchers. A total of 40 songs were compiled and eventually narrowed down to songs that were appropriate to play during pickleball and badminton gameplay. The songs were played over a sound system in the gymnasium.

Data Analysis

For summary statistics, repeated measures ANOVA for a continuous variable and Mantel-Haenszel Chi-Square for an ordinal variable are used to assess the effect of activity type (pickleball and badminton) and whether music is played or not on the number of steps taken, time in activity, and level of enjoyment. Additionally, a mixed linear model was developed to assess the effect size based on activity and music type, while adjusting for demographic characteristics. All data analyses were conducted using SAS software, Version 9.4 of the SAS System for Windows (SAS Institute Inc., Cary, NC, USA).

Results

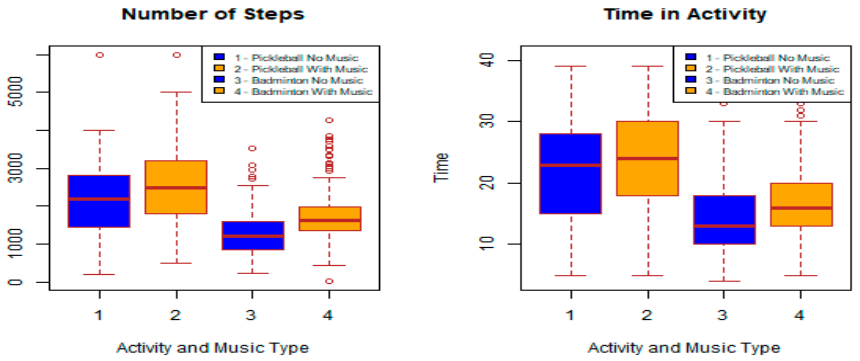
From the measures during pickleball and badminton physical activities, on average, the participants had a greater number of steps and time in activity when music was played compared to when no music was played, and a greater number of steps during the second recording compared to the first recording. During the first recording, the participants had on average 380 more steps, 2.1 more minutes for pickleball, and 504.3 more steps, 4.1 more minutes for badminton when music was played compared to when no music was played. Similar results were observed during the second recording. The number of steps and time in activity were higher during pickleball physical activity compared to badminton, whether music is played or not. The repeated ANOVA analysis indicated that the differences were all statistically significant, for both the number of steps and time in activity, the P-value < 0.0001, Table 1 and Figure 1. Similar results were observed from the mixed linear model analysis after adjusting for gender. On average, the measures (number of steps and time in activity) during all the physical activities were the highest for males. During pickleball physical activity, when music was played, the differences were all statistically significant. On average, male participants had 409.4 more steps (P-value = 0.0073) and 2.8 more minutes in activity time compared to female participants. Participants had 374 more steps with pickleball when music played, 819.6 fewer steps with badminton when no music played, and 367 fewer steps with badminton when music played compared to pickleball when no music played (P-values < 0.0001). Similar results were

Table 1
Average Pedometer Measures by Types of Music Played and Curriculum

Measure	Recording	Pickleball No Music (M ± SE)	Pickleball With Music (M ± SE)	Badminton No Music (M ± SE)	Badminton With Music (M ± SE)	P-Value
Number of steps	First	2039.0 (90.62)	2419.0 (101.19)	1307.0 (94.11)	1811.3 (98.67)	<.0001
	Second	2278.2 (123.72)	2646.3 (115.19)	1371.1 (83.53)	1771.9 (74.06)	<.0001
Time in activity (min)	First	21.1 (0.83)	23.2 (0.86)	13.4 (0.71)	17.5 (0.78)	<.0001
	Second	22.7 (1.05)	24.9 (0.92)	15.1 (0.82)	17.6 (0.63)	<.0001

Notes:
1. Overall P-value from repeated measures ANOVA after adjusting for gender.
2. Values are Mean (Standard Error).
3. P-values are from repeated measures ANOVA after adjusting for gender.

Figure 1
Activity and Music Type and Time in Activity



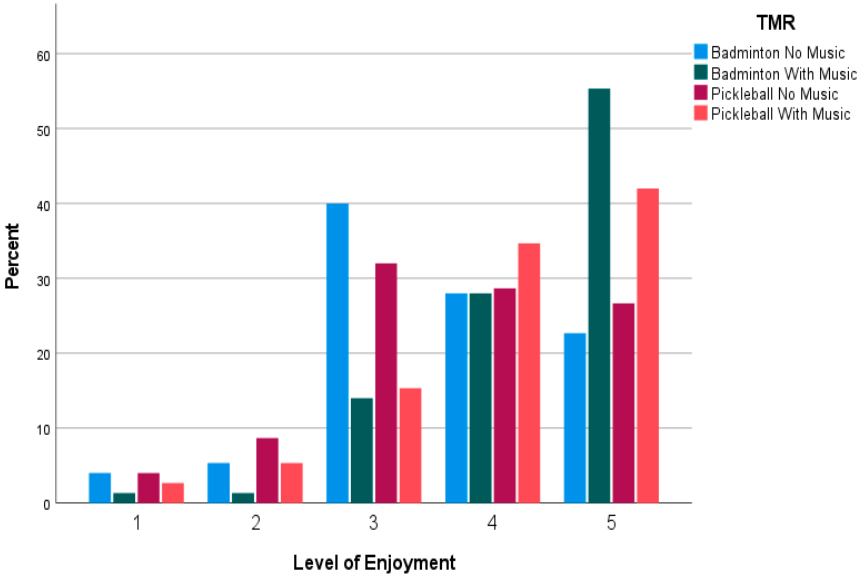
observed for time in activity, Table 2. Comparing the participants by the level of enjoyment during the physical activities, 73.3% of the participants responded enjoyable or very enjoyable with pickleball when music played and 80% with badminton when music played, while the percentage were only 52% with pickleball and 49.3% with badminton when no music played during the first recording (P-value < 0.0066) and similar higher percentage were observed during the second recording. Stratifying further the level of enjoyment by gender, a statistically significant difference was observed during pickleball physical activity; however, no statistically significant difference was observed during badminton. During pickleball physical activity, when no music was played, 61.2% of males responded that the physical activity was enjoyable or very enjoyable. In comparison, the percentage for female participants was only 34.6% (P-value = 0.0443).

Table 2
Effect of Music During Activities on Pedometer Measures, Adjusted for Genders

Characteristics	Estimate	P-Value
Number of Steps		
Gender (ref = Female)		
Male	409.4	0.0073
Type of Activity and Music (ref = Pickleball No Music)		
Pickleball With Music	374.0	<.0001
Badminton No Music	-819.6	<.0001
Badminton With Music	-367.0	<.0001
Time in Activity (minutes)		
Gender (ref = Female)		
Male	2.8	0.0221
Type of Activity and Music (ref = Pickleball No Music)		
Pickleball With Music	2.2	0.0006
Badminton No Music	-7.6	<.0001
Badminton With Music	-4.3	<.0001

[1] P-value from Mixed Linear Model adjusted for gender and music.

Figure 2
Level of Enjoyment by Activity and Music Type



When music was played, the percentages were 83.7% for males and 53.9% for females (P-value = 0.0024) during the first recording, and similar results were observed during the second recording.

Discussion

The purpose of this study was to better understand the effects of using music on high school PE students' PA rates in two lessons in pickleball and badminton, and enjoyment with music. From this study, the data indicated that differences were noted when music was played and not played during badminton and pickleball activities. Generally, it was found that more steps were taken and the time spent on the activity for students was higher when music was played. The findings coincide with the study conducted by Barney and Prusak (2015). In this research, elementary-aged PE students participated in walking and Frisbee activities with music playing and no music. It was learned that when music was played in both activities. Students took more steps and spent more time in the activity. In another study, similar results were found by Brewer et al. (2016), who investigated junior high school PE students playing basketball and volleyball with and without music. For this study, junior high school PE students took more steps and spent more time in activity when music was played during both activities. From this current study, the results coincide with previous research of music positively affecting K-12 PE students' PA. When looking closer at the four lessons in both pickleball and badminton lessons that had music playing, it resulted in higher step counts and more time in activity. In the pickleball lessons, students took over 360 more steps and spent two more minutes in the activity. In the badminton lessons, students took over 400 more steps and spent three more minutes in the activity. It can be inferred that the increase in step counts and time in activity is significant and shows music's impact on PA during these activities.

Another variable investigated in this study was the effect of music on students' enjoyment during pickleball and badminton activities. Barney et al. (2016) examined the effects of music on fourth-grade students' enjoyment in activities during PE class. For this study, students participated in tossing/catching activities with music and hula hoop activities without music. Students were surveyed and interviewed at the end of the lessons. For the interviews, students made the following statements regarding music's effect on student enjoyment during class activities. A female student stated, "I love PE class, but when the music was playing, it made what we're doing in class a lot funner." A male student said, "When there is not music

playing, class wasn't as fun." A third student commented, "Music made the class fun." For this study, students stated that pickleball (73%) and badminton (80%) were either enjoyable or very enjoyable when music was playing. For this study, there was no qualitative data regarding music's effect on student enjoyment. Yet, a large majority of the high school students found music's positive impact on their enjoyment when playing pickleball and badminton. They were smiling, laughing, and dancing to the music between points; these were outward expressions of the students, making class a positive experience. With these positive experiences with music during these activities, it is hoped that they will translate into a lifetime of participation in PA for high school students.

Impact of Study

From previous research, music has been shown to increase the number of steps taken and the time spent in activity when music is playing. The activities used in the previously mentioned research have been walking and Frisbee (Barney & Prusak, 2015), basketball and volleyball (Brewer et al., 2016), and, for this study, pickleball and badminton. From the six different activities used in the above-mentioned research, these activities illustrate the variety of activities that have positively affected student participation. This should confirm to K-12 physical educators the impact that music has on student activity in various activity settings. Another point is that the research has been conducted with students in elementary, junior high school, and high school settings. Music has no boundaries and can positively affect students of all grade levels to greater activity.

Study Limitations

The investigators have noted limitations placed upon the study. The participants for this study came from one high school. Because the participants came from a single school, it may not provide a representative sample of high school students from other schools, thus limiting the generalizability of the findings. Further study should explore the reproducibility of the process and findings with multiple high school PE programs at different schools and in different regions of the United States.

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