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PEDAGOGY

# An Exploratory Study of Physical Education Teachers' Perceptions of the Barriers to Employing Technology

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## Abstract

*The purpose of this study was to explore physical educators' perspectives on the barriers to employing technology in physical education instruction. The participants of this study were 253 elementary, middle, and high school physical education teachers who taught in the state of Georgia. The participants completed an online survey that was derived from an extensive review of literature regarding barriers to integrating technology during instruction. The survey used a Likert scale asking participants to respond with a level of agreement and disagreement regarding specific barriers and included an open-ended response asking for additional barriers. Data were analyzed with the use of descriptive statistics and a one-way analysis of variance. This study found that class size, budget, and lack of resources were the main barriers perceived by physical educators, whereas lack of knowledge and lack of skill were not perceived as barriers to employing technology during instruction. Both age and years of experience had a significant main effect on the barriers of lack of knowledge, skill, and training. Additional barriers reported were lack of connectivity, lack of desire, and lack of time. The results of this study explore and highlight the significant barriers to employing technology in physical education instruction. Further research*

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*is warranted to support the need for meaningful implementation of technology to make the learning environment more dynamic, customizable, and accessible for both teachers and students.*

*Technophiles, tech savvy, Generation Z,* these are just some of the terms used to describe today's generation that is surrounded and almost obsessed with technology, always keeping up to date, and staying connected with the world. Anderson and Jiang (2018) reported 95% of teens have access to a smartphone and 88% have access to a desktop or laptop computer. Thus, as technology use continues to increase within society, schools are expected to stay up to date with technological advances and prepare students with the skills to implement technology effectively (Woods et al., 2008). More importantly, teachers are expected to have competence and an expertise in implementing technology within their instruction.

While technology has become a commonplace within the classroom, "a content area in which technology has not become customary, yet has great potential, is in physical education" (Gibbone et al., 2010, p. 27). Physical education (PE) teachers often face many barriers within their discipline such as reduced time in the curriculum, insufficient resources, nature of the subject matter, and marginalization by school authorities (Lux & McCullick, 2011). Now, the proliferation of technology is potentially another.

Perhaps one of the roadblocks facing PE teachers is that the term "technology" is broad, comes in many forms, and may be used for a variety of purposes. Specifically, Mears (2009) summarized and classified technology available to physical educators and found the primary uses were monitoring/participation devices, the distribution of content, tools for assessment, and maintaining records of students. However, technology may also be incorporated to enhance the instructional part of the educational experience (Pyle & Esslinger, 2013). Lambert (2016) argued that the implementation of technology is just one "click" away and could offer a variety of benefits for both the student and the teacher. Therefore, PE programs have the potential and ability to be enhanced through the development of content-specific technology (Gibbone et al., 2010) that is specific to the *teaching* of PE.

This content-specific technology offers many options, such as increased activity time, improved instruction, and greater feedback,

which allow PE teachers to enhance the overall learning experience for the student (Roth, 2014). The content-specific technology includes (a) monitoring devices, (b) applications and software, and (c) exergaming equipment.

## Monitoring Devices

Pedometers and heart rate monitors are small portable devices that measure the number of steps and heart rate. These monitoring devices can be utilized in three primary areas: (a) teach about physical activity, (b) improve the quality of instruction, and (c) produce accountability. The use of these devices during PE can be valuable in providing students information about their levels of activity and as a motivational tool.

## Applications and Software

Commonly known as "apps," this form of technology provides physical educators with a variety of tools. Physical educators are almost spoiled for choice with the number of apps that can be utilized within a class. However, with the endless availability of apps, it is important physical educators integrate them in an instructional and meaningful way. Therefore, Hagenbach (2017) developed a criterion for app integration that requires PE teachers question the (a) purpose, (b) students' activity level, and (c) learner-centeredness of the app to ensure students are active, engaged, and learning with technology.

Harris (2009) posited the integration of technology software to enhance student learning with the use of the motion analysis software *Dartfish*. Findings revealed the unanimous opinion that *Dartfish* could be employed as a tool to enhance learning, specifically creating an environment in which students are active learners. Similarly, Palao et al. (2015) assessed the effectiveness of the use of video feedback on student learning. As a result, the teacher acknowledged video feedback as a successful instructional tool due to positive improvement the students demonstrated in skill execution, technique, and knowledge when learning the hurdles.

Although PE teachers acknowledged technology as an instructional tool, according to Harris (2009), they felt overwhelmed by the time commitment and often felt incompetent. Similarly, Palao et al. (2015) noted, due to the combination of minimal confidence and the

time commitment required, the teachers would not have attempted the use of *Dartfish* independently. The literature is rife with evidence that although studies have not specifically focused on the barriers to implementing technology, teachers are, in fact, experiencing them. To date, the literature in this area has a glaring omission of research regarding the barrier's PE teachers experience when trying to implement technology as an effective teaching tool.

## Exergaming Equipment

The use of exergaming equipment has steadily increased in recent years within PE. Exergaming equipment includes virtual sports such as *Wii Sports* and Kinect*, Dance Dance Revolution*, and virtual bikes, which provide the user with an interactive experience of virtual routes. Students are required to be physically active when participating in exergaming, moving and interacting within the game itself. With regard to research findings, Fogel et al. (2010) found among inactive children that exergaming increased the amount of physical activity more than the standard PE program. Also, exergaming increases self-esteem and motivation, providing a positive experience for the players (Krause & Benavidez, 2014). Thus, it appears exergaming is an enjoyable tool that benefits an individual physically, psychosocially, and cognitively (Staiano & Calvert, 2011).

With such a range of technology available to PE teachers, along with many resources, it is curious why it is not being used more frequently. Technology will only continue its presence; therefore, it is imperative the possibilities for implementing technology in PE are not ignored (Lambert, 2016). The use of technology in PE can help reduce the number of students who are not physically active. Given that students are becoming increasingly digitally literate, physical educators should take advantage of the technology as a catalyst to reinvent the way students can be physically active.

It is also important to note the benefits of using technology as an instructional method in PE. Recognizing the benefits puts an emphasis on the importance of researching further the barriers of employing technology. The benefits are endless to the implementation of technology in PE, specifically during instruction. PE teachers can use technology to cater to students who may not be as physically active and provide them with an alternative method to be more engaged. "Not only does technology engage students in a different

format, but it can also make learning more efficient, customizable, transparent, and motivational" (Lambert, 2016, p. 58).

With regard to the present, the implementation of educational technology can create a more dynamic and accessible PE environment. Students will be able to connect more with the content and retain more information as educators start to speak their tech-savvy language. In addition, students may use technology outside of class to monitor and increase their physical activity levels, making them independent learners (i.e., self-directed activity). In terms of the future, technology will continue to advance, and when teachers demonstrate its use to students in PE, the hope is technology will encourage a lifelong physically active individual who is competent and literate. Overall, this might allow PE teachers to alter society's perspective on PE's value as a school subject—and because technology updates on a regular basis, PE programs can be updated by technology, which fixes the bugs and modernizes its status.

With the seemingly countless benefits and opportunity for change, however, technology is not being employed in a meaningful and productive way. Although the literature is sparse, a study focused on PE teachers' perceptions of ability and usage of technology and found some factors that are contributing to its implementation in PE. The findings suggested factors such as availability, physical activity time, lack of skills, teacher attitude, and budget, as well as demographic aspects such as teaching experience and gender, influenced its integration (Woods et al., 2008). One study focused on Spanish PE teachers and found that the most recent perceived obstacles were (a) decreased amount of time spent on physical activity; (b) lack of resources; (c) time, training, and knowledge; (d) unsuitable use; and (e) technical problems (Villalba et al., 2017).

However, further research pertaining specifically to the barriers of employing technology in PE instruction is limited to few studies, which are now dated. One shared characteristic of those studies is that the PE teachers' perspective has not been determined so far (Kretschmann, 2015). The limited literature is predominantly focused on classroom teachers. PE is a distinctive environment, and as a result, there are additional factors for teachers to consider when teaching it. Thus, we must primarily determine what is preventing its use, to increase the employment of technology during

instruction. Instruction can enhance teachers' demonstration, explanation, analysis, and feedback. It is an opportunity for innovation and improvement in the lesson. In PE, technology is essentially an additional piece of equipment aiding teachers in delivering better learning strategies during instruction.

With the demands of the digital age, PE teachers are experiencing barriers, either internally or externally preventing them from using technology during instruction. A barrier can be defined as a circumstance or obstacle that keeps people or things apart or prevents communication or progress. In terms of this study, a barrier is the reason why physical educators are not employing technology during instruction; from their perspective, what factors are hindering them?

Hew and Brush (2007) analyzed empirical research studies that focused on general barriers affecting the use of technology in K–12 schools for instructional purposes but did not mention PE specifically. After a review of the relevant literature, 123 barriers were found and categorized into (a) resources, (b) knowledge and skills, (c) institution, (d) attitudes, (e) assessment, and (f) subject culture. Findings of this study were significant for general education, highlighting specifically the barriers of instructional technology. Although teachers experience these barriers in a classroom setting, the findings did not attend to physical educators and the additional barriers they may face. It is imperative the research identifies the barriers specifically to the subject of PE to close the knowledge gap physical educators experience.

Although research into this topic is minimal, Pyle and Esslinger (2013) suggested that a major external barrier is that administrators do not consider PE to be a traditional classroom environment and thus are not aware of the possibilities of technology in PE. This indicates that PE teachers often do not have the support or encouragement of the school leadership and that the training for technology implementation during instruction may not be an option for them. Whether this is indeed a major barrier for PE teachers still needs to be established.

Thus, there is a need to better understand the attitudes and perceptions of PE teachers and what factors influence or hinder their technology use. An investigation of this topic should make the

future generation of physical educators more familiar with the possible barriers and more prepared to and successful in overcoming them. As technology has continued to develop, the literature within PE has heavily focused on the strategies of technology integration. For example, how to implement pedometers and heart rate monitors (Beighle et al., 2004), apps (Hagenbach, 2017), and exergames (Fogel et al., 2010) has be widely recognized. Although there is extensive research on the use of technology in PE, there is minimal research on whether teachers are employing it within their teaching. Krause (2017) suggested "to introduce and utilize these technologies properly to their full potential, teachers must first be proficient with using them" (p. 478). Thus, if physical educators are experiencing challenges with technology integration, it is important to research this issue further and pinpoint the reasons why this is happening.

Consequently, the purpose of this study was to analyze PE teachers' perspectives on the barriers to employing technology in PE instruction. Toward this end, this study was guided by the following research question: What do PE teachers consider to be the barriers to employing technology in physical education instruction?

## Method

The study used a quantitative, nonexperimental descriptive approach, specifically by utilizing a survey research design. This approach was chosen because of its ability to garner "the attitudes, opinions, behaviors or characteristics of the population" (Creswell, 2012, p. 376). Specifically, this study used a cross-sectional survey design, which provided numerous advantages, as it required a minimal amount of time to both administer and obtain the required information and allowed us to garner the teachers' current attitudes, beliefs, perspectives, and opinions. This was pertinent to this study as the most up-to-date and existing perspectives of PE teachers' barriers to technology could be recorded and analyzed.

### Participants

Utilizing a web-based method of recruitment, we searched southeastern states' school websites to access PE teachers' email addresses. Specific criteria the participants had to meet to participate in the survey included (a) currently employed as a PE teacher, (b) at a public, private, or charter institution, and (c) at the elementary,

middle, or high school level. It was important to identify this criteria as the study emphasized barriers to employing technology during instruction. The recruitment search yielded 886 participants meeting the requirements. Of those, the survey was completed by 253 PE teachers.

## Survey Instrument

We developed a quantitative survey that included three sections: demographic information, barriers to employing technology, and an open-ended response. The survey development was derived from an extensive review of the scholarship in the area of instructional technology specific to PE and education, in general (Gibbone et al., 2010; Hew & Brush, 2007; Woods et al., 2008). The survey was designed to explore the different technology barriers physical educators encountered, based on previously reported barriers within the existing research.

The demographic section included age, institution, years of experience, current level of teaching, and years of experience. Section 2 measured participants' perceptions regarding the barriers to employing technology. Specifically, participants were asked to indicate to what extent, if any, each of the following are barriers to their use of technology during PE instruction. A 7-point Likert scale was utilized, with a score of 1 being *strongly agree* and 7 being *strongly disagree*. The barriers included 11 items: resources, knowledge, skills, training, support, budget, class size, insufficient space, subject culture, institution, and attitude. The final section was an open-ended question asking for any additional perceived barriers.

## Data Collection

A pilot test of the survey was administered to a group of 10 experts including researchers, teacher educators, and experienced physical educators. The purpose of the pilot test was to establish content validity, determine the clarity of the items, and estimate the amount of time it took to complete the survey.

Once institutional IRB approval was obtained, data were collected over a 4-week period. Teachers received an email inviting them to participate in the survey. The email introduced the researcher, outlined their rights required by the Institutional Review Board (IRB),

explained the process to complete the survey, and included the link to the online survey. After the first emailing, a 10.2% response rate was recorded. After a week, participants were sent a follow-up email encouraging those who had not yet participated. This follow-up email resulted in more than doubling the response rate, with 21.4% of the participants responding to the survey. A final email was then sent on the fourth week of the study, which gave participants one last opportunity to complete the survey. After this communication, the response rate for the survey was 28.6%.

### Data Analysis

The demographic information and survey response data ($N = 253$) were analyzed for descriptive statistics. A one-way analysis of variance (ANOVA) then determined whether there were any statistically significant mean differences for any of the variables (Punch, 2013). The ANOVA was employed in the assessment between the demographics of the participants (age, institution, years of experience, current level of teaching, and level of education) and the perceived barriers. Reported significant effects were further investigated through a Fisher's least significant difference (LSD) post hoc test, with statistical difference accepted as $r < 0.05$. The qualitative findings were coded, and themes were identified.

Additionally, given the survey for this study was a unidimensional scale measuring the concept of a barrier, Cronbach's alpha measured the internal consistency of the scale (Cortina, 1993). The alpha score for the barriers section was calculated at $\alpha = .796$, a reliable score.

## Results

The results of this study indicate that PE teachers experience a number of barriers (Table 1) when employing technology during PE instruction. The three largest barriers for these PE teachers were class size (70.8% of PE strongly agreed, agreed, or somewhat agreed), followed closely by budget (69.1%) and lack of resources (64.7%). Conversely, the teachers strongly disagreed, disagreed, or somewhat disagreed that lack of skills (67.6%) and lack of knowledge (63.2%) were barriers when employing technology during PE instruction.

**Table 1**

*Physical Educators' Perceptions of Barriers to Employing Technology in Their Classes*

| | Strongly agree | | Agree | | Somewhat agree | | Neither agree nor disagree | | Somewhat disagree | | Disagree | | Strongly disagree | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Barrier** | **%** | ***n*** | **%** | ***n*** | **%** | ***n*** | **%** | ***n*** | **%** | ***n*** | **%** | ***n*** | **%** | ***n*** | ***M*** | ***SD*** |
| Class size | 32.4 | 81 | 24.4 | 61 | 14.0 | 35 | 6.4 | 16 | 9.2 | 23 | 10.8 | 27 | 2.8 | 7 | 2.70 | 1.83 |
| Budget | 25.7 | 64 | 22.1 | 55 | 21.3 | 53 | 8.0 | 20 | 6.8 | 17 | 10.0 | 25 | 6.0 | 15 | 3.02 | 1.86 |
| Lack of resources | 14.1 | 35 | 26.9 | 67 | 23.7 | 59 | 4.8 | 12 | 5.6 | 14 | 18.5 | 46 | 6.4 | 16 | 3.42 | 1.90 |
| Insufficient space | 19.5 | 48 | 18.3 | 45 | 19.9 | 49 | 11.4 | 28 | 6.1 | 15 | 17.1 | 42 | 7.7 | 19 | 3.48 | 1.96 |
| Nature of the subject matter | 8.0 | 20 | 14.5 | 36 | 16.1 | 40 | 21.7 | 54 | 8.0 | 20 | 23.3 | 58 | 8.4 | 21 | 4.11 | 1.79 |
| Lack of training | 3.9 | 10 | 11.2 | 28 | 28.3 | 71 | 8.4 | 21 | 10.8 | 27 | 26.7 | 67 | 10.8 | 27 | 4.34 | 1.77 |
| Lack of support | 4.0 | 10 | 10.4 | 26 | 24.9 | 62 | 14.1 | 35 | 7.6 | 19 | 26.9 | 67 | 12.1 | 30 | 4.40 | 1.76 |
| Attitude | 6.4 | 16 | 8.1 | 20 | 14.9 | 37 | 24.2 | 60 | 6.9 | 17 | 27.8 | 69 | 11.7 | 29 | 4.47 | 1.75 |
| Institution | 4.4 | 11 | 4.4 | 11 | 12.5 | 31 | 33.9 | 84 | 8.3 | 21 | 26.6 | 66 | 9.7 | 24 | 4.56 | 1.55 |
| Lack of knowledge | 2.0 | 5 | 8.0 | 20 | 17.2 | 43 | 9.6 | 24 | 17.6 | 44 | 31.2 | 78 | 14.4 | 36 | 4.84 | 1.64 |
| Lack of skills | 1.6 | 4 | 4.4 | 11 | 15.8 | 39 | 10.5 | 26 | 16.2 | 40 | 36.8 | 91 | 14.6 | 36 | 5.04 | 1.53 |

## Demographics

The age range of teachers who responded was 21 to 60+ years, with the mean age range being 31 to 40 years. The responses were obtained from three types of institutions including public, private, and charter. A total of 83.4% of the participants taught at a public institution. Approximately 42.3% of the participants taught at the elementary level, followed by 30% at the high school level and 27.7% at the middle school level. The participants had a range of teaching experience from 1 to 44 years, with an average of 16.29 years. For level of education, 41.4% of the participants held a master's degree and 33.6% held a bachelor's degree (Table 2).

## Age

A significant main effect was reported for age on lack of knowledge ($p = 0.002$), lack of skill ($p = 0.004$), lack of training ($p = 0.002$), and class size ($p < 0.05$). The barrier of lack of knowledge was significantly different between all the age ranges. The Fisher's LSD post hoc analysis reported significance between all age ranges and 60+ years. Specifically, PE teachers who were aged 60+ years ($M = 3.15 \pm 1.28$) were in stronger agreement that lack of knowledge was experienced as a main barrier, compared to those between 21 and 30 years ($M = 5.11 \pm 1.58$; $p = 0.001$).

Similarly, further analysis reported significant differences between the age ranges of 21–30 years, 31–40 years, 41–50 years, and 60+ years concerning lack of skill. In particular, those in the 60+ age range ($M = 3.85 \pm 1.67$) agreed lack of skill was a barrier they experienced, compared to the 21–30 years ($M = 5.47 \pm 1.18$) age range ($p = 0.001$).

The barrier of lack of training had statistical difference between the younger age ranges (21–30 years, 31–40 years, 41–50 years, and 51–60 years) and the eldest age range (60+ years). From this, it can be understood, the 60+ age range ($M = 3.07 \pm 1.49$) agreed more that lack of training was a barrier, whereas the 21–30 years age range ($M = 4.89 \pm 1.58$) neither agreed nor disagreed ($p = 0.001$).

Regarding class size, a statistically significant difference was found between the age range of 21–30 years ($M = 2.44 \pm 1.79$), who were in a slight stronger agreement that class size was a barrier, and the age range of 60+ years ($M = 3.79 \pm 2.04$, $p < 0.05$). Overall, the

**Table 2**
*Demographic Characteristics of Survey Participants*

| Demographics | *n* | % |
|---|---|---|
| Age | | |
| 21–30 | 35 | 13.9 |
| 31–40 | 75 | 29.9 |
| 41–50 | 84 | 33.5 |
| 51–60 | 43 | 17.1 |
| 60+ | 14 | 5.6 |
| Institution | | |
| Public | 211 | 83.4 |
| Private | 26 | 10.3 |
| Charter | 16 | 6.3 |
| Current level of teaching | | |
| Elementary | 107 | 42.3 |
| Middle | 70 | 27.7 |
| High | 76 | 30.0 |
| Years of teaching experience | | |
| 1–5 | 39 | 15.4 |
| 6–10 | 35 | 13.8 |
| 11–15 | 50 | 19.8 |
| 16–20 | 49 | 19.4 |
| 21–25 | 36 | 14.2 |
| 26–30 | 16 | 6.3 |
| 30+ | 23 | 9.1 |
| Level of education | | |
| Bachelor's | 85 | 33.6 |
| Master's | 104 | 41.1 |
| Specialist | 59 | 23.3 |
| Doctoral | 5 | 1.9 |

results suggest PE teachers who are in the age range of 60+ years experience lack of knowledge, lack of skill, and lack of training as barriers when using technology in PE instruction. However, those in the age range of 21–30 years experience class size as more of a barrier.

### Type of School

There was no significant main effect for institution on any of the dependent variables apart from class size ($p > 0.001$). Further analysis reported a significant difference between public ($M = 2.54 \pm 1.73$) and private ($M = 4.56 \pm 1.71$) institutions ($p = 0.000$). As a result, PE teachers at a public institution were in stronger agreement that class size is a barrier, compared to those at a private institution.

### Current Level of Teaching

The data analysis revealed a significant main effect for current level of teaching on the barriers of budget ($p < 0.05$) and class size ($p < 0.05$). For budget, there was a statistical significance between the middle ($M = 3.52 \pm 2.10$) and high ($M = 2.62 \pm 1.58$) school level of teaching ($p = .003$). PE teachers at the high school level were in stronger agreement that budget is barrier to employing technology, compared to the middle school level.

In terms of class size, the Fisher's LSD post hoc analysis revealed a significant difference between the elementary ($M = 3.14 \pm 1.94$) school level and both the middle ($M = 2.48 \pm 1.74$) and high ($M = 2.59 \pm 1.68$) school levels ($p < 0.05$). PE teachers who were teaching at the middle and high school levels responded stronger agreement in terms of class size as a barrier, compared to those teaching at the elementary level.

There was a significant difference on the barriers of lack of knowledge, lack of skills, lack of training, the nature of the subject matter, and attitude regarding current level of teaching. However, the mean scores reported the level of agreement at 4.0, meaning PE teachers responded they neither agreed nor disagreed.

## Years of Experience

The more experience a PE teacher had, the higher level of agreement was shown for the barriers of lack of knowledge, lack of skill,

and lack of training. Therefore, years of experience had a significant main effect. Results from the post hoc analysis showed those with more years of experience agreed that lack of knowledge was a barrier. Specifically, PE teachers who only had 1 to 4 years of experience somewhat disagreed regarding lack of knowledge, compared to those who had been teaching 35–39 years and 40–44 years. This trend followed throughout, as PE teachers who had increased experience of 35–39 years were also in stronger agreement that lack of skill was a barrier, compared with those who had 1–4 years of experience (Table 3).

**Table 3**
*Significance Between Years of Experience and Barriers*

| Years of experience | Lack of knowledge | | Lack of skill | | Lack of training | |
|---|---|---|---|---|---|---|
| | ***M*** | ***SD*** | ***M*** | ***SD*** | ***M*** | ***SD*** |
| 1–4 | 5.15 [a] | 1.62 | 5.56 [b] | 1.29 | 5.03 [c] | 1.69 |
| 5–9 | 4.61 | 1.69 | 5.03 | 1.33 | 3.94 [c] | 1.69 |
| 10–14 | 5.08 | 1.28 | 5.20 | 1.22 | 4.43 | 1.68 |
| 15–19 | 4.77 | 1.73 | 4.88 | 1.64 | 4.23 | 1.77 |
| 20–24 | 4.97 | 1.65 | 5.08 | 1.63 | 4.18 [c] | 1.82 |
| 25–29 | 5.30 | 1.66 | 5.39 | 1.67 | 4.96 | 1.74 |
| 30–34 | 3.93 [a] | 2.06 | 4.00 [b] | 1.92 | 4.07 [c] | 2.06 |
| 35–39 | 3.29 [a] | 1.38 | 3.25 [b] | 1.39 | 3.13 [c] | 1.73 |
| 40–44 | 3.60 [a] | 1.34 | 4.80 | 1.64 | 3.80 | 1.64 |

[a] significant $p < 0.05$. [b] significant $p < 0.01$. [c] significant $p < 0.05$.

Moreover, lack of training reported significance between the years of experience as shown in Table 3. An important result was the significant difference between 1–4 years and 5–9 years of experience. Interestingly, PE teachers with only a few more years of experience agreed that lack of training was more of a barrier, which further highlighted the constant progression of technology today. However, in relation to lack of knowledge and lack of skill, PE teachers with extended years of experience (35–39 years) reported stronger agreement regarding lack of training as a barrier, compared to those with less experience (1–4 years).

## Level of Education

Lack of resources showed a small significant difference between the bachelor's ($M = 3.83 \pm 1.89$) and specialist ($M = 3.08 \pm 1.89$) levels of education ($p < 0.05$). Those who held a specialist degree were in slightly stronger agreement that lack of resources was a barrier, compared with those who had a bachelor's degree. Concerning attitude, there was a significant difference between teachers who had only a bachelor's degree and those who had a master's degree. However, the mean scores reported the level of agreement at 4, which means PE teachers responded they neither agreed nor disagreed. Therefore, the results do not yield important or pertinent findings.

## Qualitative Results

The last question of the survey asked participants to add any additional barriers experienced during PE instruction that were not included in the survey. A total of 25% of the participants responded ($N = 64$). Table 4 shows the most frequent barriers, percentages, and sample responses. First, PE teachers indicated connectivity to be a predominant barrier, in terms of poor or no Wi-Fi connection in a gymnasium. Second, lack of desire by both students and others around them was noted as an additional barrier. PE teachers struggled to employ technology if the students did not find PE to be important and coworkers were not willing to make the necessary adjustments.

Surprisingly, those PE teachers responding demonstrated a negative attitude toward technology being used in PE. For example, they advocated that "physical education is a physical class which needs to be geared toward physical activity, not technology" and highlighted there is "no need for technology in PE. Students should be allowed to have one subject that they are not linked to technology, and this subject is PE." As a result, some PE teachers expressed the opinion that PE is a time for students to be physically active, which technology does not encourage. Finally, findings indicated that lack of time, in terms of both class time and planning time, was a barrier.

**Table 4**
*Additional Barriers to Technology Integration in Physical Education Classes*

| Barrier | % | Sample responses |
|---|---|---|
| Lack of connectivity | 17.2 | • Wi-Fi connection in the gym is iffy at times.<br>• The biggest problem in the gym is Wi-Fi.<br>• Poor Wi-Fi within gym building. |
| Lack of desire | 14.1 | • The people around me are not willing to make adjustments.<br>• Having people who want to teach material and not just roll out a ball.<br>• Students do not find PE to be important or take it seriously. |
| Negative attitude | 12.5 | • I see PE as a physical class which needs to be geared toward physical activity.<br>• I want my students to move; they get plenty of screen time.<br>• I'm not a fan of technology in the gym. |
| Insufficient time | 10.9 | • I do not have enough planning time to incorporate as much technology as I would like.<br>• There is a lack of time in the class period given all the requirements by my district.<br>• Lack of time to incorporate technology and have the students in the [Target Heart Rate] Zone for at least 20 minutes. |

## Discussion

The most apparent finding reported was class size as the main barrier. The literature in support of this is minimal, although findings from Woods et al. (2008) suggest inadequate space, due to class size, is a limiting factor in the utilization of technology. In the decade since, no scholars have identified and explored this as a significant barrier. The findings from this study reveal that, as expected, due to the smaller student population at a private school, those who teach at a public school are in stronger agreement that class size is a barrier. Analysis of the barrier of class size by teachers' grade level showed those teaching at the secondary level were more likely to agree that it was a barrier than their counterparts teaching at the elementary

level. This may have been because elementary school gymnasiums are generally smaller in size, which necessitates smaller class sizes, and states' policies for PE class size at the secondary level are more likely to allow for larger numbers (SHAPE America & American Heart Association, 2016).

As a result, the findings from this study indicate the challenge of a large class size for PE teachers, especially compared to the traditional classroom. If class sizes continue to increase, a greater impact is experienced by both teachers and students in terms of decreased instructional time, practice, and individualized feedback. Specifically, is it is becoming increasingly difficult for PE teachers to deliver quality and effective instruction by employing technology. While few would argue otherwise, PE teachers should be given the best opportunity to implement technology that improves instruction. According to these teachers, they may be limited before students even walk into the gym due to the overwhelming size of the class.

Another important finding from this study is the PE teachers view budget as the second-largest barrier in the implementation of technology. This should come as no surprise as PE tends to be underfunded and is one of the main subjects targeted by budgetary shortfalls (Turner et al., 2017). These cuts often come from school administrators who are unaware of the technological possibilities in PE and overlook its potential for success (Pyle & Esslinger, 2013). This financial concern hinders the ability of PE teachers to purchase relevant, appropriate, and enough technological equipment for the teachers and students to use (Gibbone et al., 2010). Therefore, it limits accessibility to both equipment and software, negatively affecting the subject of PE (Woods et al., 2008).

Additionally, lack of resources was another barrier reported. This lack of resources may include technological equipment (iPad, wearable devices, software, and charging stations), access to the technology (connectivity and software), available technical support from relevant personnel, knowledge from coworkers, and insufficient time (Hew & Brush, 2007). This finding is similar to that in a research study conducted in Spain that discovered lack of resources as an obstacle perceived by PE teachers (Villalba et al., 2017). However, the findings emphasized the lack of economic resources, whereas

this study highlighted that even resources that do not cost anything such as time, support, and knowledge are unavailable to PE teachers.

In summary, the three main barriers identified by the teachers in this study can be labeled as external, meaning outside of their control (Ertmer et al., 2012). Therefore, the results suggest that the PE teacher is not the limiting factor when wanting to employ technology in instruction, but instead external factors, such as administrators. However, external factors often fail to recognize technology potential in PE and consequently hinder its prospective success. One should assume that PE teachers are the experts in this field, yet they are not included or heard in many pertinent decisions.

Interestingly, lack of knowledge and lack of skills have been a consistent finding within the literature as major barriers to overall technology integration (Hew & Brush, 2007; Villalba et al., 2017; Woods et al., 2008). However, the PE teachers in this study significantly disagreed that lack of knowledge and lack of skills were barriers. This could be the result of PETE programs that now emphasize the importance of developing a technologically competent teacher candidate who has the pedagogical knowledge to adopt technology during instruction (Gibbone & Mercier, 2014). Therefore, these findings are potentially demonstrating a shift in terms of the characteristics, knowledge, and skills sets that teachers of today and the future may possess. This could be beneficial as PE teachers with a higher level of computer literacy are more likely to implement technology in their teaching (Kretschmann, 2015). As a result, the findings further validate PE teachers are not the sole problem when it comes to integrating technology.

Scholars have argued that individuals often possess a high skill level in terms of personal use, but not necessarily the ability to implement technology into instruction, which requires a specific skill set (Thomas & Stratton, 2006). The results of this study, unfortunately, do not lend any more insight into the extent of knowledge and skills of PE teachers. However, it is difficult to dispute that the rising generation of PE teachers will be more digitally inclined. It is important to identify if PE teachers have the knowledge and skills that can be transferred to instruction.

Additionally, age and years of experience had a major influence on whether the participants either agreed or disagreed with the

stated barrier. This finding suggests that a digital divide between the digital natives and the elder generation, known as the digital immigrants (Guo et al., 2008), may exist. In particular, PE teachers who were aged 60+ were in stronger agreement that lack of knowledge and lack of skills were barriers, compared to the 21–30 age range. Similarly, those with more years of experience also agreed that lack of training was more of a barrier, compared to those with only 1–4 years of experience.

This demonstrates a gap regarding knowledge, skills, and training between the younger and elder generations of teachers. Some may question if attitude plays an additional role, with the elder teachers having a negative attitude toward technology; however, this study did not find a significant difference regarding age and attitude. In fact, according to Woods et al. (2008), all PE teachers value the opportunity to continue to improve their knowledge and participate in professional development regarding technology. Therefore, it is imperative PE teachers are provided with the means to overcome these barriers, with opportunities such as workshops and training. Thus, Pyle and Esslinger (2013) noted, for technology to have maximum positive impact in PE, it is vital to increase the teachers' knowledge base. Overall, education will continue to develop into the digital age and it is essential our teachers do too.

The study's survey items were derived from scholarship in the area of instructional technology in PE and education, in general. However, the PE teachers in this study revealed additional barriers when trying to employ technology in instruction. The most pertinent finding was lack of connectivity in terms of either a poor or absence of a Wi-Fi signal. This can, however, be categorized under lack of resources; therefore, there may have been some misunderstanding of the meaning of "resources" in the survey. Nevertheless, given the ease of obtaining connectivity in a mall, in a restaurant, or even on a plane, it is remarkable a gymnasium does not have access to the internet. This portrays the marginalization PE, as a subject area, experiences while underscoring the implication that, as some suggest, it is being neglected at a time society needs it most. A surprising finding was that these teachers did not believe that a negative attitude was a significant barrier. Research has revealed PE teachers were often skeptical toward technology, as the key objective

is to promote movement (Kretschmann, 2015). PE teachers in this study who responded to the open-ended question indicated there is no need for technology because PE is a physical class. They said PE content needs to be geared toward participation in physical activity. These responses indicate a lack of understanding that technology should not be viewed as trying to replace the physical aspect of PE, but instead as trying to support, improve, or offer an alternative to the instruction of it. This runs parallel with the lack of knowledge for some PE teachers, not only knowledge on how to use technology but also, more importantly, knowledge on what technology to use.

An additional finding consistent with the literature was the barrier of lack of time. Specifically, PE teachers do not have enough time to effectively plan and incorporate technology into a lesson. Research has suggested the time to plan and collaborate with others is a challenge, with many stating it requires a significant time cost (Palao et al., 2015; Villalba et al., 2017). In relation, technology also limits class time and trying to incorporate it can often be time-consuming, whereas physical educators would rather ensure enough physical activity instead (Woods et al., 2008). PE teachers stated they do not have enough time to train the students on the various forms of technology as well as successfully accomplish the state standards.

However, the students lack of desire to participate could be another barrier as students' expectations and desires for what occurs in PE class may not align with the use of technology. Therefore, even before implementing technology into a lesson, PE teachers may face the students' lack of desire to learn how to use technology in PE. This desire not only relates to the students but also to other teachers. The findings indicate that coworkers' attitudes and desires play a vital role when the PE teacher wants to incorporate technology. Gibbone et al. (2010) suggested PE teachers who have a positive attitude toward technology have a greater inclination to adapt it into their teaching. However, as the findings in this study suggest, if the people around you are not willing to make adjustments, then trying to encourage any type of change, especially with regard to technology, will be difficult.

## Limitations

Research survey design often seeks a high response rate, so there is an element of confidence when the results are generalized to the

population (Creswell, 2012). Research has indicated a response rate of approximately 60% should be the objective for researchers when distributing a survey (Fincham, 2008). However, with regard to this study, a response rate of 28.6% was reported. This is a limitation as it subsequently leads to the issue of response bias. This limitation makes it difficult to determine whether the sample that responded were representative of the overall PE teacher population. For example, PE teachers who have a positive attitude toward technology may have been more inclined to respond to an online survey than teachers who are not as prone to use technology. Thus, the responses of the participants may not accurately reflect the perceptions of the sample and population (Creswell, 2012).

Additionally, the sample of the survey is limited to PE teachers who teach in one southeastern state. Therefore, the results of this study yield pertinent barriers experienced by teachers in one specific area and may not generalize to other PE teachers in different states. With regard to the survey, the gender was not included in the survey. This is a limitation as it is unknown what the ratio of males to females who responded and if there were any significant barriers between genders.

Moreover, measures of both validity and reliability were important in this study. Validity is the "degree to which an instrument measures what it is supposed to measure" (Kothari, 2004, p. 73). Therefore, survey validity was improved as a pilot test was conducted. The pilot test ensured the questions were appropriate and relevant to the purpose of the study. However, the barrier of lack of resources was misunderstood within the study with participants often answering the open-ended question with additional barriers that related to lack of resources. Reliability is the "degree to which an instrument is stable and consistent" (Creswell, 2012, p. 159). Steps that ensured questions were clear and the procedure of the survey was consistent were taken. Each participant received an email on the same day, at the same time, asking them to participate in an online survey. The procedure did not change throughout the data collection process.

Overall, this study identified specific barriers to technology integration within PE instruction. It provided support for the literature and identified additional barriers that contribute to the gap within PE research. While some limitations may prevent generalizability,

this study highlighted the endless barriers for PE teachers and should encourage research regarding solutions to the problems.

## Implications for Practice

The results of this study have implications for potential change concerning supporting PE teachers' integration of technology, developing the use of technology in instruction, and promoting technology in PE. First, while it may be a significant task to reform PE, administrators need to develop long-term solutions to the overwhelming class sizes and amount of time teachers are given. Second, financial support and additional resources are required for the development and sustainability of technology in PE. More funding opportunities are needed and resources such as equipment, Wi-Fi, and technical support should be readily available.

Additionally, for PE teachers to continue to adopt technology, instructional training, workshops, and follow-up support should be considered. Further research needs to outline and identify the specific training that would cater to the needs and abilities of physical educators. The marginalization of PE was a reoccurring issue throughout the study. There is a need for change regarding individuals' attitudes toward and perspectives of PE. The integration of technology could upgrade PE and demonstrate its importance for the future. Therefore, further studies focusing on how technology could alter an individual's perception of PE may provide a deeper understanding of its impact and why it is needed.

Despite the endless barriers, the possibilities to employ technology will only continue to develop and play an integral role in PE. Therefore, physical educators should be provided with the support needed for meaningful implementation. Technology is not trying to replace teachers or be used instead of physical activity. It is an additional tool that can improve the learning environment, making it more dynamic, customizable, and accessible. As this study demonstrates, PE teachers are facing many barriers when trying to employ technology in instruction. This needs to change. Physical educators have the responsibility to encourage and promote an active and healthy lifestyle. Let technology be a solution and not the problem.

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