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Gadgets in the Gymnasium: Physical Educators' Use of Digital Technologies

Les gadgets au gymnase : l'utilisation des technologies numériques par les enseignants en éducation physique

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Abstract

This article highlights results from a recent study that investigated Atlantic Canadian physical educators' adoption and implementation of various digital technologies. Employing a mixed-methods research design (survey participants, *n* = 206; focus group participants, *n* = 12), the research intended to provide a clear overview of physical educators' implementation of digital technologies—as well as an account of the factors that may enable or limit their use. Results suggest that some digital technologies are used more (e.g., audio players, computers) than others (e.g., Dartfish, iTouch). Moreover, a number of external barriers (limitations in time, expertise, resources) and internal barriers (teacher beliefs, established pedagogy) were identified. In light of these results, a number of observations and comments are offered. Results from this research might be of particular interest to those engaged with physical education and technology implementation.

Résumé

Cet article souligne les résultats d'une étude récente qui s'est penchée sur l'adoption et la mise en application de diverses technologies numériques par les moniteurs d'éducation physique du Canada atlantique. À l'aide d'un modèle de recherche faisant appel à des méthodes mixtes (participants au sondage, *n* = 206; participants au groupe de discussion, *n* = 12), l'étude entendait fournir un survol limpide de la mise en œuvre des technologies numériques par les enseignants en éducation physique, ainsi qu'un compte-rendu des facteurs qui peuvent permettre ou limiter cet usage. Les résultats suggèrent que certaines technologies numériques sont plus utilisées (p. ex. lecteurs audio et ordinateurs) que d'autres (p. ex. Dartfish, iTouch). De plus, un certain nombre d'obstacles externes (des limites relatives au temps, à l'expertise, aux ressources) et internes (croyances des enseignants, pédagogie établie) ont été repérés. À la lumière de ces résultats, nous offrons certaines observations et des commentaires. Les résultats de ces recherches peuvent être intéressants pour les personnes qui s'occupent de l'éducation physique et de la mise en application des technologies.

Introduction

For many years, a small number of simple electronic technologies enjoyed a presence within Canadian physical education programs. Some examples included stereos with analog record players and, following that, cassette players. More recently, these now-dated technologies have largely been replaced by smaller and more user-friendly digital technologies such as compact disc (CD) players and MP3 players (especially iPods). Moreover, additional digital technologies have been gaining popularity within physical education. For instance, consider the now-familiar use of computers and tablets (especially iPads and SmartBoards), movement-based gaming technologies (e.g., Nintendo Wii, Just Dance), fitness trackers (e.g., heart rate monitors, pedometers, Fitbits, accelerometers, applications [MyFitnessPal]), video analysis software and applications (e.g., Dartfish, Coach's Eye), as well as a number of other applications related to physical education. The utilization of newly developed hardware and software (programs and applications) within physical education programs is, seemingly, becoming more promising and common.

Certainly, there are many opportunities for physical educators to adopt and implement digital technologies in their programs. However, despite the potential possibilities, many physical educators are unconvinced of their benefit, hence adoption has been slow by some (Thomas & Stratton, 2006; Wyant, Jones, & Bulger, 2015). Still, given the burgeoning popularity, and the emerging possibilities of technologies within physical education, we set out to investigate Atlantic Canadian physical educators' implementation of them within their own physical education contexts. This investigation aimed to allow for an improved understanding of the digital technologies used and/or disregarded by the region's physical educators. Employing a mixed-methods research design, the research intended to provide a clear overview of physical educators' implementation of these digital technologies—as well as an account of the factors that may enable or limit their use.

Popular Digital Technologies in Physical Education

Attending to (and defining) digital technologies within physical education presents some challenges. First, the pace at which these technologies change results in two logical consequences: some are no longer as popular in use (e.g., Dartfish) and others, at the time of the research, were not yet as popular as they are today (e.g., Fitbits). Second, with this pace of development, categorizing digital technologies is becoming less of a straightforward task. For example, given that many of these digital technologies house central processing units (CPUs), most could be labelled as computers. Relatedly, smaller tablets, larger iPods, and popular smartphones (especially iPhones) perform many of the same functions. As a consequence, attempting to differentiate them and their uses can easily become a futile effort. Nonetheless, and without discounting these limitations, below we offer a brief overview of some of the most popular digital technologies used within physical education. These include computers, tablets and their applications, MP3s/iPods, video and/or audio players, exergaming, fitness tracking, and Dartfish. We recognize that some of these are hardware, others software, and others a necessary combination of the two. We also recognize that there are others that exist (e.g., Fitnessgram, global positioning systems [GPSs], etc.); we chose to focus upon these seven.

Computers

Given the language limitation offered above, we suggest that providing a clear description of *our* conception of a "computer" is a helpful exercise. Herein then, by computer we are referring to a desktop or laptop personal computer. Physical educators rely largely upon computers for planning, teaching, and management purposes. This includes accessing the Internet (or a school-site intranet) for planning (or locating) a lesson or unit, streaming a video for students to view, or inputting student information (e.g., grades) into a database. Though these multiple uses exist, research has suggested that physical educators' primary use of computers has been to input student information into databases (Thomas & Stratton, 2006). When considered alongside all of the other potential digital technologies, physical educators are most likely to use this technology—due to both the requirement to do so, but also because of the relative familiarity and ease of using this now-ubiquitous resource (Goktas, 2012).

Tablets (iPads) and Applications

Of all tablets available, Apple's iPad dominates the education market share for tablets in North America. This is especially true within Canada, where the iPad has captured over 90% of the education market (Khaddage, 2013). Perhaps one of the greatest strengths of the iPad (as well as any non-iOS tablet) is the seemingly infinite number of applications available for it. Indeed, there are tens of thousands of applications in the Apple App Store related to healthcare and fitness (Cummiskey, 2011). With so many possibilities, navigating through the Apple App Store presents a daunting task. However, a number of pedagogues have identified some of the most relevant applications for physical educators (e.g., see Chorney, 2014; Cummiskey, 2011). Though tablets have a number of useful functions (including video and/or audio recording and playback), applications arguably present the most unique possibilities for incorporating digital technologies into physical education. Unfortunately, even though plenty of applications exist, there is an obvious lack of research literature related to their use by physical educators.

MP3s/iPods

Remembering the "overlap" between MP3s/iPods, smartphones, and tablets, some have focused upon the use of iPods within physical education. For example, Forrest (2009) researched neophyte physical educators' reflective practices when teaching with a games-centred approach by having them audio-record their prompting questions and dialogue during their lessons. In this scenario, Forrest found the technology to be a useful tool in helping physical educators improve their own practice. Others have suggested iPods might be used to send and receive podcasts related to physical education content—this as a "solution" to address the ever-diminishing "face time" available for physical education instruction (Mears, 2009). As is the case with many of these other digital technologies, though anecdotal accounts may suggest many successful and positive uses for iPods, empirical evidence is wanting (Crawford & Fitzpatrick, 2015).

Video and/or Audio Players

Some have observed that there exists a dearth of research information related to the use of digital video within physical education (e.g., see Green, 2002) though others (e.g., Weir & Connor, 2009) have suggested the benefits of using digital video are plentiful. These benefits

include the ability to highlight correct technique and offer corrective feedback to students (Palao, Hastie, Guerrero Cruz, & Ortega, 2015; Weir & Connor, 2009). For example, Tearle (2003) has found students benefited from being able to see movement in discrete and whole parts—demonstrated by a video of a model or target exemplar. Despite these potential uses, Thomas and Stratton (2006) have found that physical educators' primary use of digital video has been for recording and summative assessment purposes. Similarly, Tearle and Golder (2008) have found the most common uses to be digital recording, video playback, and subject videos; video analysis is used by a comparatively small percentage of physical educators. It seems that some of the best potential uses are the ones least likely to be used. It is also worth noting that while students and their physical educators have found the best aspect of digital video to be its ability to enable performance feedback, they also have both suggested that the worst aspect was that it is simply too time consuming (Palao et al., 2015; Tearle & Golder, 2008; Weir & Connor, 2009).

Exergaming

Movement-based gaming technologies, also labelled as exergaming technologies, have been increasing in popularity within physical education programs for over a decade (Hayes & Silberman, 2007; Perlman, Forrest, & Pearson, 2012). Physical educators have introduced exergaming into their classes due to their perceived affective attributes (i.e., they can be fun; Dickey, 2005) and physical benefits (e.g., they can increase physical activity; Fogel, Miltenberger, Graves, & Koehler, 2010). Despite such claims about the benefits of exergaming within physical education (see also Staiano & Calvert, 2011), results related to these outcomes, as well as learning course content, are limited and equivocal (Baranowski, Buday, Thompson, & Baranowski, 2008; Ennis, 2013; Papastergiou, 2009). Consequently, Active Healthy Kids Canada's position statement suggests that active video games should *not* be a strategy to increase physical activity in children and youth. (Chaput et al., 2013).

Fitness Trackers

A number of devices are available to help individuals track their level of physical activity. These include, but are not limited to, the following: pedometers (to track number of steps taken), accelerometers (to track frequency, intensity, and duration of activity), heart rate monitors (to track heart rate as an indication of exercise intensity), and Fitbits (to track steps taken, distance covered, calories burned, and sleep accumulated, among other measures). Some devices, like heart rate monitors, are costly. This unfortunate barrier alone might prevent such technologies from being more widely used within school communities. Evidence suggests that simply having heart rate monitors in use increases both students' physical activity and their motivation to be physically active (Clapham, 2011; Clapham, Sullivan, & Ciccomascolo, 2015; Janz, 2002; Partridge, King, & Bian, 2011).

A much more common and inexpensive fitness tracking device is the pedometer. Pedometers became so popular at the turn of the century that a number of related teacher resources were soon developed. These included lesson plans specifically designed to incorporate pedometer use in physical education classes (Pangrazi, Beighle, & Sidman, 2003). The inexpensive nature, and wide availability, of pedometers likely contributed to their use and popularity. However, despite their ease-of-use, research has demonstrated that physical educators' perspectives of using pedometers can become negative after using them in class

(McCaughtry, Oliver, Dillon, & Martin, 2008; Partridge et al., 2011). Initially foreseeing few difficulties, physical educators have identified a number of practical limitations, including complications with measurement, accuracy, and difficulties in systematically retrieving data and devices (Partridge et al., 2011).

Dartfish

Dartfish is a popular motion analysis software program. It is essentially a video-recording technology package that allows for immediate feedback to learners (and/or subsequent movement analysis) using digital video (Thomas & Stratton, 2006). Given the more-complex nature of this digital video technology, some have recognized that training in how to use the resource is insufficient; physical educators also need "the basic knowledge of how to apply teaching principles to the results of the data collected" (Thomas & Stratton, 2006, p. 630). Moreover, Dartfish's focus upon "mechanistic breakdowns of fundamental movements" (Lloyd, 2011, p. 77) risks luring physical educators away from the broader goals of physical literacy. Still, it is worth noting that recent research found that physical educators who employed Dartfish unanimously suggested that its implementation enhanced student learning in physical education (Harris, 2009; Palao et al., 2015).

Investigating Digital Technology Use Amongst Physical Educators

As is evident in the review above, there is a limited but growing body of research related to technology and physical education. Much of the existing research has focused on attempts to increase physical educators' use of technology, or ways to improve technology use and teacher efficacy (Martin, McCaughtry, Kulina, Cothran, & Faust, 2008; McCaughtry et al., 2008; Morgan, Pangrazi, & Beighle, 2003). There still exists limited literature related to the extent to which physical educators are using digital technologies. Additionally, there is a notable absence of published research related to how and why physical educators choose to (or choose not to) use various digital technologies. Lastly, the vast majority of technology-related physical education research published to date has been conducted in the United States. This is likely the result of the United States' national education standards requiring teachers to be able to effectively implement technology into their teaching (National Council for the Accreditation of Teacher Education [NCATE], 2013; National Association for Sport and Physical Education [NASPE], 2009a, 2009b). Canada has no such national standards, and perhaps that is why there is a lack of research addressing the Canadian context. Given the aforementioned limitations in the research literature, this research set out to explore the extent to which physical educators in Atlantic Canada use digital technologies, the types of technologies they employ, their thoughts on their usefulness, as well as enablers and barriers to their use.

Study Design

A sequential explanatory mixed-methods approach (Creswell, 2005) was utilized for this study (see Figure 1). This two-phase process allowed secondarily collected qualitative data to elaborate upon the initially collected quantitative and qualitative data (Creswell, 2005). Initial data were collected from a large group of physical educators through the use of a cross-sectional survey design. The survey instrument, the Atlantic Canada Physical Education Survey (ACPE Survey), was comprised primarily of single response and Likert-type questions; a small number

of open-ended questions were also included. Secondary data were collected from a smaller group of physical educators through the use of on-line focus group interviews. The research was first reviewed by three universities' research ethics boards and found to be in compliance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans*.

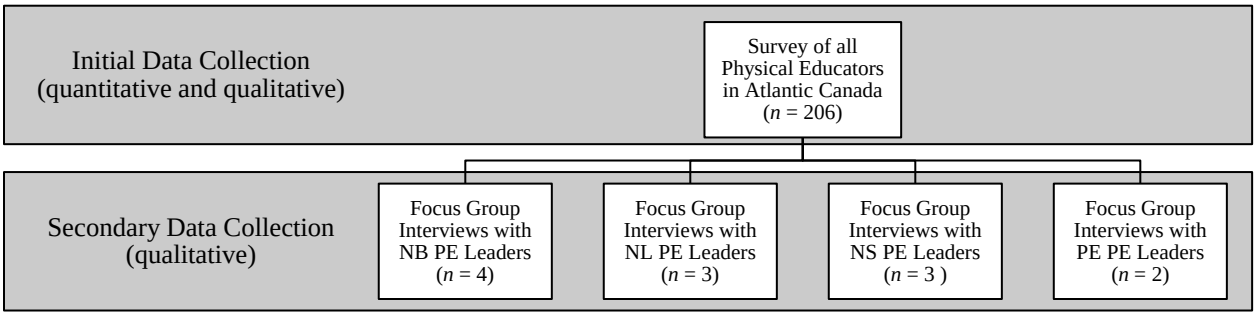

Figure 1. Sequential explanatory mixed-methods study design.

The survey. An on-line survey was sent to approximately 1,000 Atlantic physical education teachers (New Brunswick ≈ 325, Newfoundland and Labrador ≈ 200, Nova Scotia ≈ 425, Prince Edward Island ≈ 75). These numbers represent the data the presidents of the four Atlantic provincial physical education associations had on their membership lists. From the approximately 1,000 emails sent out, 206 teachers (102 male; 80 female; the remaining 24 elected not to answer) logged into the survey and agreed to participate, representing approximately one fifth of the population of physical educators in Atlantic Canada who belong to their respective provincial associations. Of these, 79 (42% of respondents) were from Nova Scotia, 73 (39%) were from New Brunswick, 20 (11%) were from Newfoundland and Labrador, and 15 (8%) were from Prince Edward Island.

The ACPE Survey that participants were asked to complete online was derived from an established survey developed previously by Mandigo et al. (2004). The ACPE Survey was subject to a rigorous review and pilot process (see Randall, Robinson, & Fletcher, 2014; Robinson & Randall, 2016). In the broadest sense, the survey was meant to enable the researchers to infer: (a) who is responsible for teaching physical education in Atlantic Canadian schools, (b) the qualifications and experiences of Atlantic Canadian physical educators, and (c) the nature of Atlantic Canadian physical education programs. Sections of the survey focusing on physical educators' use of digital technologies included the following questions and prompts:

- How often do you use the following technologies when teaching physical education (e.g., computer, iPad, iTouch, audio/video player, exergaming, pedometer, etc.)?
- Please add any additional comments you may have about the use of technology in your physical education classes.

On-line focus group interviews. After the survey data were analyzed, 12 participants were purposely invited to participate in focus group interviews (New Brunswick = 4, Newfoundland and Labrador = 3, Nova Scotia = 3, Prince Edward Island = 2). This purposeful sampling (Creswell, 2005) would best be described as critical sampling (Patton, 1990); participants who might best be able to illustrate the provincial situation were chosen. That is,

these 12 participants were all current or past executive members from the four provincial professional physical education teacher associations, or were highly recommended from the provincial presidents as teachers who were considered leaders in their respective provinces.

In total, eight on-line focus group interviews were conducted with the 12 focus group participants. The length of these eight interviews ranged from 62 minutes to 133 minutes. Four separate focus groups, each representing one of the four Atlantic provinces, participated in two on-line focus groups each. Examples of the guiding questions for the on-line focus group interviews included:

- Tell us about how you currently use digital technology?
- How do you use digital technologies when you teach physical education?
- What barriers exist that prevent you from using various digital technologies in physical education?
- What should the gymnasiums of the future look like (with respect to technology)?
- How should technology be a part of physical education in the future?

Data Analysis

Descriptive statistical procedures such as frequency scores, means, and standard deviations were employed for many of the survey responses. Responses to open-ended questions consisted primarily of short sentences and, where appropriate, similar responses were tallied or the responses were grouped/categorized by common theme. On-line focus group interviews were transcribed verbatim. Searching for commonalities, original insights, and patterns, physical educators' responses were read multiple times while elements were coded into "emerging" themes.

Results

Initial Data Collection: Survey Results

The survey asked participants about their frequency of use of a number of digital technologies, including a computer, an iPad tablet, and video/audio players (see Table 1). Additional space was provided for participants to comment. Audio players were used most frequently, with half of all participants using them daily, and a full 81% using them at least once every week. Although used far less frequently than an audio player, the second most frequently used device was a computer with 29% of participants reporting they used a computer either daily or weekly. At the same time, slightly more (31%) also indicated they used a computer only once or twice a year. The participants reported that they rarely, if ever, used Dartfish (88% of participants reported they never used it). Other devices that participants reported rarely using (never or only 1 to 2 times per year) included exergaming devices (88%) and fitness tracking devices such as pedometers and heart rate monitors (88%). Tablets were reported to be used very infrequently with less than 10% of participants using them daily and 78% reporting they never used them.

Table 1

Frequency of Physical Educators' Use of Various Technologies for Teaching

	Never	Once or twice a year	Monthly	Weekly	Daily
Computer	16%	31%	24%	17%	12%
iPad	78%	5%	2%	6%	9%
iTouch	80%	3%	2%	9%	6%
Audio player	1%	4%	15%	31%	50%
Video player	16%	41%	32%	10%	1%
Exergaming	70%	18%	9%	3%	1%
Pedometer/HRM	35%	43%	16%	6%	0%
Dartfish	88%	9%	3%	0%	0%

Initial Data Collection: Survey Comments

Following the survey questions related to the frequency of use of different technologies, participants had the opportunity to provide additional comments related to their use of technology. In total, 32 comments were provided. These ranged from comments that simply stated, "I use music everyday" and "GPS" to more detailed responses related to their perceived barriers. The three most common and salient themes found in the research were the following: limitations in time, expertise, and resources. Time limitations were expressed by physical educators who shared the following sorts of statements: "30 minute classes – not a lot of time to 'log in'", "Having PE for 30 minutes 2-3 times per week makes it essential to have that time be movement based and for everyone and since not everyone would have an iPad, exergame…then these things are never used." Expertise limitations were expressed by physical educators who shared the following sorts of statements: "I still need more in-servicing.", "What is dartfish?", and "I do not know what exergaming or dartfish are." Resource limitations were expressed by physical educators who shared the following sorts of statements: "We do not have the same access to technology as other schools in the district.", "My 'gym' is in a cafeteria so I have little access to many of the above technology.", "If we had more tech it would be used.", and "It is expensive. That's a barrier to use."

Secondary Data Collection: Focus Groups

The follow-up focus group interviews allowed for a more in-depth inquiry into the use of digital technologies within the region. In addition to supporting the perspectives offered by the survey results, focus group discussions also alluded to additional observations. More specifically, the barriers repeatedly spoken about during the focus groups related to differential access to resources, lack of financial resources, unconvincing evidence, and established pedagogy. Following, then, is a brief overview of some of these observations.

Differential access to resources. Focus group interviews revealed that, across the four Atlantic provinces, there were considerable differences with respect to district and/or administrative support for technology integration within physical education. For example, within one province, the introduction of iPads and iPad applications was especially common within physical education (i.e., all physical educators within most school districts were given iPads):

> All physed teachers have iPads. [It] does what we need it to do as far as being able to assess in the present time versus the checkboard or pen and paper methods. Also they have been doing a lot of video modeling and split classroom techniques [with the iPads]…. We use it for assessment, we use it for curriculum delivery, as well as for peer review and self-review. (Participant 3A)

In contrast, within the other three provinces, iPads were not provided to physical educators and their use within physical education was consequently limited:

> We have zero support when it comes to iPads in our district. We cannot even get iPads set up on our network, let alone set up to use in the gym…. I purchased my own and they still wouldn't grant me wireless access to use it as a pilot. (Participant 1A)

Lack of financial resources. Technology can be expensive to acquire and, in times of strained educational budgets, finding large sums of money for the acquisition of technology can be very difficult. As one participant shared:

> I agree everyone would love to have access to a SmartBoard or more than one iPad to use in your gym but typically that does not seem to be the case. Just having more finances to buy those kinds of things would definitely help. Even before the SmartBoard days I remember thinking it would be wonderful to have a class set of GPSs as opposed to rounding up a few from the community and then deal with two to three different models of GPSs trying to teach kids how to use them. Having the funding to be able to provide you with the proper tools to use technology in the class is the major barrier I think. (Participant 4B)

Participants also noted how financially difficult it was to keep up with the fast pace of change. Even if devices were acquired, keeping the devices updated was very costly. As one participant stated, "Some barriers would be finance. I mean technology is always changing. It changes kind of quick. By the time you get the technology, sometimes through fundraising, there is new technology" (Participant 2A). Similarly, once technology was acquired, the participants recognized the cost of keeping the equipment in good working condition: "The other thing is money to keep the supply of technology going and the maintenance as well. We have 525 students who are hard on equipment I guess is what I am trying to say. Getting things repaired can be tricky and costly" (Participant 4A). Another participant elaborated further, stating,

> I think maintenance, too, this can be a problem as well. If you are depending on the technology sometimes it can be a hassle if you are in a situation where it cannot be maintained. If you do not have someone on staff who can actually help look after it, if you are the person who always has to maintain it, sometimes in smaller schools, you

> might not have an opportunity to do it. Maintenance can be a barrier as well. (Participant 3A)

Unconvincing evidence. It was only during the interviews that the participants began to talk about some of the barriers that were directly related to teacher beliefs about technology and technology's role in the physical education classroom. More specifically, physical educators shared that they were somewhat unconvinced that technology ought to be purposefully integrated into physical education, questioning or remarking about instructional and/or activity time being "lost" to technology time: "I don't want technology to overcome what is happening. I think it can be a good teaching tool but kids still need time on task so I'm torn, I guess" (Participant 1C), and "Time. I change classes every half an hour so if I [use digital technologies] it has to be kind of a one off if I use it" (Participant 4B). No participants suggested that technology should not exist in physical education, but several participants voiced concern at the pace of expected technology implementation without adequate evidence that it was useful. For example, one participant stated, "I agree, technology is great and all but I find sometimes when a certain thing comes forward it is almost like they go 100-110% in that direction and they forget the grassroots" (Participant 1A).

Additionally, it is now commonplace to come across messages lamenting the overweight and inactive status of North Americans as a society. Being fully cognizant of these messages and noting that physical education is the only subject area that intentionally prepares and requires students to move, another group of participants questioned the various purposes of physical education and technology's role in meeting the overall objectives. For example, one participant stated,

> I think it should be used as a guide or an aid just like in the classroom a book is an aid. Participant 3C and Participant 3A were saying, 'Don't lose focus on teaching, respect technology and use it for what it is useful for but don't forget your body is made for work and you need to work your body to stay healthy.' That should be the kind of way technology should be in physical education. (Participant 3B)

Near the end of one of the focus group sessions, another participant stated,

> I would agree with Participant 1A and Participant 1B that we don't want to focus so much on technology that they [the students] forget about why they are actually there—to move and so on. I think a lot of our youth right now spend too much time on screen doing gaming and so on, and are just not active enough. (Participant 1C)

For this group of physical educators, students moving for a larger percentage of class time was important and they looked suspiciously upon technology as one way to impede upon this movement time.

Established pedagogy. Many physical educators have developed pedagogical practices and routines that have allowed them to deliver the curriculum in a manner that works for them. In some cases, introducing technology forces these established practices to change and some of the participants shared that they were not comfortable with this change. Consider, for example:

> I have tried using my iPad to input marks with our power school I thought what would be very convenient but I find trying to do it I am looking away from students and I am really hesitant to put my head down and try to input marks without watching the students so I tend not to do that. I am still doing a quick paper and pencil or just taking the video and pictures and looking at them later. (Participant 3A)

Discussion

The frequent use of audio players reported in the survey results is not altogether surprising as this is in agreement with results found by Thomas and Stratton (2006). Audio players are still some of the most commonly used digital technologies. We suspect the most common use for these audio players is for participants to play music for their students during their physical education class or during part of their physical education class. For example, many physical educators play music as students enter the gymnasium, others play music for students during warm-up activities/times, and others play music during skill/game/activity practice. Additionally, dance is one of the categories of movement in all four of the provincial curriculums. Physical educators are required to teach some form of dance every year. We suspect many participants use audio players for these units and lessons.

The relatively low percentage of participants who reported using a computer daily or weekly was an unexpected finding. Given that many physical educators must, at the very least, record daily attendance on a computer, we can only suppose that many interpreted that these were not "teaching acts." In a similar manner, perhaps they did not view recording assessment and evaluation scores and comments on a database, and via a computer, as "teaching." Our conclusion then is to surmise that these participants do in fact use computers quite often—but they don't seem to use them very often for purposes any greater than record keeping.

The relatively absent use of iPads (i.e., 78% of physical educators never used them) speaks, we believe, to our earlier observation that the pace of technological change (and availability) impacts research results. That is, though it is clearly true that few participants used iPads in their instruction when they were initially surveyed, many schools and school districts in some of these four Atlantic provinces have subsequently provided iPads to their physical educators. That is, we began surveying participants just before iPad use was "taking off" by physical educators within these provinces. Had we completed this research one year later, we believe we would have found many more physical educators using iPads. Notwithstanding this suspicion, we note that in *some* of these provinces it is difficult to acquire the technology and/or there is resistance at both the school and district level. For example, one survey participant stated,

> We have zero support when it comes to iPads in our district. I am still fighting to get them set-up on our network let alone to use in the gym. We are getting some resistance from the district level as well. (Participant 3B)

In another province, all teachers are required to use them daily. The participants from this province reported using their iPads in a variety of ways. For example,

> We use it for video modeling, assessment, we use it for curriculum delivery as well as peer and student self-review. Taking a video of the student and the student then reviews the video and then with instruction is able to kind of self-correct. (Participant 2C)

Somewhat similarly, another participant stated, "As games are happening I video students performing certain skills or parts of games using strategies and then have a break in class, show the video, discuss some of the situations and then put them back into play" (Participant 1D). In addition to their use for performance analysis, physical educators also report using the iPad to demonstrate how a complicated game is played, or what the game looks like when being played at a high level. For example, one survey participant shared "after teaching a little bit of it [the game], you can go in and show them a video of the game and [how it is] played at a higher level; just to show them there is something else you can use or this is how fast paced the game can get" (Participant 2A).

We note that one of the focus group participants shared that she was attempting to use an iPad for assessment purposes but was uncomfortable looking away from students for what she perceived to be too long of a time period. Thus, she recorded the observation/assessment as she had done in the past (paper/pencil) then transferred the results to the iPad later. This is an interesting observation as here we see a physical educator attempting to use an iPad for assessment purposes—an idea that, in theory, is supposed to make assessment more efficient. However, in this case, it is deemed to be too time consuming and goes against what the physical educator believes to be best practice. Additionally, pedagogues instil in physical educators the importance of constant surveillance of their students. By turning her attention to the iPad, finding the appropriate student, and imputing a grade, she feels this takes too much time away from actually observing the students.

As is supported by other recent research findings (Weir & Connor, 2009), video players enjoy limited use within these participants' programs. Still, though few participants incorporate video players daily (1%) or weekly (10%), a sizeable portion use it monthly (32%). However, we failed to inquire about the uses they had for these video players. We would suspect that their use was in agreement with previous research (Woods, Goc Karp, Miao, & Perlman, 2008) that demonstrated teachers use these devices to aid the visual learner or show students videos of proper technique. Our own observations in local school communities seem to suggest that recording and playback of videos are some of the more common uses; movement analysis applications are employed rarely, if at all. We believe this infrequent use of video players may be due to the fact that iPads and their applications have the capability to do what video players have done in the past—and we also note that iPads are much lighter and easier to set up and use.

To us, it is promising that a full 88% of participants use exergaming never, or only once or twice a year. Our concern rests with the small number of participants who frequently include exergaming in their programs (e.g., 1% use it daily and/or 3% use it weekly). Quite frankly, we are somewhat skeptical of a physical education program that includes considerable opportunities for exergaming. Given that exergaming requires little-to-no movement instruction by physical educators as well as little-to-no authentic and transferable sport- or gymnastic-related movements, we see exergaming as an opportunity for students to achieve some physical activity—rather than some physical education. Accordingly, we are satisfied that this sort of digital technology was taken up by a very small minority of physical educators in the region.

National suggestions about limiting exergaming use (Chaput et al., 2013) are being heeded by Atlantic Canada's physical educators.

Fitness tracking devices are not a part of regular physical education instruction for many physical educators. Only 6% of the participants use them weekly, while 35% never use them (and an additional 43% only use them once or twice a year). Given the infrequent use of these devices, and informal conversations with teachers, we believe that they are used when teaching students about fitness tracking devices and/or body "measurements" for information and demonstration purposes, usually during fitness units. That is, they are being taken up by some physical educators within topics of individual lessons, rather than as tools for regular use.

Of the digital technologies listed, Dartfish technology was the least used by the participants. A full 88% never used Dartfish while 9% only used it once or twice a year. Moreover, this was the only digital technology that was not used daily or monthly by any of the 206 participants surveyed. Such limited use has not been due to a lack of effort by some. For example, considerable investments in resources and professional development have been provided to physical educators throughout parts of these provinces—seemingly to no avail. This finding resonates with Palao et al.'s (2015) findings; they found that—even after training and assistance with the software—participants could not be convinced of its effectiveness and use.

It is not surprising that "lack of resources" (whether the resource would be actual funding to buy specific equipment, lack of equipment provided by the school/district/province, or lack of available professional development time) was consistently mentioned as a barrier. This is similar to results found in other research (Woods et al., 2008). Given that most of these digital technologies are expensive, it is fair to wonder how, or why, schools might purchase them, especially given the current financial climate. When the technology is not provided, or funds are unavailable to purchase resources and provide the necessary professional development, physical educators cannot really be expected to be using them.

Physical educators' concerns related to time as a barrier to use have also been echoed in the literature (Woods et al., 2008). Their comments suggest that some physical educators have not found ways to include digital technologies, without also "losing" important and limited instructional time (e.g., logging in prior to class or having the class set up with the technology before school or during lunch). While digital technologies ostensibly should make one's tasks better or easier, here physical educators are suggesting that their inclusion is not seamless enough. Perhaps one way of addressing this is to ensure physical educators receive suitable required professional development so that they may develop the expertise to include them without also sacrificing their valuable instructional time. However, professional development in this area seems to be lacking as well.

Participants' hesitation to implement technology without convincing evidence of its ability to improve curricular outcomes can be seen as positive in that these physical educators need to be convinced that a technology will enhance teaching and/or learning before they are willing to adopt it. This is an admirable stance. Just over a decade ago, Thomas and Stratton (2006) voiced similar concerns and noted that research was "required to discover if ICT in PE is effective in the development of motor skill, and if so, how best to deliver the lesson utilising such equipment" (p. 631). More recently, Palao et al. (2015) noted little had been done to fill this

research gap and they, consequently, attempted to begin such research by assessing the effectiveness of video feedback on student learning. Their results found that all three practice conditions—verbal feedback by the teacher, video and teacher feedback, and video and student feedback—produced improvements in skill *technique* but "when factoring in the quality and quantity of the execution, the best improvement was again obtained in the teacher-led video condition" (p. 59). Knowledge gains were also greater when the teacher was involved. Better task execution was obtained by the video and student feedback condition. While Palao et al.'s (2005) research demonstrated that video could be useful to assist student learning, the researchers noted that, "if it were not for the assistance of the research team, the teacher felt the technology would be too overwhelming to use" (p. 60). This is hardly convincing evidence.

Noting the reluctance of some physical educators in the present study, we suspect that not only will more solid evidence be required, but the technology will have to be easier to use. It should be noted that the video program used in the Palao et al. (2015) study was Dartfish—an observably less-than-user-friendly platform to use. We suspect future studies that use more portable devices, such as an iPad or iPod, might prove to be more convincing and could, consequently, have a greater impact on changing physical educators' beliefs and practices. Literature in general education (Ertmer & Ottenbreit-Leftwich, 2010) and physical education (Juniu, 2011) have begun to address this issue by providing suggestions on pedagogically appropriate ways to integrate technology so that it enhances student learning.

Conclusion

It is clear that most physical educators who participated in both the survey and the focus groups view technology as something that has the potential to contribute to physical education classes, though only in somewhat limited ways. The most commonly used devices that were repeatedly mentioned in the focus groups were iPads and SmartBoards. In most instances, the participants suggested that iPads could contribute positively to class via the use of video playback. With access to the device's own camera function or through the use of applications like Ubersense or Coach's Eye, physical educators could highlight specific features of a skill or game that might otherwise be inaccessible to the student (i.e., students cannot both complete an activity/skill and watch themselves at the same time). Physical educators who were using technology in this manner felt that the ability to point out specific aspects of a student's own performance (while the student was viewing herself/himself) made the feedback they provided more valuable for the student. As noted above, Palao et al. (2015) have begun to provide evidence in support of this belief.

With respect to SmartBoards, none of the focus group participants actually had a SmartBoard in their gymnasium but a couple had access to one in a nearby room. Those that had access to a SmartBoard and those who suggested it would be a welcome addition spoke of the interactive nature of the board to demonstrate various topics (e.g., the function of the lungs, game play elements, skill cues and components). Noting that physical educators often use their wall space (e.g., by having students throw or kick a ball against the wall in early stages of skill development), participants raised concerns about the potential loss of wall space and/or for the device being damaged if it was permanently attached to the gymnasium wall. This raised the issue of equipment storage. Regardless of these issues, most participants stated they were actively seeking a SmartBoard, or that it was on their "wishlist."

Clearly it is not enough for physical educators to be aware of—or even to use—digital technologies in their teaching practice. That is, physical educators, like all teachers, ought to choose appropriate technologies to support their teaching—rather than designing lessons to "fit" with the available technology (Juniu, 2011). Expanding upon Shulman's (1987) initial conception of pedagogical content knowledge (PCK), technological pedagogical content knowledge (TPCK; Koehler & Mishra, 2008) requires physical educators to apply their knowledge of curriculum, pedagogy, and technology in a way that is suitable and adaptable to the educational context.

Similar to what others have suggested, some physical educators in this study viewed technology in an especially skeptical manner, believing that the introduction of technology necessarily detracts from the core principal of physical education—to get people moving for learning (Casey & Jones, 2011; Stidder & Capel, 2010). Indeed, as has been observed by others, technology has undoubtedly contributed to the decline in children's and youth's physical activity (Finkenberg, 2008; Nigg, 2003). With this observation, it is certainly understandable for some to therefore wonder why we are looking to technology to improve physical education (or physical activity). In response to this, it must be noted that national teacher organizations such as CAEP and SHAPE America (as well as discipline-specific organizations such as NASPE) all include statements related to expectations that physical educators will use technology to enhance student learning. This is interesting considering there appears to be a lack of research directly examining the impact of technology on student learning in physical education.

We suspect other teacher educators and physical educators across the country will be able to relate to many of our findings. That is, they will see variations in the availability and support for the use of technology across their provinces/states, their district, and within their own school. They may be experiencing the difficulty of trying to keep up with the acquisition and use of the newer products and updated applications. Similarly, they may be familiar with the frustrations related to accessing adequate professional development when the technology does become available. Additionally, we suspect the physical educators in this study are representative of many across the country—from those who embrace technology fully to those who continue to question its value. Those who are slower to embrace technology appear to need evidence that it will improve practice. If not, why bother? This should be an area of future research.

As others have noted (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010; Palao et al., 2015; Wyant, Jones, & Bulger, 2015), changing beliefs with respect to technology integration is difficult but required if physical educators are going to begin to utilize it in their lessons. However, for this to happen a few simple conditions must be met. First, the technology must enhance what the physical educator is currently doing. It cannot simply mimic what she or he can do; it must instead do those functions better, more quickly, or more efficiently. For example, a physical educator does not need to log into a wireless network, load a grouping application on an iPad, shake the iPad, and wait for the application to randomly assign students to groups when it can be done twice as quickly without carrying around an electronic device in one's hands. Second, the use of digital technology must not be too time consuming to both set up and subsequently use in class. If the use of technology requires too much additional set up or planning time on top of an already overcrowded schedule, and/or it detracts from student time on task in class, many physical educators will be reluctant to use it. Third, and most importantly, physical educators must be convinced that technology will help them reach curricular outcomes.

In summary, the majority of physical educators may be willing to implement and use digital technologies when they enhance their practice and student learning. Without those possible outputs, potentially useful digital technologies risk simply becoming gimmicky gadgets in the gymnasium.

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