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TECHNOLOGY

Only When It Is Raining: Technology in Physical Education

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Abstract

The preparation of teachers' technological competencies for teaching and learning has become important and evident, now more than any moment in history because of the COVID-19 pandemic. Physical educators are generally technologically literate; however, they tend to have skeptical attitudes toward integrating technology and require additional training. This mixed-methods study explored teacher educator and preservice expectations for and implementation of technology in physical education. The Technological Pedagogical Content Knowledge (TPACK) framework was used as a lens in this study to conceptualize teacher thinking and practice related to technology. Results indicate that teacher educators and preservice teachers value technology, generally feel unprepared, acknowledge that physical educators have contextual barriers, and believe technology can be a valuable partner in achieving learning outcomes. Teacher educators and professional development programs need to train future and current teachers adequately on integrating technology in meaningful ways.

The COVID-19 pandemic has increased attention on the state of technology in education. The immediate transition from face-to-face to online environments has shed light on inequities and teacher preparedness to use technology. Additionally, there have been significant access and equity issues for students and teachers. This has been especially true for low-income students, with at least one

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report finding that at least 20% of students had inadequate access to internet, devices, and/or technology competency (Stelitano et al., 2020). Many teachers have struggled with communication, student participation, teaching content, providing feedback, asynchronous instruction, monitoring progress, and determining understanding (Stelitano et al., 2020). The preparation of teachers to utilize their technological competencies for teaching and learning has become important and evident, now more than any moment in history.

Technology in Physical Education

The pandemic has forced all teachers to use technology for learning. Prior to the pandemic, teachers primarily used technology for teaching preparation rather than for learning activities (Russell et al., 2003). National physical education content standards promote technology use for health- and fitness-related concepts and activities (SHAPE America, 2014). Regardless of this promotion, physical educators need greater technological knowledge and skills to implement technology into physical education lessons effectively (Ince et al., 2006; Woods et al., 2008). Additionally, physical educators tend to have a negative and skeptical attitude toward integrating technology into the classroom (Kretschmann, 2012). Despite a negative and skeptical attitude, physical educators are generally computer literate. Not surprisingly, higher technology literate teachers use technology more frequently than their less technology literate peers (Kretschmann, 2015).

Physical educators, like other teachers, use technology for the preparation of lessons, but they also use social media to connect and learn new ideas (Krause et al., 2017). They embrace technology use in their classrooms and use a variety of tools in their teaching such as images, activity monitors (pedometers and heart rate monitors), and mobile applications (Krause et al., 2017; Kretschmann, 2015). Mobile applications, for example, can increase a physical educator's ability to manage class data, contact students and parents, promote programs, create lesson plan, provide feedback, assess students, and manage time (Yu et al., 2018).

Teacher Preparation and Technology

Teacher preparation programs across the United States prepare future educators with a set of diverse skills, including competencies

in technology. Physical education teacher education (PETE) programs are inconsistent and often fail to develop adequate competencies of including technology in their undergraduate coursework (Juniu et al., 2013). Furthermore, PETE programs struggle with developing models that produce technology-competent graduates who can use technology appropriately to advance learning in the K–12 setting (Gibbone & Mercier, 2014; Juniu, 2011). It is important to acknowledge the difficult task that teacher preparation programs face in training future teachers to enhance their content and pedagogical knowledge in addition to their technological knowledge. The development of technology skills is not the sole responsibility of PETE programs. Professional development must also target these competencies; however, professional development in schools tends to neglect the needs of physical educators (Armour & Makopoulou 2012).

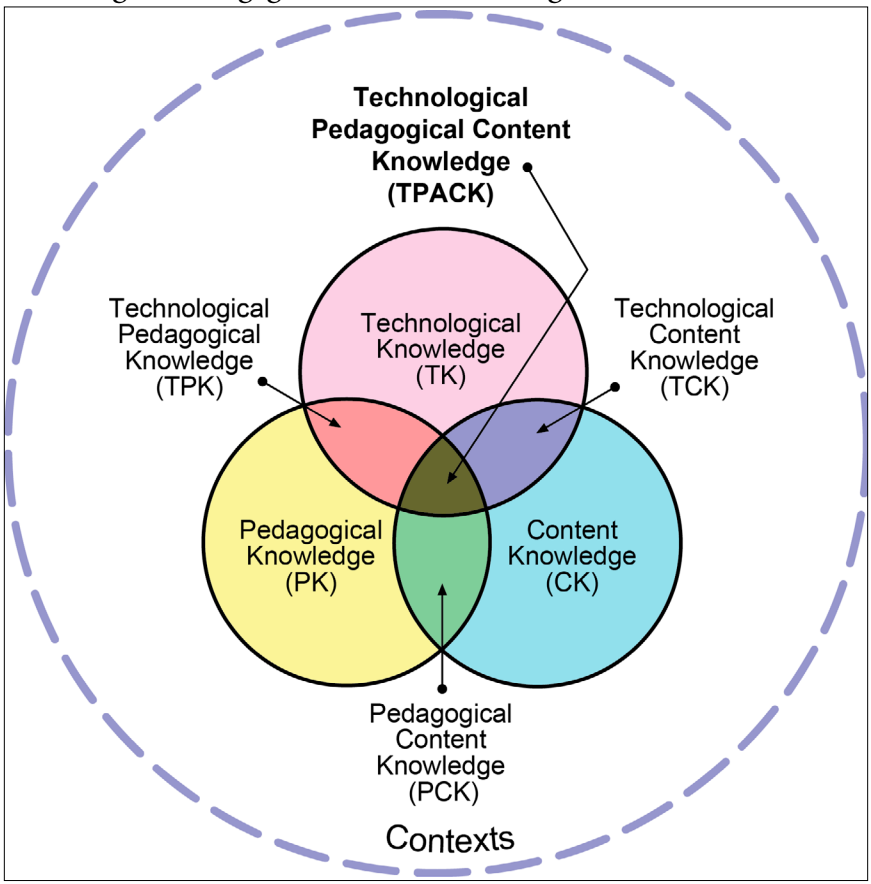
Teachers learn to use technology in certain situations but are not able to apply to their own context or modify to the belief system in place at their school site (Hur et al., 2018). Additionally, new teachers tend to use technology in teacher-centered versus student-centered ways but can adapt and develop technology skills quicker than their experienced colleagues (Englund et al., 2016). Under the rapid shift to online teaching under COVID-19 conditions, it has become increasingly clear that teachers face challenges in conceptualizing face-to-face pedagogies in the distance learning environment (Goad & Jones, 2017).

Theoretical Framework

The Technological Pedagogical Content Knowledge (TPACK) framework is a model for conceptualizing teacher thinking and practice related to technology. TPACK describes the interplay and connected constructs of Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK) as pertaining to teaching (Mishra & Koehler, 2006). The TPACK model is an extension of the seminal work of Shulman (1986), who describes pedagogical content knowledge as the intersection of what to teach and how to teach it within content areas. Figure 1 illustrates the interconnected nature of TK, PK, and CK. Of note is the idea of "contexts," which surrounds the TPACK model, acknowledging that the unique nature of each school environment, classroom, and

Figure 1

Technological Pedagogical Content Knowledge Framework



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student and teacher creates considerations to the appropriate application of TPACK (Mishra & Koehler, 2006; Rosenberg & Koehler, 2015). Additionally, this model describes the interplay between TK and PK (Technological Pedagogical Knowledge, TPK), TK and CK (Technological Content Knowledge, TCK), and PK and CK (Pedagogical Content Knowledge, PCK). TPK is the acknowledgment that teaching and learning can change when certain technologies are applied including understanding the constraints, developmental appropriateness, and teaching strategies (Koehler & Mishra, 2009). TCK is the understanding that technology and content influence

each other and the thinking behind the selection of technology that aligns with learning or demonstrating content. PCK, a construct from Shulman's work, represents the ability of a teacher to adapt and modify instruction to fulfill the needs of students, utilizing an understanding of how students learn applied to specific content (1986). TPACK has been investigated widely in education including in physical education with preservice teachers, in-service teachers, and teacher educators (see Krause & Lynch, 2018; Semiz & Ince, 2012).

While there is evidence that physical educators are generally technology competent, the profession struggles with training and implementing technology-related practices (Ince et al., 2006; Kretschmann, 2015; Woods et al., 2008). One barrier to implementation is expectations for physical educators not only from other teachers but also from teacher education faculty. Teacher educator modeling of technology use or TPACK is important to a new teacher's strategic use of technology in the classroom (Tondeur et al., 2012).

Therefore, the purpose of this study was to explore teacher educator and preservice teacher expectations for and implementation of technology generally in education and specifically in physical education. As such, the research questions that guided this study were

1. What are preservice teachers' and teacher educators' expectations for educational technology in general education classes?
2. What are preservice teachers' and teacher educators' expectations for technology use in physical education settings?
3. What are preservice teachers' and teacher educators' perceptions and experiences of technology integration in physical education?

Method

This mixed-methods study took place at a public university teacher preparation program in California between spring and winter 2019. This was immediately prior to the COVID-19 pandemic and subsequent shift to distance learning instruction. Convenience sampling was utilized, and all teacher educators and teacher candidates at this university were invited to participate in the study. One hundred twenty-six surveys were returned via Qualtrics, an

electronic survey platform. Incomplete surveys were removed from the survey pool because informed consent forms indicated this to be a way for students to "opt out" of having participant data included in the survey. Sixty-nine complete surveys were included in the final data analysis.

In California, single- and multiple-subject credential candidates are postbaccalaureate students and have a bachelor's degree. The California Commission on Teacher Credentialing (CCTC) has six Teaching Performance Expectations (TPEs) that guide credentialing programs in developing competencies for beginning teachers (CCTC, 2016). Five of the six TPEs specifically mention various technology-related competencies. These competencies include but are not limited to teachers being able to use communicative technologies, assistive technologies, instructional technologies, technology to assist in assessment, teach about digital citizenship, and understand technology pedagogy (CCTC, 2016).

Participants

The Institutional Review Board (IRB) approved this study prior to data collection. Participants consented to participation, and pseudonyms are used for anonymity. Participants (N = 69) in this study were credential candidates enrolled in a single-subject or multiple-subject credential program at a large urban university in Northern California (n = 48) and teacher educators at the same large urban university in Northern California (n = 21). This study focused on perceptions and expectations for technology use in all subject areas but also included questions focused on physical education. All teacher education faculty and credential candidates interact with physical education candidates in courses and many participate in fieldwork observations of physical education and non–physical education candidates. The inclusion of non–physical education participants was intended to provide contrast and to reveal potential assumptions about the content of PE within the department.

Participants were recruited by email and, when appropriate, verbally. Email invitations, detailing the purpose of the study as well as inviting anonymous participation, were sent to each faculty member and all students enrolled in credential classes. A total of three emails were sent out, with 2 weeks between each reminder. Additionally, verbal reminders were used; for example, faculty were reminded at

Table 1
Participants Teaching Licensure Area

Licensure area	Credential candidates	Teacher educators
Multiple subjects	20	6
Art	2	2
English	11	2
History/social science	1	2
Mathematics	0	1
Music	1	2
Physical education	3	0
Science	7	0
World language	2	0
Unknown/declined to state	1	6
Total	48	21

meetings and credential candidates were reminded in class by faculty not involved in the study. To be included in the study, credential candidates had to be matriculated students in either the single-subject credential program or the multiple-subject credential program. Faculty were both tenure and nontenure track, but they had to be currently involved with student teacher supervision and/or teaching courses in the single- or multiple-subject credential programs.

Credential candidates (n = 48) and faculty included participants from nine credential areas (Table 1). Credential candidate participants were close to evenly split with 20 candidates not yet student teaching and the remaining candidates in either their first semester or their second semester of student teaching (n = 28). The teacher education faculty (n=21) included part-time and full-time faculty who taught classes and/or supervised students enrolled in the teaching credential program. Nine of the teacher education faculty had 10 or less years teaching, three had between 11 and 19 years teaching experience, and nine had 20 or more years of teaching experience.

Data Collection

We drafted the survey items, grounded them in the language of the TPEs, and then sent them to a panel of experts for review.

The panel consisted of two well-published educational technology researchers, three K–12 teachers, one teacher education fieldwork coordinator, and one physical education researcher. Content validity was established through the incorporation of feedback and final review of the survey from the expert panel. The survey had five parts: demographic data (years teaching, school information, technology access, etc.), evaluation of the value of technology in education, expectations for new or beginning teachers' competencies related to technology, expectations for experienced teachers (defined as 5 or more years of teaching experience), and open-ended questions. Credential candidates and faculty were asked the same questions except within the demographics section. For example, credential candidates were asked if they were student teaching where teacher education faculty were asked about their role within the credential program (i.e., supervision of candidates and/or teaching courses).

The expectations of technology portions of the survey consisted of items generated from the technology expectations in the California TPEs. These items utilized a five-level Likert-scale rating system from *no expectations* to *able to teach peers*. Experienced teachers were defined as having 5 years or more of teaching experience because in California, teachers by their fifth year of teaching have to "clear" their credential by completing the new teacher induction program also known as Beginning Teacher Support and Assessment. The three open-ended questions allowed participants to identify expectations about technology in general and for physical education specifically. These questions also allowed them to note if they had examples of exemplary use of technology in physical education. For example, the two open-ended questions focused on physical education were "In what ways, if any, do your expectations for technology use in physical education differ from those you expect in other content-areas? (Please enter 'same' if they are the same as other content-areas, or 'none' if you have no expectations for tech use in PE)" and "If you have experienced or observed any educational technology being used for teaching and/or learning in physical education, please describe one or two examples here."

Data Analysis and Trustworthiness

Data in this manuscript focus on the qualitative data from the survey and the quantitative question related to the value of technology

in education. Descriptive statistics were used in the analysis of the quantitative section of the survey. This allowed for determination of frequencies, percentages, and means. The open-ended survey responses were analyzed by two researchers, one physical education expert, and an educational technology expert. Both researchers are experienced with qualitative data analysis. Data were initially reviewed through open- and axial-coding techniques and themes established (Corbin & Strauss, 2008). Themes were discussed and refined and then a second round of coding commenced without regard to the theoretical framework. Data were then analyzed through the lens of the TPACK framework. After the two researchers completed the second round of coding without regard to theoretical framework and TPACK coding, they met to review coding results. Additionally, data were triangulated across open-ended questions, subject area, and if they were a teacher educator or a teacher candidate (Patton, 2002). All codes were reviewed, both where there was agreement and where codes did not match between the researchers. Additional discussions took place during the recoding and not only were codes refined but also agreement was made on all coding. The open-ended coding results, valuing of technology, and demographic items were then analyzed for patterns and trends in the data.

Results

The results of this study are organized around three themes, grounded in the contexts for enacting TPACK. The first theme discusses expectations for technology in education generally, the second theme discusses expectations of technology use specifically in physical education contexts, and the third theme highlights examples the participants gave of technology use in physical education contexts.

Expectations for Technology in Education

The first open-ended item in the survey was intended to elicit survey respondents' expectations for technology use in any and all K–12 learning settings. Within this overall theme, two subthemes emerged in the coding process. The first theme was an acknowledgment from teacher candidates and teacher educators that technology should be used to advance the goals of education. The second theme discussed the perceived lack of technology competencies.

Technology Should Be Used

Participants in this study generally viewed technology competencies as important (Table 2). Clearly, both teacher candidates and teacher educators viewed technology as a valuable and essential skill for teachers. This was exemplified in their descriptions of their expectations for teachers using technology for educational purposes.

Table 2
How Valuable Is Technology for Teaching and Learning in K–12 Schools?

	Credential candidates		Teacher educators	
Scale descriptor	***n***	**%**	***n***	**%**
Essential	18	37.5	11	52.4
Valuable	23	47.9	7	33.3
Somewhat valuable	7	14.6	3	14.3
Not valuable	0	0	0	0

Participants described a variety of expectations for technology use for instructional and assessment purposes. A multiple-subjects teacher candidate discussed knowing how to search for and use appropriate websites that allow elementary students to practice the skills being taught, and knowing not to use websites that "do not correct errors or just give the student the correct answer." In this response, there is a specific understanding of TPK. The teacher candidate discusses a higher level of understanding of the appropriate way to filter and apply internet resources that provide students opportunities to receive multiple practice opportunities and feedback. Relatedly, a teacher educator who had a clear understanding of the "big picture" of technology use in the classroom said,

> Many pre-service teacher's [*sic*] fail to understand the difference between using technology in class to enable subject learning (literacy, math, science) and teaching actual computer science and coding skills. When they become classroom teacher's [*sic*] this leads to them not being able to explain the technology used in class to parents and correcting their misconceptions about it.

In this quote, the teacher educator illustrates TPACK by discussing technology use to improve subject competency. Additionally, this quote separates technology competence from TPK and a teacher's ability to explain the "why" behind technology use in education. Similarly, another teacher educator noted technology goes beyond academics and into considering and understanding the role and impact of technology on brain development and attention span. Certainly, the concept of teaching teacher candidates and students appropriate uses of technology with the teacher establishing boundaries and understanding its impact beyond the content-specific learning is important.

We Are Unprepared

Although respondents identified technology skills as important, when asked how they learned to use technology, 41 of the teacher candidates said they learned to use technology on their own, with very few having learned on the job or received professional development, certifications, coursework, or degrees. Discouragingly, few teacher candidates identified learning educational technology within their formal teacher education program. However, this concept of learning technology on their own correlated with the teacher education faculty who said they learned how to use technology on their own (n = 19) and all teacher educator participants, who said they learned on the job or through professional development. There is a reliance on self-taught technology skills and learning on the job.

The same issues of preparedness existed across the different subject areas within this study. Participant responses indicated issues of learning and teaching 21st-century skills when the teacher educators either lacked those skills, lacked resources or up-to-date technology, or struggled with balancing technology skills with pedagogical skills. Several teacher candidates noted feeling unprepared with technology skills, notably how to use the university's learning management system and readily available technology such as Google Docs. Specifically, these teacher candidates and a teacher educator were suggesting that, at the start of the credential program, there be some type of induction that teaches incoming candidates about the commonly used technology in the credential program. Additionally, several teacher candidates called for a specific class about technology because "technology in education should be part

of [the] credentialing curriculum" (Art teacher candidate). These teacher candidates were acknowledging their own lack of TK. Also, the teacher candidates seemed to believe it was the sole responsibility of the teacher credential program to educate these preservice teachers on educational technology. Some candidates did not take ownership of their technological learning or seek out resources to help them develop competencies related to technology.

Expectations for Technology in Physical Education

The analysis of expectations for technology use in physical education revealed three subthemes. The first was an acknowledgment of a perception that contextual limitations affected the ability to include technology. The second subtheme discussed the view that physical education was different from other subject areas, and that applied to the expectations for technology as well. However, as the third subtheme discussed, some viewed technology in physical education as essential and as able to lead to positive outcomes.

Physical Education Has Resource Constraints

The perception of teacher candidates was that there were logistics that were problematic in the implementation of technology in the physical education setting. Location, where physical education was taught (e.g., fields, blacktop, gym), was one of the primary limitations cited. Additionally, a physical education candidate pointed out that "access to digital devices is extremely limited/non-existent." A multiple-subjects teacher candidate had similar sentiments but expanded their critique by noting that physical educators hardly have access to whiteboards and that physical educators should use available technologies to "support [learning] and development if it is warranted and beneficial and not just because some external force says they need to." It is possible the "external force" is the CalTPA (a mandatory teaching performance assessment), which requires teacher candidates to submit evidence of technology use to advance the goals of the lesson.

Only When It Is Raining

"Only need technology for P.E. indoors when raining. E.g. follow along dancing steps or routines (Gonoodle)." Gonoodle is a resource teachers can use with their class for activity breaks. Students follow

along with the instructions and physical movements in the video. As evidenced by this quote from a multiple-subjects credential candidate, there is a perception of the when, how, and what of technology use in physical education. Overall, the expectations from teacher candidates and teacher educators were that technology use in physical education was different from other subjects. Only a few teacher candidate respondents (n = 5) mentioned that technology should not be used in physical education. Some participants thought that technology use in physical education would possibly be less than in other subjects "because of the hands-on and kinesthetic nature of PE activities" (Multiple-subjects teacher candidate). Another sentiment was that physical education offered an escape from technology, as this multiple-subjects teacher candidate expressed: "I myself appreciate sports like swimming because I am forced to disconnect from a screen. I think kids need that same opportunity." Similarly, a physical education teacher candidate mentioned that in physical education "students should be focused on being physically active and away from social media temptation. The use of so much technology in my opinion is the cause of lack of activity for many children and adults as is." Additionally, this teacher candidate noted that technology in physical education would be difficult for the teacher to monitor, but it could be valuable because it "would be great for some type of electronic portfolio or to log results of self-assessments and such." One physical education teacher candidate demonstrated TPACK competencies in their response by identifying specific, and appropriate, ways technology can be used in physical education to enhance learning.

One teacher educator viewed that students in physical education had less frequent experiences with technology but that the daily use of technology from the teacher was approximately the same as other content area teachers. This aligned with the view of a multiple-subjects teacher candidate: "The only expectations for technology use in P.E. should be for the teacher – for contacting parents/faculty and for student assessment." Certainly, physical education teachers can use technology for more than this, but this teacher candidate demonstrates expectations for TK by identifying that some technologies can help a physical education teacher in assessment.

Some teacher candidates and teacher educators believed the technology expectations did not differ regardless of subject area. This teacher educator noted,

> My expectations for mastery do not differ, though I do recognize that technology is used in unique ways in Physical Education (as it does for each discipline). As a result the nature and frequency of technology use may differ across disciplines, including PE.

Encouragingly, this teacher educator does not have different expectations for mastery of technology for teaching and learning but acknowledges that each subject area has its own contextual variables that impact how and what technologies are used.

In Technology We Trust

Technology can be used for a wide range of educational outcomes that are positive for both teacher and student. Some respondents believed technology could be used for positive outcomes such as assessment of health outcomes. Specifically, heart rate monitoring in "health units" was mentioned several times. A science education teacher candidate specifically identified how a physical education teacher could "use heart rate monitors to teach students target heart rate and where the zones they should be working out in in [*sic*] order to maintain a healthy lifestyle." Clearly, this teacher candidate demonstrates TPACK understanding of technology integration into physical education by selecting appropriate technology, content, and pedagogical application. Additionally, a multiple-subjects teacher educator echoed the concept of the use of monitoring technology for health outcomes but cited contextual constraints: "That being said, I don't think many PE teachers have access to technology at the individual student level." The access issue is certainly important. Access to technology might contribute to the varied expectations for technology usage by physical educators. Other respondents demonstrating TPACK identified the use of video technology such as using iPads and applications such as See-Saw "to video motor skill development and provide models" (Music teacher educator) and feedback (Multiple-subjects teacher educator). Respondents also identified accommodating students' varied needs, including those with special needs, as another use for technology. For example, a

science education teacher candidate suggested the use of Wii and the Wii balance board in adapted PE because they used it in a physical therapy setting. Technology can be used in a wide range of ways in physical education to enhance educational outcomes, but it can also be used to accommodate the needs of all students.

Technology Use in Physical Education

Participants were asked to provide examples of how they had seen technology used or used technology in physical education. Responses consisted of reports of both what participants had seen and on how technology could be used. As identified in the prior theme, there was a general sense that technology use was and should be different in physical education due to contextual variables; however, most participants identified positive examples that made progress toward learning outcomes valuable in physical education.

The most common sentiment for teacher candidates and teacher educators was technology use in physical education for a wide range of instructional and assessment purposes. For example, participants identified technology use in physical education to track physical activity (heart rate and step counts), look up workout exercises prior to starting class, use QR codes at stations for instructions, view video of performance, and monitor food intake. One physical education teacher candidate discussed the use of smartphones to assist the teacher with instruction during or even prior to class. Students being able to use their smartphones is a great option "to track steps or look up workout exercises prior to starting class. Typically, students in a P.E. class are outside, most students have smartphones, so this would be a great way to get them involved using their own technology." This teacher candidate identifies important elements of TPACK, using the technology to prime students prior to a lesson, track activity in class, and motivate students.

Video was commonly cited as an instructional and assessment tool. Specifically, slowing down video after recording students "performing an activity performing an activity and providing their peers with critiques such as dribbling mechanics or gameplay" (Science teacher candidate). All mentions of the use of video revolved around analyzing and improving performance for the individual student and/or providing feedback to a peer. Encouragingly, the concept of the use of video in the analysis of movement is common and

demonstrates TPACK competencies from teacher candidates in a variety of disciplines. The use of video was not the only way participants used technology for assessment or instructional purposes. Another physical education teacher candidate discussed the use of "plickers" as an informal assessment of learning and believed this was something they could "continue to use after student teaching as a form of student self-accountability, grouping methods (by colors), student engagement, and formative assessment." Plickers use QR codes and mobile technology. Each student has a card with a QR code and the student replies to questions by holding up their card while the teacher scans the room with the Plicker app to capture responses (Chng & Gurvitch, 2018).

Consequently, respondents also mentioned inappropriate uses of technology in physical education. Watching movies was cited several times, for example, showing sport movies on rainy days or "[watching] inspirational movies to encourage students to try their best in whichever or all sports they may practice" (English teacher candidate). While this practice likely happens, it is certainly problematic. There is no evidence to suggest that movies, even if they are sport related, influence learning outcomes in physical education.

Discussion and Conclusion

The COVID pandemic has highlighted the role of technology in education, and it is important to understand the expectations that are in place for physical educators in the face-to-face environment. The purpose of this study was to explore teacher candidate and teacher educator expectations for and implementation of technology in physical education. The results of this study demonstrate that technology is a valuable teaching tool, including in physical education. The first research question relates to nondiscipline-specific technology expectations in education. There is a positive inclination toward technology in teaching with 85% of participants (n = 59) identifying technology as valuable or essential to teaching. However, there is also a sense of being unprepared to use technology in teaching due to the lack of formal training. Training is often self-directed on the job or through professional development. Professional development for physical educators tends to focus on general pedagogies and often neglects issues specific to physical education (Armour & Makopoulou, 2012; Armour & Yelling 2004). This is likely because

teacher preparation programs struggle with including technology and the disconnect between theory and practice in teacher preparation programs (Gibbone & Mercier, 2014; Hur et al., 2018; Juniu, 2011).

The second research question focuses on expectations for technology use in physical education. Technology in physical education is contextually more difficult, not only availability of technology but also managing the technology in the active spaces in which physical educators teach. Certainly, the needs of a physical educator to protect and manage technology in an active space such as a gym, blacktop, or field are different than a more controlled space inside a classroom. Physical educators should be trained not only how to use technology but also in the management techniques unique to the demands of the subject area. Encouragingly, there is a sense from the participants that physical education teachers should be held to the same expectations for mastering technology use as other teachers.

Technology use in physical education seems counter to the goal or purpose of physical education. Physical educators have likely heard these types of arguments for integrating technology, written assignments, homework, or other instructional practices focused on advancing learning and assessment. Ensuring physical educators are making informed decisions of "why" they select certain teaching practices and how to advocate for what they do is an integral skill.

Perceptions of quality technology integration in physical education, the third research question, includes high-impact teaching practices as well as inappropriate teaching practices. Many strategies are health and fitness focused for teaching about health, and some focus on tracking physical activity with tools such as heart rate monitors and pedometers. Focusing on health and fitness outcomes for physical education is perhaps one of the more obvious connections and aligns with literature related to K–12 online physical education programs (Daum & Buschner, 2012). Additional quality teaching practices include the use of QR codes to assess tools such as plickers (Chng & Gurvitch, 2018) or on-station cards to allow for different types of instructions including video. Additionally, smartphones or other devices can be used in skill analysis and for peer feedback. On the other hand, inappropriate teaching practices include watching movies to "encourage" students and showing movies on rainy days.

Advocacy is an important skill to educate not only other teachers but also administration about why these practices do not help advance student learning toward content standards and the goals of physical education.

Limitations of this study include a relatively small sample size and the inclusion of only one university. Future studies should focus on bridging the gap between theory and practice including advocacy strategies for teachers who want to include technology in their teaching. Teacher education programs should promote reflective practices specific to technology and assist preservice teachers in applying new technologies. Teacher education programs should create a "community of practice" atmosphere for preservice teachers to take ownership of their technological development and examine beliefs, share new ideas, and develop TPACK (Hur et al., 2018). In the preparation of future educators, a heavy burden falls upon teacher education programs to include technology-focused high-impact practices. Teacher educators need to create an atmosphere in which teacher candidates are encouraged to plan for, implement, and reflect on technology-related teaching practices.

References

Armour, K. M., & Makopoulou, K. (2012). Great expectations: Teacher learning in a national professional development programme. *Teaching and Teacher Education*, 28(3), 336–346. https://doi.org/10.1016/j.tate.2011.10.006

Armour, K. M., & Yelling, M. (2004). Professional development and professional learning: Bridging the gap for experienced physical education teachers. *European Physical Education Review*, 10(1), 71–93. https://doi.org/10.1177/1356336X04040622

California Commission on Teacher Credentialing. (2016). *California Teaching Performance Expectations*. https://www.ctc.ca.gov/docs/default-source/educator-prep/standards/adopted-tpes-2016.pdf?sfvrsn=8cb2c410_0

Chng, L., & Gurvitch, R. (2018). Using plickers as an assessment tool in health and physical education settings. *Journal of Physical Education, Recreation & Dance*, *89*, 19–25, https://doi.org/10.1080/07303084.2017.1404510

Corbin, J. A. & Strauss, A. (2008). *Basics of qualitative research*, 3rd ed. Thousand Oaks, CA: Sage.

Daum, D. N., & Buschner, C. (2012). The status of high school online physical education in the United States. *Journal of Teaching in Physical Education*, *31*(1), 86–100. https://doi.org/10.1123/jtpe.31.1.86

Englund, C., Olofsson, A. D., & Price, L. (2016). Teaching with technology in higher education: Undersatnding conceptual change and development in practice. *Higher Education Research & Development. 36*, 73–87. https://doi.org/10.1080/07294360.2016.1171300

Gibbone, A., & Mercier, K. (2014). Accomplishing PETE learning standards and program accreditation through teacher candidates' technology-based service learning projects. *Journal of Physical Education*, *Recreation & Dance*, *85*, 18–22, https://doi.org/10.1080/07294360.2016.1171300

Goad, T., & Jones, E. (2017). Training online physical educators: A phenomenological case study. *Education Research International*, 2017, 12. https://doi.org/10.1155/2017/3757489

Hur, J. W., Cullen, T., & Brush, T. (2018). Teaching for application: A model for assisting pre-service teachers with technology integration. *Journal of Technology and Teacher Education*, *18*, 161–182.

Ince, M. L., Goodway, J. D., Ward, P., & Lee, M. A. (2006). The effects of professional development on technological competency and the attitudes of urban physical education teachers toward technology. *Journal of Teaching in Physical Education*, *25*, 428–440. https://doi.org/10.1123/jtpe.25.4.428

Juniu, S. (2011). Pedagogical uses of technology in physical education, *The Journal of Physical Education*, *Recreation*, *& Dance*, *82*, 41–49. https://doi.org/10.1080/07303084.2011.10598692

Juniu, S., Shonfeld, M., & Ganot, A. (2013). Technology integration in physical education teacher education programs: A comparative analysis. *Actualidades Investigativas Enducacio´n*, *13*, 218–240. https://doi.org/10.15517/aie.v13i3.12044

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, *9*, 60–70.

Krause, J. M., Franks, H., & Lynch B. (2017). Current technology trends and issues among health and physical education professionals. *The Physical Educator*, 74, 164–180. https://doi.org/10.18666/TPE-2017-V74-I1-6648

Krause, J.M., & Lynch, B. (2018). Faculty and student perspectives of and experiences with TPACK in PETE. *Curriculum Studies in Health and Physical Education*, *9*, 58–75. https://doi.org/10.1080/25742981.2018.1429146

Kretschmann, R. (2012). What do physical education teachers think about integrating technology in physical education? *European Journal of Social Sciences*, *27*, 444–448.

Kretschmann, R. (2015). Effect of physical education teachers' computer literacy on technology use in physical education. *The Physical Educator*, 72, 261–277. https://doi.org/10.18666/TPE-2015-V72-I5-4641

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*, 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Rosenberg, J. M., & Koehler, M. J. (2015). Context and technological pedagogical content knowledge (TPACK): A systematic review. Journal of Research on Technology in Education, 47(3), 186–210. https://doi.org/10.1080/15391523.2015.1052663

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examining teacher technology use. *Journal of Teacher Education*, *54*, 297–310. https://doi.org/10.1177/0022487103255985

Semiz, K., & Ince, M.L. (2012). Pre-service physical education teachers' technological pedagogical content knowledge, technology integration self-efficacy and instructional technology outcome expectations. *Australasian Journal of Educational Technology*, *28*, 1248–1265. https://doi.org/10.14742/ajet.800

SHAPE America – Society of Health and Physical Educators. (2014). *National PE standards.* Retrieved from https://www.shapeamerica.org/standards/pe

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*, 4–14. https://doi.org/10.3102/0013189X015002004

Stelitano, L., Doan, S., Woo, A., Diliberti, M., Kaufman, J.H., & Henry, D. (2020). The digital divide and COVID-19: Teachers' perceptions of inequities in students' internet access and participation in remote learning. Retrieved November 09, 2020, from https://www.rand.org/pubs/research_reports/RRA134–3.html https://doi.org/10.7249/RRA134-3

Tondeur, J., Van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, *59*(1), 134–144. https://doi.org/10.1016/j.compedu.2011.10.009

Woods, M. L., Karp, G. G., Hui, M., & Perlman, D. (2008). Physical educators' technology competencies and usage. *Physical Educator*, *65*, 82–99.

Yu, H., Kulinna, P. H., Lorenz, K. A. (2018). An integration of mobile applications into physical education programs. *Strategies*, *31*, 13–19. https://doi.org/10.1080/08924562.2018.1442275