Student Engagement & Digital Tools: Lessons Learned During the COVID-19 Pandemic

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Abstract

Abrupt changes to teaching and learning because of the COVID-19 pandemic pushed teacher educators to incorporate new technologies and pedagogies while teaching unfamiliar course designs (i.e., online, blended, flipped, hybrid, HyFlex). This study examined elementary teacher candidates' experiences with tech tools in college courses and the tools they subsequently incorporated into teaching during field placements. The results of two surveys indicate that teacher candidates broadly appreciated the use of tech tools in their university-based courses. That said, they wanted the tools to be used meaningfully by technically proficient instructors who align the tools with course learning outcomes. Teacher candidates also wanted the increased accessibility to course materials and class meetings to continue after the pandemic ends. Finally, data from this study both echoes previous research indicating that teacher candidates use the technology tools they experience during college classes and presents a correlation between the tools candidates found engaging as learners and those they employed when teaching during field placements.

Keywords: technology, teacher candidates, online

Student Engagement & Digital Tools: Lessons Learned During the COVID-19 Pandemic

Without question, the COVID-19 pandemic has touched everyone in one way or another. In teacher education, university and college instructors were pushed to teach in new contexts with unfamiliar tools. Beyond the initial shift to courses offered entirely online in spring 2020, teacher educators also faced similar circumstances the following academic year when asked to teach blended, flipped, hybrid and/or HyFlex courses[1]. In the push to rapidly redesign courses so they were accessible in multiple contexts, many instructors were left to use trial-and-error approaches when incorporating digital technology; however, as semesters and the pandemic progressed, college instructors' focus moved from simply *being* online to *engaging* students while learning online.

Numerous researchers have documented the vital role engagement plays in learning (e.g., Gilboy et al., 2015; Reeve, 2012; Skinner & Belmont, 1993). Since the 1990s, digital technologies have increasingly been linked to student engagement (as an antecedent, consequence, or both), and the two became inextricably intertwined during the COVID-19 pandemic. While this avenue of research is growing rapidly (e.g., Bond & Bedenlier, 2019; Bond et al., 2020), research regarding the engagement of *teacher candidates* with digital tools is scarce (Bedenlier et al., 2020) and underscores the lapse on the part of teacher educators to demonstrate meaningful integration and advantages of technologies (Liu, 2016; Ping et al., 2018; Tondeur et al., 2012; Tondeur et al., 2019).

As we move beyond the confines of the pandemic, it is important to stop and consider what has been gained as the bounds of our profession have been stretched. What did we learn about digital tools and teacher candidate engagement? Importantly, such newfound knowledge can help to shape pedagogical decision making in courses across the spectrum of online, blended, flipped, hybrid, HyFlex and face-to-face classrooms. But how do we know which tools are worth transferring? Additionally, when looking beyond the university experience, what happened when teacher candidates moved from college classes in digital spaces to field placements in digital spaces? Did they use the technologies

modeled by instructors? Answers to these questions can provide a foundation for understanding how digital tools can be used to engage teacher candidates as well as assist candidates in using technology when teaching. Accordingly, the following questions guided this study:

1. What digital technology did students name as being most widely used by course instructors during the pandemic?
2. Which technology tools did teacher candidates find engaging? Which technology tools did teacher candidates find least engaging?
3. Whether and how did teacher candidates' university classroom experiences with technology influence their own subsequent teaching?

Literature Review

Defining Engagement and Digital Technology

Over a decade ago scholars Trowler and Trowler (2010, p. 9) proclaimed, "The value of engagement [in education] is no longer questioned." However, researchers are still at odds in defining engagement, let alone the complex influences that shape and are shaped by engagement. Drawing from syntheses of previous work on the effects of digital technology on student engagement in higher education, the following understandings guided this study:

> Student engagement is the energy and effort that students employ within their learning community, observable via any number of behavioral, cognitive or affective indicators across a continuum. It is shaped by a range of structural and internal influences, including the complex interplay of relationships, learning activities and the learning environment. The more students are engaged and empowered within their learning community, the more likely they are to channel that energy back into their learning, leading to a range of short and long-term outcomes that can likewise further fuel engagement. (Bond et al., 2020, p. 3)

Equally important is having a shared understanding of what is meant by digital technologies. While some scholars (e.g., Amirault, 2021; Warner et al., 2018) define *educational* technology as any tool that helps solve problems (i.e., writing tablets,

utensils, and constructs such as calculus), *digital* technologies are "electronic tools, systems, devices and resources that generate, store, or process data" (State Government of Victoria, Australia 2019). In this current study, defining digital technologies (tools) in this manner placed distinctive parameters around the pedagogies being studied.

Technology and Engagement in Teacher Education

In a systematic review of 43 peer-reviewed articles documenting the effects of technology on student engagement, Bedenlier and colleagues (2020) found only two studies that specifically addressed teacher candidates (p. 317). One of the articles (Atmacasoy & Aksu, 2018), included a review of ten quantitative peer-reviewed studies detailing the impact of blended learning on academic achievement and attitudes of teacher education programs in Turkey. Findings in this review included positive links between blended learning and fostering high student engagement (Atmacasoy & Aksu, 2018). The second article, by Theelen et al. (2019), also offered a synthesis of previous findings. In this review researchers looked at 15 studies documenting the links between teacher candidates' interpersonal competence, well-being, and computer-based classroom simulations (Theelen et al., 2019). Touching on only individual facets of student engagement, the review concluded that teacher candidates generally reported feeling engaged during the computer-based classroom simulations (Theelen et al., 2019).

Technology and Engagement in Higher Education

Because of the lack of research connecting digital technology and engagement of teacher candidates, researchers have turned to the literature on tech tools and higher education as a foundation for further inquiry. In a literature review of 243 articles citing the use of technology in higher education, Bond et al. (2020) noted that text-based tools were most frequently researched (71.4%), followed by knowledge organization sharing tools (35.7%), multimodal production tools (28.6%), website creation tools and learning software (19%), assessment tools and social networking tools (14.3%) and mobile learning hardware (e.g., iPads) (9.5%).

Data collection in these studies was most frequently conducted through surveys (54.8 %), followed by ability tests (30%), observations (26.2%), document analysis (23.8 %), interviews (16.6%) and focus groups (9.5%) (Bond, et al., 2020). Bond et al. (2020) also found behavior engagement (participation, interaction, involvement, achievement, confidence, assumed responsibility, and study habits) in 90% of reviewed literature to be the most studied dimension of engagement. Further, cognitive engagement (positive interaction with peers and teachers, enjoyment and motivation, interest, enthusiasm, and sense of connectedness) was found in 67 % of the literature (Bond, et al., 2020). Affective engagement (learning from peers, self-regulation, deep learning, critical thinking, and staying on task/focusing) was the focus in 57% of the studies. Finally, 69% of the studies Bond et al (2020) examined looked at multiple types of engagement.

Teacher Candidates & Technology

A wide body of research has documented teacher candidates' and novice teachers' technology use in teaching and learning, with most research noting that, although teacher candidates claim to be fully prepared to use technology in the classroom, few student or novice teachers integrate technology tools into lesson delivery (Batane & Ngwako, 2017). Wilson (2021) encapsulates this body of work (e.g., Hew & Brush, 2018; Howard, 2019; Ritzhaupt et al., 2012) by noting that two types of barriers hinder technology integration: first-order barriers (e.g., access) and second-order barriers (e.g., attitudes, knowledge). Second-order barriers can be influenced through participation in teacher education courses (Liu et al., 2016; Reid, 2014).

Hlas and colleagues (2017) note that pre-service teachers have three opportunities to learn about technology: direct technology instruction during coursework, indirect technology instruction through instructor modeling, and invitations to interact with technology (i.e., prompting preservice teachers to use or tinker with technology). While teacher education courses devoted to technology integration have the potential to influence preservice teachers' own technology integration (Wilson, 2021), researchers (e.g., Puentedura, 2009; Williams et al., 2014; Winke & Goertler,

2008) note that these courses are most often deemed inadequate due to the continuous challenge of exposing teacher candidates to technologies that are ever-changing and utilized for varied instructional purposes.

Conceptual Framework

Four approaches theorize student engagement: the behavioral perspective, the psychological perspective, the sociocultural perspective, and a holistic perspective (Kahu, 2013). The behavioral perspective focuses on the relationship between the instructor's teaching practices and student engagement. The psychological perspective considers engagement to be "varying in intensity and responsive to the environment, suggesting that there is much that can be done to improve engagement" (Kahu, 2013, p. 763). Focusing on the affective facet of engagement, researchers (e.g., Askham, 2008; Furlong et al., 2003) in the psychological perspective highlight the emotional context of learning and the recognition of an individual's expertise (e.g., Fredricks et al., 2004). The sociocultural perspective focuses on the broader social context of teacher candidates' experiences. Scholars within the socio-cultural perspective (e.g., Dall'Alba & Barnacle, 2007) argue that higher education must "engage the whole person: what they know, how they act, and who they are" (p. 689). Finally, the holistic perspective views engagement as both a process and an outcome (Hardy & Bryson, 2010). Embracing the multidimensions of engagement, Kahu (2013) defines the holistic perspective as a "dynamic continuum with different locations—task, classroom, course, institution" (p. 764).

Conceptual Framework of Engagement, Antecedents and Consequences

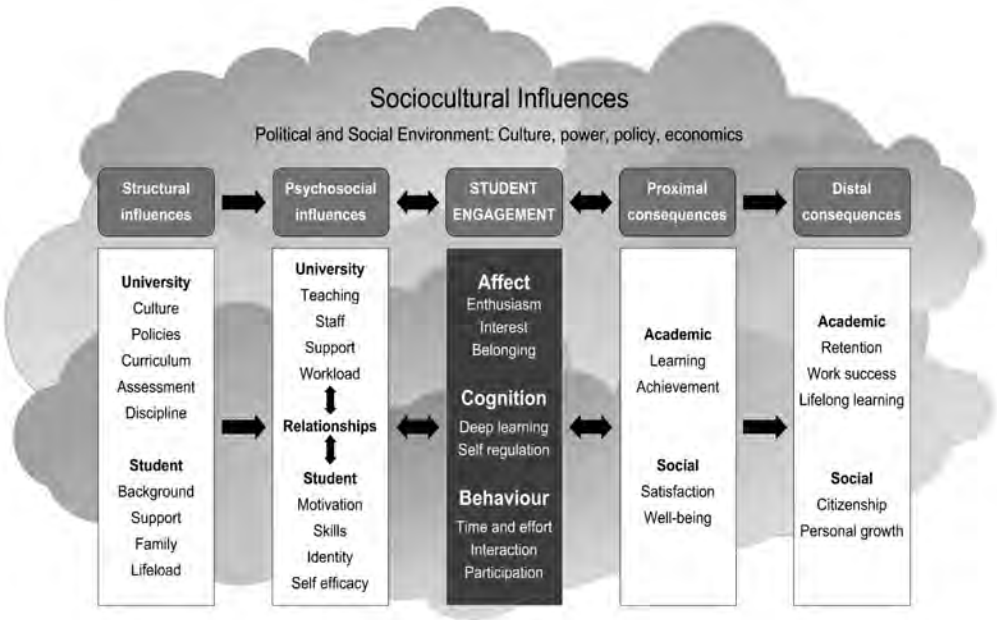
While the four approaches to student engagement outlined above offer practical insights into the complexities of the construct, a consistent definition of 'student engagement' in higher education has eluded researchers for decades. Kahu (2013) argues that engagement cannot be clearly characterized without parsing the *act* of being engaged from the antecedents and consequences *of* engagement. As shown in Figure 1, Kahu's framework places

the student at the center of engagement, influenced by six elements: sociocultural context, structural and psychosocial influences, engagement, and proximal and distal consequences. Situated within sociocultural influences, the factors of engagement affect one another cyclically through chains of reactions. This perspective of engagement accounts for individuals' lived experiences while still acknowledging contextual factors.

Kahu's (2013) model highlights some of the most immediate influences on engagement, psychosocial, which are impacted by structural influences often beyond instructors' control (such as curriculum, assessment, and campus culture), as well as teacher candidates' "life load, the sum of all the pressures a student has in their life, including university" (Kahu, 2013, p. 767).

Figure 1

Conceptual Framework of Engagement, Antecedents and Consequences



Reprinted with permission from "Framing Student Engagement in Higher Education," by E. R. Kahu, 2013, *Studies in higher education, 38*(5), 758-773 (https://doi.org/10.1080/03075079.2011.598505)

Moving from the left side of the diagram to the right, immediately influencing the student and being influenced by the student are the proximal consequences. With an understanding that "engagement breeds engagement," (p. 767) these influences are bidirectional (Kahu, 2013). Furthest left, the distal consequences illustrate the many outcomes of engagement. And finally, the entire framework is situated within the social, political, and cultural discourses of sociocultural influences. Undoubtedly the antecedents are influenced by the broad context, but as Kahu (2013) has illustrated, so too is every aspect of the student's institutional experience. The sociocultural context also brings power imbalances to the forefront and creates opportunities for discussions of engagement and pathways for change (Mann, 2001).

Methods

As someone deeply committed to using technology with teacher candidates in meaningful and engaging ways, I wanted to know how the digital tools I used in courses with teacher candidates impacted their engagement and subsequent fieldwork, but also more broadly how they experienced technology across university courses. This case study is bound by teacher candidates' experiences with technology during three semesters of the COVID-19 pandemic. Two surveys were administered to understand better the technology tools instructors used during the pandemic, which of those tools teacher candidates found engaging, and if any pedagogies involving the use of tech tools transferred to teacher candidates' lesson planning and teaching. Administered during Finals Week in the 2021 spring semester, 41 of 46 teacher candidates completed the first survey that dug into the digital tools candidates observed in courses during the pandemic, as well as which tools they found most engaging. 27 teacher candidates responded to the second survey, administered in the fall of 2021, documenting how they integrated digital tools into fieldwork lessons and teaching during the pandemic. Table 1 identifies the number of candidates solicited for each survey as compared to how many responded.

Table 1
Survey Participants by Course Format and Instrument

	Course Total	Course Format	Number of Participants Spring 2021	Number of Participants Fall 2021
Course A:	14	Hybrid	13	12
Course B:	15	Face-to-Face	12	7
Course C:	17	Face-to-Face	16	8
Total	46		41	27

Participants

Although this research is broader than a self-study, understanding teacher candidates' experiences in my own classes was at the forefront of the inquiry. In the fall of 2020, in teaching a HyFlex course with approximately one-third of candidates joining class via videoconference, I searched for tools to increase learning, to support engagement, and to enable candidates to communicate when they were unable to see or hear one another. After achieving what I perceived as success with the digital tool Pear Deck, I adopted the technology for use in all three of my courses in spring of 2021. As such, survey participants included teacher candidates from the three courses that I taught in spring 2021, but participants were asked about their experiences with digital tools across all their courses throughout the three semesters.

Courses A and B consisted solely of sophomore students who had applied for admittance into the School of Education at the end of the spring 2021 semester. All the students in Courses A and B also had an intensive five-week field placement at the end of the semester. Conversely, Course C spanned theories and methods of reading instruction from kindergarten to eighth grade without an attached field component (although most, if not all students, participated in a field placement concurrently with the course or in the following semester). Both sophomore and junior level students were enrolled in course C.

Setting

This study took place at a small, Catholic liberal arts college in the Midwest. With just over 1,900 students, the college has a 13-to-one faculty/student ratio and an average class size of 19. At the time that this study was conducted, there were roughly 300 students in the teacher education program. In fall 2020, the college made a concerted effort to provide faculty with digital tools needed to teach online, hybrid, and HyFlex courses. Zoom was selected and purchased as the videoconferencing tool for all instructors' use with online courses or when students were unable to attend classes face-to-face because of quarantine or illness. Several workshops were provided to instructors to demonstrate how to use Zoom and Zoom features such as breakout rooms. All course instructors were required to attend at least one of the several one-hour sessions. Additionally, the college's Integrated Technology Services (ITS) provided professional development around student engagement in online and hybrid/HyFlex course designs, highlighting the features of the college's Learning Management System, Moodle, as well as Google Forms, Google Slides, Flipgrid, and Socrative. But unlike the Zoom workshops, this professional development was optional, conducted over several weeks in the summer, and required outside work and readings. Consequently, just over 30 percent of instructors participated in these elective professional development sessions.

Instrument

Researchers underscore the importance of qualitative surveys in the exploration of meanings and experiences (Fink, 2003) and note that the goal of a qualitative survey is to understand the "diversity of some topic of interest within a given population" (Jansen, 2010, para. 6). Accordingly, and following Fink's (2003) recommendation regarding the validity of survey research, the questionnaire used in this study was adapted from two already established surveys (Schmidt et al., 2009; Davis, 1989) and employed both Likert-scale and open-ended questions. Survey validity was further verified through a critical review, by scholars in the field of technical, pedagogical, and content knowledge (TPACK) that informed subsequent revisions.

Data and Data Analysis

Data in this study consisted of two rounds of qualitative surveys with follow-up emails for clarification as needed. The first survey was completed anonymously; questions were designed to better understand what technology tools were used in college classes during the pandemic and candidates' experiences with the tools. The survey incorporated a pre-populated list of digital tools based on technologies supported by the college ITS, as well as those found on well-known educator blogs and websites that were easily accessible to instructors through internet searches (e.g., Chauhan, 2018; Eckert, 2020; T Editors, 2021). The second survey consisted of only one open-response question *(What technology tools did you use during field placement, how did you use them, and what was your experience?).*

Aligning with methodological standards for case study research, data analysis consisted of coding student responses into categories or themes. First, grounded, inductive codes were created from the data. During this process in vivo codes were created, whenever possible, as a means of better seeing and articulating patterns across the data (Miles et al., 2014). The codes created (in order of frequency) included: interaction, option, learning style, lecture, purpose, behavioral engagement, instructor barrier and proximal consequence. Two themes were then developed from "the most salient categories" that emerged during coding: engagement and accessibility.

Limitations and Implications for Future Research

Like all research, this study has limitations. First, the sample size of this study was small. As the number of participants in the first survey (n-41) was just under 14 percent of the teacher candidates within the teacher education program, additional research should be conducted to confirm the findings outlined below. Second, because the information was self-reported, it is difficult to know for certain which technologies teacher candidates were exposed to during the pandemic. Undertaking a study with a wider scope of participants (such as all the course instructors in the teacher education program) would have strengthened the implications and illuminated clearer connections. Finally,

the decline in study participants from the first to second survey is problematic. One assumption is that the drop-off may be a result of survey fatigue. Another is that candidates who didn't implement technology during the field placement may have felt as though they had nothing to contribute to the survey question. Consequently, future research should employ larger sample sizes and follow all participants throughout the duration of the field placement.

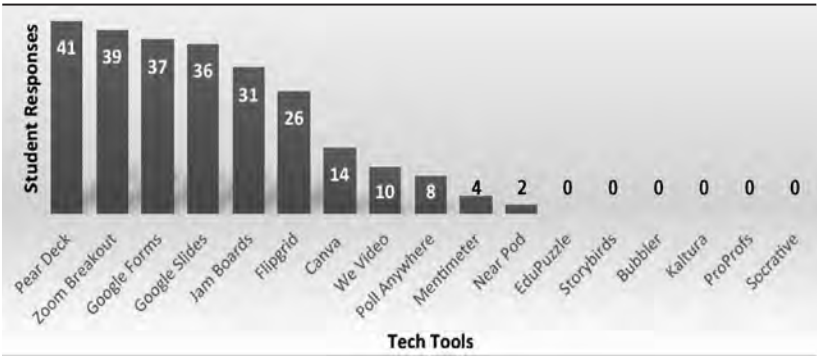
Findings

Technology Tools Used During the Pandemic

Teacher candidates were asked about the technology tools instructors used during the COVID-19 pandemic (spring 2020 through spring 2021). More specifically, teacher candidates were asked which tools they had used that had not been included in any of their courses before the pandemic. Figure 2 outlines participants' responses. 39 of the 41 teacher candidates noted that Zoom and Zoom breakout rooms were used in their courses during the pandemic. Google Forms and Google Slides were also cited by 37 and 36 teacher candidates respectively, and 31 teacher candidates used Google Jamboard. Conversely, none of the teacher candidates recalled seeing six of the pre-populated survey

Figure 2

Tech Tools Leveraged During the Pandemic



options being implemented in any of their courses during the pandemic (EduPuzzle, Storybirds, Bubbler, Kaltura, ProProfs and Socrative). The survey also listed an "other" option where teacher candidates could write in any technology tool that had been used

in a college course but was not listed on the survey; however, none of the participating teacher candidates utilized this option.

Teacher Candidates' Views of Tools to Keep and Toss

In response to an open-ended question, teacher candidates overwhelmingly (26 of 41 teacher candidates) cited Pear Deck as a tool that instructors should continue to use after the pandemic. Comments that specifically mentioned the interactivity of the tool, such as "Pear Deck has been super helpful to use as an interactive tool," and "I liked the interactive online elements like Pear Deck and other interactive activities" were found in eight of the 26 comments. The convenience of Pear Deck was also noted:

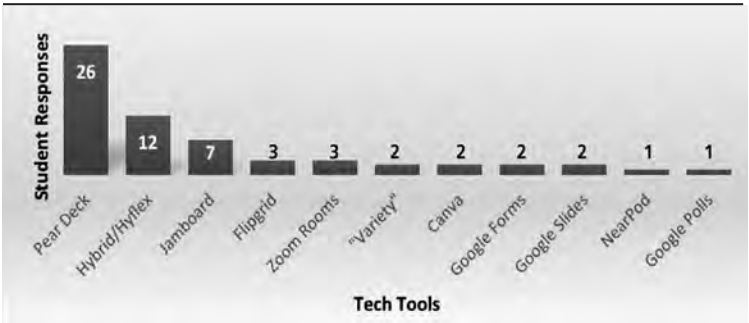
> I really liked the Pear Deck during class because it was easy to get to links and understand what the teacher was asking of us because it was right on our screen. I also thought it was really engaging and a useful tool for teachers.

These comments highlight two prevalent features that Pear Deck offers: student engagement through interactive questions and the ability to embed links into the presentation.

Teacher candidates also noted that they hoped instructors would continue to utilize hybrid and HyFlex methods of instruction where they could attend class via Zoom if ill or needing to travel (See Figure 3). Some teacher candidates also mentioned that the option to hold class via videoconference was important because "sometimes we really don't need to come to class." In addition, they appreciated "having at least one day to Zoom

Figure 3

Tools to Keep



into class." Comparatively, teacher candidates had only a small number of suggestions as to which technology tools they hoped instructors would eliminate in the fall of 2021 and/or after the pandemic. Interestingly, several of the tools teacher candidates hoped to see used in future courses were also the same tools other teacher candidates recommended be eliminated. Comments such as "I am so over Zoom breakout rooms," "Zoom lectures," and "I am so tired of learning through a computer screen" were common in this portion of the survey with 10 students specifically citing Zoom. Additionally, six teacher candidates noted that they wanted instructors to stop lecturing or be more interactive during class meetings. "LECTURING. It was so much worse on Zoom, too, because I would fully lose my ability to focus on the Zoom call" and "I feel like a lot of teachers used Google Slides this year and once Covid is done I would like to see less [of them] and be more interactive" are examples of these responses. Finally, 10 teacher candidates stated that they didn't want any technology tools to be eliminated because "they are all great options" and "implementing certain tools into face-to-face classes makes things exciting."

Engagement and Accessibility

When asked if they had any "additional comments" regarding "technology use and teaching practices during the pandemic," 17 responses were recorded. These comments were coded into two categories: engagement and accessibility.

Engagement

Teacher candidates were more appreciative and accepting of a new technology tool and pedagogy when they understood the purpose of its use and found it engaging. One student noted, "I think that the use of technology is great in the classroom as long as it increases student engagement and learning." And another stated, "[The tech tools] all had a purpose, and I think implementing certain tools into a person's classroom makes things exciting." Conversely, teacher candidates were frustrated when instructors tried to implement tools that they were not well-versed in, or when there were overall issues with technology. Responses such as, "There was a lot of time wasted with using technology,

and I do not like that," and "Certain professors need to be better informed on how to use technology" were just as prevalent.

Accessibility

While teacher candidates explicitly stated that they do not want to attend lectures via videoconference, they appreciated the accessibility Zoom offered to them during Covid. Noting the inequities in access to education, even at private liberal arts colleges, one student wrote:

> I think that the situation we are in has forced all schools to make online learning more obtainable for everyone. I hope to see this continue in the future as an option for students who need/prefer this kind of education.

Further, as noted above and highlighted in Figure 2, teacher candidates found many components of courses to be more accessible during the pandemic. In addition to the ability to Zoom into class if they were ill or had other extenuating circumstances that prohibited them from attending class face-to-face, access to course materials was also a prominent category of student comments. One student responded:

> I appreciated having easier access to slides and being able to look back. I also liked when professors recorded their online classes so if I were to not pay attention well, I could look back and make sure I had gained the information.

All in all, the increased accessibility during the pandemic was the most prevalent theme in student responses throughout the survey.

Transfer to Teaching

27 teacher candidates participated in an open response survey asking whether and how they used technology while in their field placement. Two of the 27 candidates' responses indicated that they used minimal technology while teaching, mainly because their cooperating teachers did not use technology, or they did not know how they could have integrated technology to improve the lesson. For example, when teaching a high school biology lesson, one candidate employed a jigsaw and asked each small group of students to research one function of the digestive system. As the groups presented their work, the candidate used a document

camera to add the corresponding organ to a body outline. In her response to the survey, the candidate stated:

> It went well. Nothing went wrong and there was nothing I felt needed to be changed, so I would do it again. However, I think it could be even better if I used different technology. I am just not sure exactly what that would be.

Importantly, this teacher candidate neglected to mention that the groups incorporated short videos and diagrams from the internet in their presentations. Similarly, another candidate noted that she used minimal technology during her field placement, most of which were pre-created quiz games using the online software Booklet. While the candidate was able to implement the games with the students, she was not afforded the opportunity to create any original games (inputting the questions herself or selecting the type of game students would play).

Sixteen candidates noted that they only employed the technology that their cooperating teacher used. Most prominently, 12 of the 16 reported using a SmartBoard, and four teacher candidates noted the use of Zoom or Google Classroom. Seven of these candidates commented that they would have liked to use other technologies, but they didn't "think it would work with [the] students" or they "didn't want to do anything [the] cooperating teacher didn't do." Teacher candidates who were concerned the tech tools wouldn't "work" with their students most often noted they were in primary grade classrooms.

Conversely, nine teacher candidates reported using technology in their teaching that they experienced in college courses during the pandemic. One candidate noted how she used Google Jam Board to record her kindergarteners' ideas and felt as though the lesson went well because "it was something different that my teacher hadn't used." Finally, the remaining eight candidates identified using Pear Deck in their field placements. All eight candidates noted that Pear Deck had not been used previously by their cooperating teacher and that they had not experienced Pear Deck before the pandemic. One candidate explained:

> I used Pear Deck in one of my lessons. The students loved it. It got them engaged in the lesson because many of the lessons my mentor created did not use technology. The

> Pear Deck was used to have students answer discussion questions while reading a short story. This allowed the class to have an in-person discussion for some of the questions and others answered on the Pear Deck to compare students' answers. The Pear Deck was also very helpful for the exit ticket to check on students' understanding of the lesson. I will be using it again. I think the students loved this platform and felt engaged.

Another candidate who used Pear Deck noted, "I liked being able to use the 'write a response' option to ask students to check their knowledge or reflect on what we have gone over…I will definitely use Pear Deck again."

Discussion and Implications

Teacher Candidates' Views of Tools to Keep and Toss

Overall, the findings regarding the technology tools used during the pandemic are not surprising, especially considering the campus-wide rollout of Zoom at the outset of the fall 2020 semester. This data also coincides with national trends, as 77% of 855 teachers surveyed reported that their use of videoconferencing tools grew "A LOT" stronger during the pandemic (Klein, 2021). The findings of my study suggest that, although only a small percentage of the faculty participated in the summer course, instructors (1) employed the tools highlighted in the course, (2) taught other instructors how to use the tools, and/or (3) most faculty already knew how to use the highlighted tools. Additionally, data indicates that instructors did not seek out new or additional technologies beyond what had been traditionally used/suggested at the college. This, too, is not surprising when the overwhelming number of technology tools available to instructors are considered. This data does suggest that course instructors tended to use only the tools that were supported (through purchase, professional development, or both) by the college.

Engagement and Accessibility

Study findings show that teacher candidates appreciated the technology tools employed by instructors during the pandemic and hope to continue encountering these tools, when integrated

meaningfully, in their future coursework. Of particular interest is the stark contrast between what students appreciated (variety, interaction, Pear Deck) and what they did not want to see continue (lecturing). In outlining the andragogical model of learning, Knowles (1984) argued, "For the most part, adults do not learn for the sake of learning; they learn in order to be able to perform a task, solve a problem or live in a more satisfying way" (p. 12). Knowles' (1984) theory coincides with findings in this study in that teacher candidates acknowledged and appreciated that they were not always "ready" (Knowles, 1984, p. 8, 12) to learn material at the time it was presented. Teacher candidates wanted access to information so that they could retrieve it when needed (e.g., when they are asked to perform a task using the information). Scholars of student engagement have also documented similar findings. Llorens et al. (2007), for example, noted that when higher education students believe that they have access to the resources they need to be successful, their self-efficacy also grows, leading to increased engagement.

Furthermore, candidates unequivocally appreciated the ability to attend class via videoconferencing, but only on *their* terms. While preferring to meet face-to-face, candidates recognized that not every class meeting needs to be in person. Candidates also wanted the option to attend classes via videoconference when unable to physically attend a face-to-face meeting. In sum, these findings carve out distinctive recommendations for course instructors. First, instructors should examine their pedagogies and determine where they fall on the continuum between teacher-centered and student-centered course design. While not every class meeting needs to be completely student-centered, instructors must give up their time on the stage and allow the cognitive load to shift to students. One approach to achieving this end is to ensure that courses are designed to require teacher candidates to use the information presented to them through passive learning. Moreover, engagement strategies, specifically technology tools, must be integrated into courses *meaningfully*. Thus, tools need to be carefully selected to meet the course objectives—which also need to be clearly communicated to candidates. Selection of digital tools should be done to meet multiple influences of student

engagement (Kahu, 2013) and not simply as a quick gimmick to momentarily gain attention. Additionally, and while seemingly unrelated, instructors must organize class materials so that they are continually accessible throughout the duration of the course. Finally, instructors may want to consider allowing students to attend class via videoconference when they are unable to physically attend class.

Transfer to Teaching

Nine of the 27 teacher candidates' survey responses indicated that they only employed technology in their own lessons that they had experienced through indirect instruction during coursework (Hlas et al., 2017). This finding is anticipated, as the teacher education program that the candidates are enrolled in does not offer a specific course for direct instruction of digital tools. Interestingly though, one student noted that she used a new digital tool introduced to her by her cooperating teacher; the third way in which Hlas and colleagues (2017) suggest candidates can learn the use of digital tools. However, this candidate did not experience the "tinkering" aspect of familiarizing oneself with digital tools because of the reliance on stock material. Although the tool was introduced to the candidate, giving her familiarity with how to implement it with children and many capacities and functions of the program, additional time would need to be spent teaching herself other components to be proficient in its application.

When collectively analyzing all 27 teacher candidates' responses in relation to Kahu's (2013) framework, it is easy to deduce that, even without direct instruction in the multifaceted perspectives of student engagement, candidates seemingly understood many of the complexities associated with the construct. This is evident in the multiple influences that candidates noted when responding to the survey question. Although behavioral engagement was noted in 20 surveys, candidates also touched upon psychosocial influences of relationships and individual student motivation, as well as the proximal consequences of learning and achievement (Kahu, 2013). While further research is needed in this area, this finding leaves room to consider if and how teacher candidates' instructional design would expand if they had

a deeper understanding of the influences on student engagement.

Moreover, when taken collectively, these findings present two implications. First, as researchers have documented, teacher candidates are most likely to integrate technology into their teaching if they have experienced the tools themselves (Blackfish et al., 2019). None of the 27 participants of the second survey sought out an unfamiliar tech tool to use in their field placement. This is especially compelling when considering the response from the teacher candidate who taught the biology lesson on digestion. The candidate implied within her response that she wanted to integrate technology but didn't know how or where to find a tool that would fit her needs. Moreover, since nine candidates implemented tools that they experienced in their college courses, this research echoes previous work that calls for the use of digital tools, widely, in teacher education classrooms. A second implication from this research is the suggestion that teacher candidates are more likely to integrate tech tools into their teaching if they found their experience with the tool to be engaging. While this suggestion needs further exploration, as it was beyond the scope of this study, the correlation between the tools candidates reported as being engaging, and the tools used by candidates in their own instruction is difficult to ignore.

Conclusion

The purpose of this study was to understand better which digital tools college instructors employed during the pandemic, teacher candidates' responses to the use of the tools, and whether teacher candidates integrated the tools into their instructional plans. Data indicates that Zoom and Zoom breakout rooms were the most widespread tech tool employed by instructors, followed by Google Forms, Google Slides, Google Jam Boards and Flipgrid, respectively. Notably, these tools were all well supported by the college's ITS department through purchase, workshops, and support. On the other hand, Pear Deck was cited by candidates as the tool they would most like to see instructors continue to use after the pandemic, as well as the flexibility in course design (hybrid models or the option to attend via videoconference), and easy access to course material. Conversely, teacher

candidates overwhelmingly wanted to see instructors rely less on lecture styles of teaching (especially over videoconferencing) and the option to attend class face-to-face. Moreover, study data echoes previous research with findings that indicate teacher candidates employ only those digital tools that they experienced in college courses themselves or are introduced to by their cooperating teacher. And finally, while further research is needed, study findings hint that teacher candidates are more likely to integrate technology tools into their instruction if they found the tools to be engaging themselves.

In sum, the findings from this study, coupled with the bodies of work in related fields and understandings of student engagement models, provide college and university instructors broadly, and teacher educators specifically, with several takeaways and next steps regarding instruction. First, this study suggests that if colleges and universities want instructors to use specific technology tools, they must provide systematic professional development and support. Teacher candidates valued the integration of digital tools if they found the tools to be easy to use, engaging, and beneficial to the objectives of the course. Instructors, therefore, need to be strategic and explicit about their use of digital tools, as well as proficient in the use of them with candidates. Instructors should also continue to be flexible in course design by providing options for videoconferencing and easy access to course materials. Finally, instructors in teacher education must demonstrate the meaningful integration of digital tools, as these are the technologies candidates are most likely to use in their lesson design.

End Notes

[1]Blended courses involve face-to-face meetings along with online materials and activities. In flipped courses, instructors support learning basic knowledge through pre-recorded videos that students view prior to attending class then expand upon that knowledge during the course meeting. Hybrid courses are like blended courses, but the online meetings are intended to replace some of the face-to-face meetings. Finally, HyFlex courses are those that provide students with the option to attend class face-to-face or online. *(page 2)*

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