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Can You Picture This? Preservice Teachers' Drawings and Pedagogical Beliefs About Teaching With Technology

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This study was conducted in the context of an introductory three-credit course in a master of arts and teacher certification program offered at a large land grant public university in the U.S. Mid-Atlantic region. Researchers examined preservice teacher drawings of teaching with technology and their reflection on their drawings to identify their pedagogical beliefs. Unlike prior research that shows classroom technology is mainly used by the teacher, most of the drawings in this study depicted students using handheld technology, an indication of more student-centered teaching. However, analysis of preservice teacher descriptions of the drawings shows that change in preservice teacher depictions of teaching with technology is likely the result of more ubiquitous access to handheld technology in K-12 schools rather than a change in pedagogical beliefs. The researchers suggest that teacher educators should work to develop preservice teachers' technological pedagogical content knowledge to facilitate technology integration to support constructivist teaching practices.

Prior to the coronavirus pandemic, public-school teachers' use of technology could be classified as passive, involving students mostly watching videos and reading websites (60%) rather than engaging in active learning experiences that support 21st-century skills (Schuyler & Buckley 2018). To understand the problem of continued low-level technology use for learning in schools, researchers must recognize that teacher technology integration behavior is complex and involves several distinct internal and external variables (Ertmer & Ottenbreit-Leftwich, 2010). Internal barriers to teacher technology integration practices include personal beliefs about the instructional value of technology for learning (Anderson & Maninger, 2007) and self-efficacy regarding the technical skills needed to use technology effectively for classroom instruction (Valtonen et al., 2015). External variables that influence teacher decisions to use technology include organizational and technical infrastructure and the technology integration practices preservice teachers observe during their teacher education programs and field experience (Polly et al., 2010).

Some researchers suggest, however, that preservice teachers observe more technology integration practices in their teacher preparation programs than ever before (Tondeuret al., 2017). Additionally, preservice teachers tend to have positive internal factors related to their abilities to use technology for classroom instruction (Bate, 2010; Starkey, 2010). To gain a better understanding of preservice teachers' pedagogical beliefs and their influence on teaching practices, we examined preservice teacher drawings of what teaching with technology looks like and their written reflections on the drawings.

Purpose of the Study

Preservice teachers tend to hold vivid images of teaching from their own schooling experiences, and these images influence the practices they undertake as teachers (Calderhead & Robson, 1991). For example, Thomas and Pederson (2003) found that preservice teacher drawings of themselves as teachers allowed researchers to determine that the depictions of teaching practices were constructed mostly from their own learning experiences in elementary school. Additionally, these researchers determined that preservice teachers' pedagogical beliefs were correlated to their mental models, concluding that picture drawing is a useful data source for identifying these beliefs.

Since those studies were conducted, at least 80% of secondary students now have their own devices for learning (Lenhart, 2012). An increasing number of schools have purchased tablets, Chromebooks, and mobile media players to augment classroom instruction (Herold, 2016). Increased access to technology such as mobile computing devices means that preservice teachers have access to and can potentially integrate technology for learning in their K-12 schooling experience more than ever was possible before such technological ubiquity (Bedesem & Arner, 2019).

Because of the increase in access to technology in schools, we examined preservice teachers' drawings of teaching with technology to investigate their pedagogical beliefs in the context of the prevalence of classroom technology use, which includes more ubiquitous access to handheld or

one-to-one devices. Our research questions for exploring these beliefs were as follows:

1. How do preservice teachers represent teaching with technologies they assume belong in a classroom?
2. What inferences can we make about preservice teachers' pedagogical beliefs concerning technology integration based on their descriptions and reflections on their drawing of teaching with technology?

Literature Review

Prior research shows that access to technology and technical competence is insufficient to ensure that teachers integrate technology meaningfully into their classroom teaching practices (Ertmer et al., 1999; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012). Thomas and Pedersen (2003) suggested that "unexplored entering beliefs may be responsible for the perpetuation of antiquated and ineffectual teaching practices" (p. 328).

Teachers tend to use technology in ways that align with their own pedagogical beliefs (Angeli & Valanides, 2009; Koehler & Mishra, 2009; Tondeur et al., 2017). Attitudes and beliefs are likely more robust determinants for technology integration than access to technology (Farjon et al., 2019).

In this paper, beliefs are defined as "suppositions, commitments, and ideologies" with a vital affective and evaluative component (Calderhead, 1996; Nespor, 1987). Pedagogical beliefs refer specifically to the understandings, premises, or propositions about teaching and learning that individual teachers hold to be true (Denessen, 2000), including the value teachers place on goals and choices (Anderson & Maninger, 2007), such as whether technology can help them achieve instructional goals a teacher perceives to be most important (Watson, 2007).

Pedagogical Beliefs and Models of Instruction

It is well established that preservice teachers tend to enter teacher education programs with beliefs about teaching and learning constructed from their own experiences as K–12 students, which for the most part, reflect teacher-centered practices (Gill & Hoffman, 2009; Tatar, 2015; Windschitl & Sahl, 2002). Zhao (2012) argued that the high-stakes testing culture has contributed to keeping many public schools' pedagogical practices mostly teacher centered. Teachers with teacher-centered beliefs facilitate learning using instructional models stemming from stimulus-response theory. Student input is acknowledged but not expected, and the curriculum focuses on a narrow set of learning outcomes (Brooks & Brooks, 1993).

Conversely, teachers with student-centered beliefs draw on constructivist theory to create classrooms that encourage student inquiry and exploration (Jonassen, 1995). According to Ertmer et al. (2015), the constructivist approach often leads to technology integration practices

that support 21st-century skills development, such as problem-solving, critical thinking, and collaborative learning activities. Research further suggests that these two categories are not necessarily mutually exclusive and support the idea that teachers can hold varying degrees of both kinds of beliefs (Ertmer & Ottenbreit-Leftwich, 2010; Fives & Gill, 2015; Kerlinger & Kaya, 1959; Tondeur, et al. 2008). Additionally, Nespor (1987) cautioned that belief systems are often idiosyncratic because they are developed through personal experience and are often resistant to new practices and ways of addressing challenges.

A consensus can be found in the literature regarding the relationship between pedagogical beliefs and the ways in which teachers design and implement instruction (Ertmer et al., 2012). Therefore, teacher educators should help preservice teachers examine their pedagogical beliefs and support them as they develop student-centered technology integration practices.

Pedagogical Beliefs and Picture Drawings

Drawings can be a powerful way for teacher educators to identify preservice teachers' pedagogical beliefs. For example, Thomas et al. (2001) discovered that preservice teachers' drawings of a science teacher provided insight into their mental models of teaching. They also determined that drawings generated by preservice teachers can easily be classified as either student centered or teacher centered. Weber and Mitchell (1996) concluded that the images in preservice teachers' drawings of teaching were overwhelmingly traditional and stereotypical, mostly depicting women standing authoritatively in front of the classrooms with desks arranged neatly in rows.

According to these researchers, these images indicate deep-seated beliefs that contradicted their expressed desires to become the more progressive types of educators promoted in their teacher education program. Similarly, Rule and Harrell (2006) found that preservice teachers' drawings of themselves learning mathematics were overwhelmingly negative at the beginning of their mathematics methods course. However, in postcourse drawings, preservice teachers depicted more positive images of themselves learning mathematics, which correlated with their expressed desires to enact more student-centered teaching practices in their future classrooms. These findings suggest that picture drawing is a useful data collection method for examining relationships between preservice teacher pedagogical beliefs and potential future teaching practices.

Although drawings can provide rich qualitative data when collected and analyzed, only two studies have used drawings to uncover preservice teacher beliefs about teaching with technology. Both studies point to the affordances of drawings to elicit preservice teacher beliefs. For example, Keren-Kolb and Fishman (2006) used preservice teacher drawings of teaching with technology and interviews to identify their orientation toward future technology integration practices.

Likewise, Funkhouser and Mouza (2013) discovered that preservice teachers exclusively depicted teacher-centered uses of technology at the beginning of their teacher education. Analysis of their reflections on their drawings showed that practically all preservice teachers' beliefs about teaching with technology were teacher centered. However, at the end of the course, preservice teacher drawings illustrated a mix of both teacher-centered and student-centered practices, in which students were both receivers of content and active users of technology. This result suggests that preservice teachers' pedagogical beliefs were beginning to shift to become more student-centered.

These studies' findings point to the power of picture drawings when paired with preservice teacher descriptions of their drawings to provide insight into preservice teacher beliefs about teaching with technology. Technology use is more prevalent in K-12 classrooms than at any time in history (Herold, 2016). Preservice teachers have more access to technology in their lives outside of school than ever before (Lenhart, 2012). Therefore, the time was right to again examine preservice teachers' mental images and beliefs about teaching with technology.

Research Methods

Haney et al. (2004) suggested that picture drawings are a productive qualitative method to document a change in educational spaces. To identify patterns in technology use in our set of drawings, we used trait coding. The purpose of trait coding is to document whether specific features (traits) are present in a drawing.

For example, Russell (1999) asked high school students to draw a picture of their writing process and used trait coding to identify when and how they used computers during the writing process. These researchers identified the following traits to code the drawings 0 - Blank; 1 -Computer not visible; 2 - Computer visible during final draft; 3 - Computer visible during editing; 4 - Computer prominent throughout the writing process. According to a study on the reliability of different methods for analyzing picture drawings, trait coding yielded relatively high interrater reliability levels (Haney et al., 2004).

Researchers widely agree that drawings are less likely to be misinterpreted when the analysis incorporates both visual and written data (Guillemin, 2004; Kearney & Hyle, 2003; Theron et al., 2011). Similarly, Freeman and Mathison (2009) suggested that pairing pictures with participant written reflections and interpretations is critical "when seeking to understand any material produced by participants" (p.160). Therefore, participants in this study were asked both to reflect on their drawings and describe in writing what was happening in their drawings.

Context of the Study and Course Description

We conducted this study in the context of an introductory three-credit course in a master of arts and teacher certification program offered at a large land grant public university in the Mid-Atlantic region in the U.S. The course is required and, as the initial class in the program, introduces

preservice teachers to the principles of curriculum and instruction. Preservice teachers met in a computer lab once a week for a 3-hour session for 16 weeks. Course design provided the preservice students with a 50-hour field placement in which they planned and delivered one lesson.

Participants

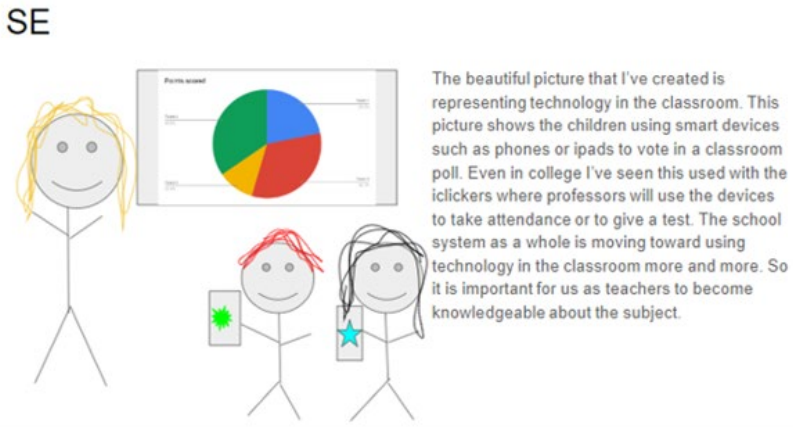
Twenty-two students enrolled in the course. Of those, 68% (N = 15) chose to participate in the study. Six participants were seeking elementary certification, and nine participants were seeking secondary education certification in the following content areas: English (two), Social Studies (two) Science (three) World Language (one) Mathematics (one). Fourteen participants identified as female, and one identified as male. Participants' ages were between 22 and 36 at the time of the study.

Data Sources and Data Collection Methods

One source of data for this study consisted of preservice teacher drawings. On the first day of class we prompted participants to draw a picture of what teaching with technology looks like. They used the drawing tools in Google Slides. The second source of data was student written reflections on their drawings. Our prompts for the reflections were developed by Funkhouser and Mouza (2013):

- Where is the teacher in your drawing? What is she/he doing?
- Are there students shown in your drawing? Where are they? What are they doing?
- What educational technology is shown in your drawing? Is it intended for teacher use, student use, or both?

Figure 1 Example of a Picture Drawing



Participants had 30 minutes to create the drawings and respond to the prompts. Researchers assured participants that we would not assess the pictures for artistic merit. They were encouraged to label items they could

not draw. The drawings and written reflections helped to elicit images of their experiences with technology in classrooms and consider their pedagogical beliefs about teaching with technology.

Data Analysis

Coding and Analyzing Drawings

To conduct trait coding, we utilized a modified version of the Draw a Science Teacher Test checklist (DASTT-C) developed by Thomas et al. (2001) to analyze the use of technology in the drawings (see Appendix). The DASTT-C development began with a listing of teacher-centered and student-centered attributes of an elementary science teacher. The DASTT-C was designed to capture teacher-centered teaching practices; therefore, the higher the score, the more teacher-centered teaching practices were depicted in the drawing.

Using the DASTT-C, researchers worked independently to examine the drawings, noting the traits that appeared in our drawings that differed from those on the DASTT-C. For example, we noticed that most pictures in our data set showed a teacher standing next to and pointing to an interactive whiteboard (IWB) with a student standing next to the IWB. We, therefore, modified the description for the DASTT-C checklist item Teacher Action: Lecturing/Giving Directions (teacher talking) to Teacher Action: Using a whiteboard to present information (No students using a whiteboard or other types of technology). This alteration documented the portrayal of teachers in charge of learning but with students using technology alongside their teacher instead of sitting passively at desks receiving information.

Additionally, we removed traits that were specific to science classrooms, such as Laboratory Organization and Symbols of Scientific Knowledge" (i.e., science equipment, lab instruments, and wall charts). Our revised checklist (see Appendix) was renamed Draw a Teacher Teaching With Technology Checklist (DATTT-C), and it contained 10 rather than 13 traits.

To ensure a high level of quality and rigor in our interpretations (Anfara, et al., 2002; Freeman & Mathison, 2009), we examined the preservice teacher's picture drawings alongside reflections of their picture drawings as a form of triangulation. Additionally, only low inference features of the drawings were considered and analyzed (Freeman & Mathison, 2009). Price (2014) defined low inference features as "those elements that are exhibited in the drawings themselves" (p. 206).

Using the revised Draw a Teacher Teaching With Technology Checklist (DATTT-C), we independently coded and scored the images. Drawings that received scores of 1-3 were considered student-centered. Drawings that received scores of (7 to 10) were considered teacher-centered, and drawings that received scores of 4-6 were labeled as mixed. The first reliability check resulted in a 37% disagreement. A second reliability check was conducted after discussing the discrepancies and ended with 93% agreement in codes and scores.

Identifying Preservice Teacher Pedagogical Beliefs

Because beliefs cannot be directly observed or measured, they must be inferred from what people say or indicate they intend to do (Pajares, 1992). Accordingly, we looked for evaluative and affective statements, such as "…the use of smartboards to make lectures more interesting" and "with the new technologies and ideas in today's society simply providing direct instruction or working for the test scores is not providing a sufficient education."

We then read and reread the written reflections. Although preservice teachers made several belief statements in each of the reflections, we only coded belief statements related directly to the use of technology for teaching and learning. Our coding scheme contained three different types of belief statements:

1. Statements that explicitly indicated that technology use encouraged student inquiry and exploration were classified as student-centered.
2. Statements describing technology as supporting traditional teaching practices, like presenting information, answering closed questions, and drill-and-practice activities, were classified as teacher-centered.
3. Belief statements that were anchored in personal experiences and emotional states of students were classified as idiosyncratic.

Findings

Here, we report on the two research questions that guided this study. We begin by identifying the kinds of teaching practices preservice teachers depicted in their drawings of what teaching with technology looks like. Then we discuss the preservice teacher reflections on their drawings about teaching with technology.

Results from the DATTT-C suggested that the kinds of teaching with technology practices preservice teachers depicted in their picture drawings shifted from images of teachers in control of technology (Funkhouser & Mouza, 2013) to images that included technology in the hands of students. For example, while all the drawings (100%) illustrated an IWB on the wall at the front of the room and most drawings depicted teachers standing next to an IWB (93%) and pointing to an IWB (66%), only 33% of drawings contained a teacher desk at the front of the room with desks arranged in rows and students seated at desks. We interpreted this decentering of the teacher as evidence of a move toward student-centered instruction.

Surprisingly, more than half the drawings (67%) illustrated technology in the hands of students. However, as described in the written reflections, the technology integration activities suggested that technology was mostly used to support typical teacher-centered activities, such as using handheld devices or laptops for drill and practice, game-like activities, or writing on the IWB to solve math problems or complete fill-in-the-blank type activities. Total scores on the DATTT-C fell into three categories. Ten drawings received scores between 4 and 6 (see Table 1) and, therefore,

were classified as mixed because they were neither strictly student-centered or teacher-centered.

Table 1 DATTT-C Scoring Results by Category

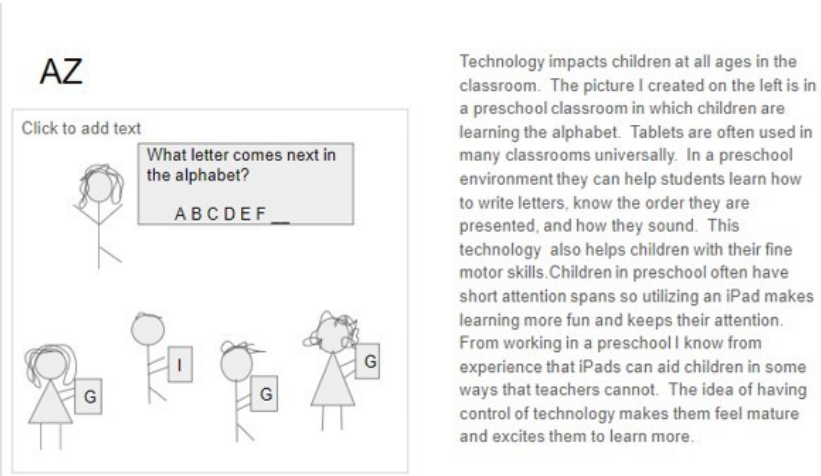
Score	Frequency	Teaching Practices
1-3	2 (12%)	Student-centered
4-6	10 (69%)	Mixed
7-10	3 (19%)	Teacher-centered

Three participants (19%) drew pictures that were classified as teacher-centered, and only two participants (12%) drew pictures classified as student-centered (see Table 1). None of the drawings received a score above 8, meaning that the drawings lacked all of the traits associated with teacher-centered instruction. In the next three sections are detailed description of each teaching type of technology drawing and the participants' associated pedagogical beliefs. The drawings identified as mixed were most prevalent, followed by the teacher-centered drawings and student-centered drawings.

Mixed Teaching With Technology Drawings

Most drawings (n = 10) received scores between 4 and 6 and were classified as illustrating a mixed approach on the student- and teacher-centered instruction continuum. These drawings contained traits on the checklist that included teachers standing next to an IWB indicating a more teacher-centered approach, and students were portrayed using technology alongside the teacher, suggesting a more student-centered approach (see Figure 2).

Figure 2 Example of a Mixed Drawing



Drawings in this category contained the checklist trait using technology to respond to the teacher (drill and practice or answering closed questions and following directions), teaching practices associated with teacher-centered instruction. However, the drawings did not contain the checklist trait desks arranged in rows or a teacher's desk placed in front of the room(see Table 2), typical of a traditional classroom environment associated with teacher-centered instruction. Instead, these pictures portrayed students as standing, which we interpreted as preservice teachers attempting to emphasize engagement and motivation as students used technology.

Table 2 DATTT-C Results by Drawing Traits (N = 15)

Drawing Traits	Number/ Percentage
Teacher Activity	
Pointing to an IWB	10/ 6%
Using IWB to present information (Students not using technology)	4/27%
Teacher Position	
Standing next to IWB	14/93%
Erect Posture not sitting or bending down	15/100%
Student Activity	
Watching or listening NOT using technology	14/27%
Using technology to respond to the teacher (drill and practice or answering, closed questions, following directions)	10/67%
Student Position	
Seated or so suggested by classroom furniture	5/33%
Environment	
Desks arranged in rows	5/33%
Teacher desk located at the front of the room	3/20%

The pedagogical beliefs about teaching with technology in written reflections confirmed our interpretation of the teaching practices portrayed in the images. Our analysis shows that belief statements made by participants who created mixed drawings tended to be as described by Nespor (1987) as idiosyncratic, in that they were based on personal

experiences and focused on the emotional states of students. For example, a preservice teacher wrote, "I know from experience that iPads can aid children in some ways the teachers cannot. … The idea of having control of technology makes them feel mature and excites them" (see Table 3). This statement suggests that this belief was based on a personal experience such as an observation that technology seemed to motivate students to learn.

Table 3 Pedagogical Beliefs by Participant and Type of Drawing

Participants	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DATTT-C Score	2	3	5	5	5	5	5	5	6	6	6	6	7	7	8
Deliver Content / Present Information (T.C.)										X		X			X
Supports Experimentation/ Collaboration (S.C.)	X	X						X							
Motivate/Engage (ID)			X	X	X		X				X		X	X	
Hinders Learning (ID)				X								X			
Inevitable/ Essential (ID)						X			X						

Two other preservice teachers who created drawings classified as mixed expressed beliefs that were idiosyncratic and could not be classified as either student- or teacher-centered but indicated they were conflicted about teaching with technology. For example, one participant explained, "I think that technology is an exciting addition to the classroom as long as there are other options for students who don't necessarily learn that way. I think that in all classrooms, there needs to be a necessary balance."

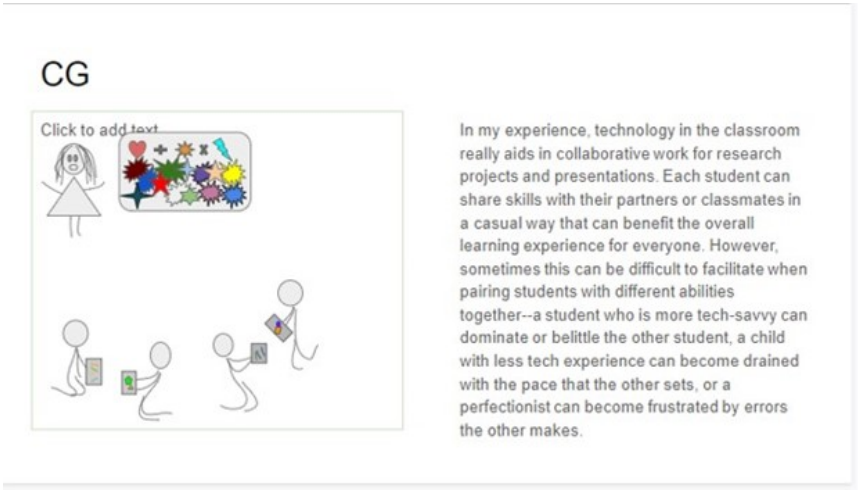
Only two preservice teachers who created mixed drawings expressed beliefs that could be considered teacher-centered. For example, one participant who scored a 6 on the DATTT-C explained, "I like that it can be used as a projector but also essentially like an interactive digital chalkboard."

Another participant who also scored a 6 cautioned that "…although clickers are a great way to test students' understanding of concepts, there are some drawbacks to their use that might compromise student learning." These preservice teachers focused on the benefits of technology for displaying information and using technology to "test" students; practices associated with teacher-centered instruction.

Student-Centered Teaching With Technology Drawings

Only two drawings received scores between 1 and 3, indicating that their drawings contained only a few traits on the DATTT-C and, thereby, were classified as student-centered. Although these drawings, like the mixed drawings, depicted teachers standing next to and pointing to information on an IWB, participants described and portrayed students in these drawings as engaged in some type of collaborative or group work (see Figure 3).

Figure 3 Example of a Student-Centered Drawing



For example, one preservice teacher explained in a reflection statement, "In my experience, technology in the classroom really aids in collaborative work for research and projects," practices associated with student-centered pedagogy (see Figure 3).

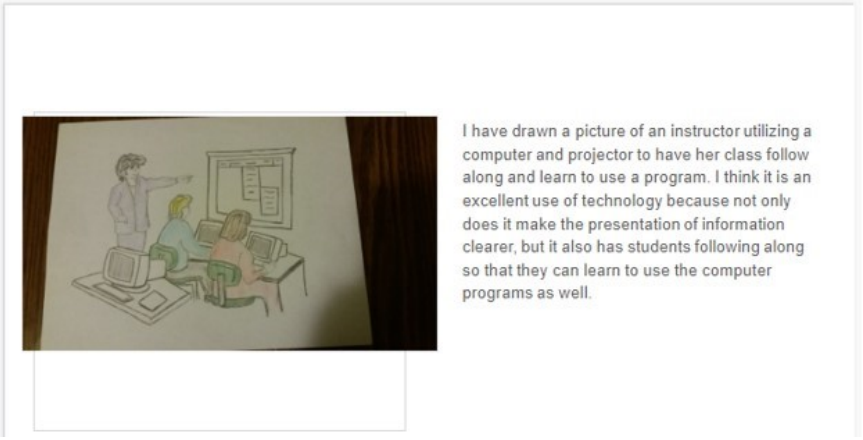
Interestingly, both participants who created drawings classified as student-centered suggested technology was used to support student collaboration. For example, one participant with a score of 3 wrote, "Each student can share skills with their partner or classmates in a casual way that can benefit the overall learning experience."

Teacher-Centered Teaching With Technology Drawings

Three preservice teachers created drawings that were classified as teacher-centered (see Figure 4). These drawings received scores between 7 and 10 on the DATTT-C because they explicitly portrayed teachers using technology to present information to students or engaged in highly

structured teacher-led activities. One participant, whose drawing scored an 8 on the DATTT-C showed a teacher in front of the classroom pointing to information on a screen.

Figure 4 Example of a Teacher-Centered Drawing



In the reflection, the participant explained, "I think it is an excellent use of technology because not only does it make the presentation of information clearer, but it also has students following along so that they can use the computer program as well" (see Table 3). A second participant who received a 7 on the DATTT-C stated, "Many students were eager to participate and got excited about writing on the smartboard" and explained in detail a teacher-led activity in which "members … were called on to come to the front of the classroom and answer questions written on the board" (see Table 3).

In sum, only two participants created drawings that illustrated student-centered uses of technology to support exploration and collaboration, and both participants expressed student-centered beliefs (see Table 3). Likewise, the three participants who created drawings that depicted teacher-centered uses of technology expressed teacher-centered beliefs, and one also believed that technology could interfere with student learning. Most participants (10) portrayed students as active users of technology and tended to express idiosyncratic beliefs stemming from personal experiences where technology appeared to motivate students to learn.

Discussion

This study aimed to identify preservice teachers' pedagogical beliefs by examining their drawings of teaching with technology and reflections on these drawings. These findings build on prior studies (Funkhouser & Mouza, 2013; Keren-Kolb & Fishman, 2006) that used drawings to identify preservice teacher pedagogical beliefs about teaching with technology. For example, Funkhouser and Mouza (2013) found that 96% of preservice teacher drawings depicted teachers in front of the classrooms

using projectors or IWB to present information to students seated passively at their desks. Only 14% of preservice teachers portrayed technology in students' hands at the beginning of their teacher education program. In contrast, in our study, 67% of preservice teachers depicted technology in students' hands at the beginning of their teacher education program.

This difference in the portrayal of technology, however, did not translate into more preservice teachers expressing more student-centered beliefs. Instead, the illustrations of technology in students' hands likely reflects investments in providing K-12 schools with access more ubiquitous to handheld technologies (Bedesem & Arner, 2019). These findings support prior research (Er & Kim, 2017; Nespor, 1987) that claimed preservice teachers tend to enter their teach education program with pedagogical beliefs that are mostly idiosyncratic and often based on episodic memory.

Our findings also demonstrate that teacher education programs should provide experiences and opportunities for reflection and growth situated at the intersection of technological knowledge and pedagogical knowledge (Koehler & Mishra, 2009). It is this overlap between the technology and the teaching practices in the TPACK model that we have identified as an important leverage point based on the illustrations and written reflections our participants provided. Future research should examine the development of preservice service teachers' pedagogical beliefs in relation to their developing TPACK throughout their teacher education programs. Further, the recent move to remote teaching during the COVID pandemic presents a unique opportunity to examine changes in preservice teacher pedagogical beliefs and TPACK resulting from sustained use of technology to support synchronous and asynchronous online instruction.

Limitations

This study had several limitations, including the sample size and homogeneity of the participant pool. The small number of largely homogeneous participants consisted of mostly white female preservice teachers. Although there appeared to be alignment between the scores on the DATTT-C and preservice teachers' pedagogical beliefs about teaching with technology, future researchers should conduct a validity test before concluding about the relationship between preservice teacher drawings and beliefs about teaching with technology. Additionally, a large portion of the drawings fell in the mixed category, which is possibly because the DATTT-C contained a priori measures. This phenomenon could be addressed through conducting an emergent and holistic coding process (Haney et al., 2004).

This study represents only a snapshot in time, and preservice teachers were not asked to provide contextual information about the lesson depicted in the drawing, such as what stage in the learning cycle (Schallert et al., 2021) that the technology employed or their objectives and purposes for integrating the technology. Future studies should include prompts to capture a more complete understanding of preservice teachers' instructional reasoning, including their intentions and purposes for using technology.

Although some studies suggest that preservice teachers enjoy the opportunity to engage in artwork like drawing in their teacher education courses (Brown et al., 2008), we recognize that the medium of drawing is a limitation. Students have different comfort and interest levels with drawing and fear about being judged on their artistic abilities. To address this limitation, it is essential to provide multiple modes of expression consistent with the principles of Universal Design for Learning (Rose & Meyer, 2002). Participants who are averse to drawing could curate images or photos to express the same ideas or write or dictate the scene they see in their mind's eye to allow for different modes of collecting data.

Conclusions

It is encouraging that the preservice teachers in this study entered their teacher education program with mental images of technology in students' hands rather than teachers using technology to deliver instruction. These images will serve to shape how and what they take away from their teacher education programs. Although current teachers and learners generally have more access to technology than ever before, this condition is insufficient to generate meaningful technology integration practices (Farjon et al., 2019; Mouza et al., 2014). The findings here align with prior studies (Chai et al., 2011; Tondeur et al., 2008, 2017) that suggest teacher education programs should work to support preservice teacher development of instructional practices at the intersection of technology knowledge and pedagogy knowledge. This support will, in turn, generate the pedagogical beliefs needed to create student-centered learning experiences that more effectively prepare K-12 students for 21st-century work, living, and learning.

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Appendix
Draw a Teacher Teaching With Technology Checklist (DTTT- C)

Teacher Activity

- Pointing to an IWB/Screen
- Using IWB to present information (Students not using technology)

Teacher Position

- Standing next to IWB
- Erect Posture not sitting or bending down

Student Activity

- Watching or listening NOT using technology
- Using technology to respond to teacher (drill and practice or answering, closed questions, following directions).

Student Position

- Seated or so suggested by classroom furniture.

Environment

- Desks arranged in rows
- Teacher desk located at the front of the room
- IWB or Screen on the wall at the front of the room