Designing Professional Development for Sustainable Educational Technology Usage: Lessons Learnt from Utah K-12 Teachers

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Abstract

Professional development (PD) programs do not always reach the teacher or allow for sustained usage of technology. However, recent studies show that teachers are more open to use technology after increased technology dependence during the COVID-19 pandemic. Motivated by that new openness to technology integration, we used interview and survey data to examine teachers' current practices for learning technology, features of PD that they consider effective and technologies that they want to learn in the future. We found that teachers learn technology in both formal and informal ways, through district-organized PD, independent learning and or by asking for help from peers. We also learned what kinds of technologies teachers want to learn more about, and that active learning and lack of cognitive overload are two of the most important features of PD for teachers in our study. Based on those findings, we offer three concrete recommendations for PD program designers.

Keywords: Professional development, technology, features, active learning

Introduction

Although there is literature on what constitutes effective professional development (PD) (Borko, 2004; Desimone, 2009), and many promising PD programs do exist, such programs do not always reach a typical teacher in a form that maintains their integrity (Hill, 2009). When it comes to technology PD

programs, the challenge is even greater. Teachers and districts struggle to keep up with continuously evolving technologies (Jones & Dexter, 2014), which in turn makes sustained educational technology usage difficult. Perhaps as a result of constantly shifting classroom technologies and inadequate PD opportunities, multiple studies found teachers feeling unprepared to move to virtual learning during the COVID-19 pandemic (e.g., Anderson & Hira, 2020; Dean & Wimmer, 2020; Justis et al., 2020; Phillips & Cain, 2020; Podmore, 2020; Schwartz, 2020).

On the positive side, the pandemic caused a unique moment in time, when all teachers were learning so much technology that they reported having ten-hour-long work days (Dean & Wimmer, 2020). Such intensive exposure to technology inspired many teachers to learn or deepen their knowledge of many technology tools (e.g., Anderson & Hira, 2020; König et al., 2020; Phillips & Cain, 2020; Rasmitadila et al., 2020; Roman et al., 2022; Trust & Whalen, 2021; Wagner, 2022; Yang et al., 2022), which in turn changed their attitude towards and willingness to play with technology (Schwartz, 2020). As a response to this historical event, we conducted a study to examine how teachers' approach to technology changed (Cain et al., 2022; Pantic et al., n.d.), and found that teachers were more open to using technology, videoconferencing and digital platforms for presenting content.

It was this shift in willingness to use technology (Cain et al., 2022; Pantic et al., n.d.) that motivated us to examine technology usage beyond the COVID-influenced practices and move on to investigating established practices for learning technology. Additionally, we inquired how existing PD programs could be improved to maintain sustainable usage of technology learning after the momentum that the pandemic created fades. In the words of Hill (2009), in order to improve PD programs, we need to examine existing practices and make them better, rather than replace them with new programs of uncertain effectiveness. To that end, we posed the following three research questions:

RQ1: When learning a new educational technology tool, what strategies do teachers in Utah – a western US state – currently use?

RQ2: What features of PD for educational technology do teachers in Utah – a western US state – see as effective?

RQ3: What type of tools or skills would teachers in Utah – a western US state – like to learn more about through PD?

Literature Review

Formal Professional Development

Most of the time, when we talk about PD for teachers, we refer to the formal workshops and courses organized by the district in which a teacher works. According to Desimone (2009), however, the literature "casts a (much) wide(r) net" (p.182) for what might be included as PD. These may consist of workshops

and courses organized by the district, but they may also refer to conferences, and participation in learning communities – online or in-person. Regardless of the structure of PD, research shows that there are certain core features that make PD effective (Desimone, 2009). Those features include: content focus, active learning (or opportunity to engage with the content), coherence (or the extent to which teacher learning is consistent with teachers' knowledge and beliefs), duration (or sufficient time), and collective participation (or an opportunity for interaction and discourse).

While most of these core features are self-explanatory, active learning could use a more precise definition. Active learning is an instructional method opposite from the traditional one which transmits content to be consumed by the learner. In contrast, active learning is defined as an approach to learning that requires students to engage in the process of learning by doing meaningful learning activities (Bonwell & Eison, 1991). There is a lot of evidence to support the effectiveness of active learning as an instructional method (Lindvall & Ryve, 2019).

Professional Development in Technology

Learning technology is similar to learning other subjects. Teachers learn both formally and informally. Formal learning includes district-initiated systems of PD (Jones & Dexter, 2014), while informally, teachers can learn on their own (independent learning or self-exploration), and/or with the help of their colleagues and mentors (Jones & Dexter, 2014; Ottenbreit-Leftwich et al., 2018). Formal and informal ways of learning, however, are interconnected as they work together to help teachers build their knowledge within their school and other education communities.

As there are many benefits to meaningful educational technology integration in the classroom for both teachers and their students (e.g., Burns, 2013; Dooley et al., 2016; Edwards, 2019; Gaggioli, 2019; Hicks, 2011; Morgan, 2013; Muis, 2008), there are also many national (e.g., Bull et al., 2016; Hershkovitz & Karni, 2018; Kelley & Sisneros, 2020; Whiteside et al., 2016) and local initiatives (Utah Education Network, n.d.; Utah State Board of Education, 2021; Warner & Wright, 2017) that are put in place to support teachers' learning of technology. In Utah and other US states, teachers must seek out PD in order to maintain their teaching licenses, which are state-issued credentials granting teachers the ability to teach in public schools. Schools, school districts, universities, and other organizations offer PD programs to teachers. One such program, The Educational Technology Endorsement Program (ETEP) (Utah Education Network, n.d.), for example, provides free courses for teachers in Utah.

Cognitive Overload

When a teacher is exposed to more information than their working memory can handle, the so-called cognitive overload (Sweller, 1994) begins and learning stops. According to this theorist, cognitive load is the amount of information working memory has the capacity to process. Cognitive overload, on the other hand, happens when the brain receives excessive or excessively complex information, content it

cannot process, which in turn leads to frustration and or disengagement (Schimming, 2022; Sweller, 1994). In the context of our study, a cognitively overloaded teacher might struggle thinking about the functions of seven different buttons on the new app they are being taught to use – leaving little mental bandwidth to think about how the new app might support their students' learning. Cognitive overload combined with typical concerns teachers have about time constraints, energy commitment, and the pressure to keep up with changing technology (Liu & Szabo, 2009) has the potential to undermine teachers' learning of new technologies.

Methods

Given that our goal for this study was to investigate teachers' current processes for adopting new technologies and their vision for effective PD in general, we decided to use a qualitative methods approach (Patton, 2002) in combination with descriptive statistics of an open-ended survey item. Combining survey and interview data allowed us to measure what new technologies the larger state population of teachers sought to learn and a more individual-teacher perspective on the ways they want to learn innovative applications of technology. The interviews enabled us to identify common steps teachers currently employ in learning new technologies, and what they saw as common features of effective PD in general.

Sample

Nine hundred and two (388 elementary, 511 secondary and 3 Other) teachers (female=698, male=203, prefer not to answer=1) from 27 counties in Utah responded to our survey. Their average age was 42.2 (*SD*=11.4), while their average work experience was 12.7 (*SD*=9.1) years. Fifty-three percent of them had a Bachelor's degree, while the rest had a graduate degree. In terms of ethnicity, 30 teachers (3.3%) identified as LatinX, and 66 (7.3%) identified as Other. Their racial make-up was 94.7% White, 0.4% Native American or Native Alaskan, 1.6% Asian or Asian American, 0.1% Black or African American, 1.2% Multiracial, 0.3% Native Hawaiian or Pacific Islander, and 1.7% Other.

Out of the 248 teachers who specified that they would be interested in participating in a follow-up interview, we selected ten (five elementary and five secondary) teachers for an in-depth interview. Teachers were selected in an attempt to achieve diversity of gender, race, ethnicity, school district, age, work experience, and education. Full demographic information can be found in Table 1.

Table 1

Demographic Information for Interview Participants

	School Level	Education	Gender	School District	Age	Years of Work Experience	Subject Matter	Race	Ethnicity
Participant 1	E	Masters	M	Washington	45	13	4th grade	White	non-LatinX
Participant 2	E	Bachelors	F	Jordan	38	10	5th grade	White	non-LatinX
Participant 3	E	Bachelors	F	Weber	36	6	1st grade	White	non-LatinX
Participant 4	E	Bachelors	F	Salt Lake	55	29	2nd grade	Native Hawaiian or Pacific Islander	Other
Participant 5	E	Bachelors	F	Murray	36	14	5th grade science and ELA	White	LatinX
Participant 6	S	Masters	F	Salt Lake	-	6	SPED	Black or African American	non-LatinX
Participant 7	S	Masters	F	Weber	54	17	Chinese	Asian or Asian American	non-LatinX
Participant 8	S	Bachelors	M	Tintic	44	3	Woodshop	White	non-LatinX
Participant 9	S	Bachelors	M	Logan	54	26	Band	White	non-LatinX
Participant 10	S	Bachelors	F	Davis	25	2	Math	White	non-LatinX

E = elementary, S = secondary;

Data Collection

This study is part of a larger study (Cain et al., 2022) examining technology usage by K-12 teachers in the state of Utah. During 2021, we actively reached out to more than 6,000 educators in all 29 counties in Utah. Nine hundred and two teachers responded to our survey, ten of which participated in a follow-up interview. All interview participants were compensated with a $50 Amazon gift card, and every 10th participant in the survey was compensated with a $20 Amazon gift card. Interviews were conducted via Zoom and were on average 60 minutes long. An audio recording of each interview was saved and transcribed verbatim using an online transcription tool called Otter (https://otter.ai/). Surveys took approximately 15-minutes to complete and had 53 questions in total. For the purposes of this paper, we

analyzed two of the interview questions ("Can you walk me through the process of learning a new technology tool?" and "What would the ideal professional development to learn how to use a new technology in your school look like?"). We also analyzed one of the open-ended survey questions ("If you could take a PD workshop or a class on technology integration, what would you like to learn more about?").

Data Analysis

To analyze the interview data, we used qualitative analysis software, MaxQDA (see: https://www.maxqda.com), to conduct open coding of the data (Emerson, 1995; Patton, 2002; Saldaña, 2015). Unit of analysis included all meaningful utterances that answered each research question. Their length ranged from one to a few sentences. This phase resulted in a total of 38 codes for RQ1 and 19 codes for RQ2. After the open coding phase, we proceeded to axial coding, where we organized codes into related categories (Patton, 2002) which best answered each of the two RQs. As a result, the codes were organized into three categories aiming to answer RQ1 (see Table 2 below): *Self-exploration, Formal Training, and Ask for Help.*

Table 2

Codebook for Learning Strategies Used (RQ1) with Frequencies

Code	Frequency	Definition	Example
Self-exploration	90% of teachers; 16 instances overall	Teachers describing a preference or a habit to go through tools on their own, teaching themselves using trial and error and or Internet resources	*Participant 9: "I am not afraid to like, try it out. I just like - go for it.* [...] *I go ahead and click on that. And I'll just click around. Okay? Trial and error, until I find my way to make it work."* *Participant 10: "I just Google it. So that is probably my number one go-to, because I do not like to bug people."*
Formal Training	70% of teachers; 9 instances overall	Teachers listing examples of taking classes, tutorials prepared by the district and other types of training offered by the school or the district	*Participant 2: "To me, how it works for me, is like, if I go to a class about technology, I listen to all of that."*
Ask for Help	60% of teachers; 11 instances overall	Teachers listing examples of reaching out to other teachers, school or district experts, or the manufacturer	*Participant 3: "I have a colleague on my team. She is the edtech coach here.* [...] *So her and I, ... I'll go to her... we can ... we bounce ideas off each other."*

Results for RQ2 were organized in two categories (see Table 3 below for definitions, examples and frequency): *Active Learning,* and *PD that Avoids Cognitive Overload.*

Table 3

Codebook for Effective PD Features

Code	Frequency	Definition	Example
Active Learning	60% of teachers; 9 instances overall	Teachers giving examples or explaining that they learn best when they have a hands-on experience	*Participant 16: "...giving time to just play around with the tool is really beneficial."*
PD that Avoids Cognitive Overload	40% of teachers; 4 instances overall	Teachers protesting against PD sessions with too much information	*Participant 2: "...we were just listening to too many* [sic] *information and getting none."*

We used one of the survey questions (aka "If you could take a PD workshop or a class on technology integration, what would you like to learn more about?") to answer RQ3. This was an open-ended question where 902 teachers listed tools and skills that they wanted to learn more about. To analyze this data, we used MaxQDA, which allowed us to eliminate non-meaning-bearing words, such as prepositions, articles and auxiliary verbs (aka "stop words" in MaxQDA). After doing this, we found that people used 1197 different meaning-bearing words, 75 of which were used 10+ times. After narrowing down the list to words signifying skills and tools, we came up with a list of 24 words. For those words, we calculated rank, frequency and a percentage of individual responses in which each word appeared.

Results

Current Practices in Learning New Educational Tools

Research Question 1 focused on strategies that teachers currently use to learn new educational technology tools. After analyzing the data, three different strategies emerged as important in current learning practices of Utah teachers: *Self-exploration, Formal training,* and *Ask for help*.

Self-exploration

The most common approach for learning new tools that teachers mentioned using was *self-exploration.* Ninety per cent of the teachers discussed it as their first method to learn new technology. Self-exploration happened through trial and error or by using the Internet to guide their learning.

When it comes to "*trial and error*", several teachers mentioned "*click*[ing] *around"* until they could make it work. They learned this way because they felt the need to "*figure out*" the tool on their own, or they simply liked to "*play*" with technologies, before they decided if they wanted to use it. One teacher even said that their trial-and-error approach to learning technology led to mistakes that they later turned into educational opportunities for their students:

Participant 9: "I actually save all my mistakes. Because I then will… write myself a little lesson plan and attach it to it and talk to the kids about what I did wrong. And why."

Interestingly, most teachers mentioned using the method of self-exploration after they were already somewhat familiar with the tool from seeing it at a conference or learning about it at a training session.

Half the teachers we interviewed also mentioned learning a lot from the Internet by "*googling*" information or using YouTube. Some other places to learn from were Instagram which, according to one teacher, allowed them to pull up posts from other people who were using the same tool by typing a hashtag, such as "*Adobe Fresco*". Social media also proved useful for one teacher in terms of reaching out to their knowledgeable friends:

Participant 4: "I send a massive message on my Facebook to friends, like "Hey, I'm having this difficulty". And usually they'll send…. I have three friends that are very faithful [...] *they'll send me, you know, either a tutorial or...".*

Formal training

The second most common learning approach, used by 70% of the teachers, was *formal training*. These teachers said that they talked about attending PD sessions, "*training*" and "*classes*", especially for tools that they had never seen before. When the educational technology tool was new, they expressed preferring someone to "*sit down and walk [them] through it*" or going through introductory online courses offered by the district. Sometimes, being introduced to tools in that manner developed an interest in some teachers to learn the tool more thoroughly:

Participant 7: "I learned about it from a teacher workshop [...]. *So, then I got very interested, I even went to take their online classes. So now I'm Kami certified.*"

Even though this strategy was used less frequently than self-teaching, for most teachers, it preceded self-teaching, as it can be seen from this excerpt. Therefore, we conclude that many teachers rely on training when being introduced to new tools, but as we found in the earlier theme, self-exploration, teachers prefer tools that they can play with later, and do benefit from online resources.

Ask for help

Finally, some teachers (60%) also indicated learning to use new tools by *asking for help* from their peers. For most, this category included examples of established collaborative relationships with "*other teachers*" or reaching out to technology specialists in the district. The following example shows how one such supportive relationship looks like:

Participant 3: "I have a colleague on my team. She is the edtech coach here ... I'll go to her… we bounce ideas off each other."

Some other examples included reaching out to tech specialists in the school or the district:

Participant 2: "I had grades on my Canvas, and we could connect that with our like, grade system

from the district. And I couldn't do that. I tried and tried, and then I asked for help. [...] [I asked] the tech team. And they knew how to do it."

From this second example, we can see that district tech specialists also play a role in teacher's learning of new technologies. The practice of reaching out to the person who was perceived as the knowledgeable other, whether they were a fellow teacher or a technology expert in the school or the district was frequent among other teachers we interviewed.

Effective PD Features

Research Question 2 focused on features of PD on technology that teachers perceived as effective. After analyzing the data, two features emerged as most important in what teachers perceived as effective PD for learning technology: *Active Learning,* and *PD that Avoids Cognitive Overload.*

Active Learning

Six out of ten teachers insisted that hands-on experiences are the most beneficial. Some of them mentioned that they attended PD sessions where they could not "*play*" with the technology, due to the fact that the sessions were lecture-based and hence, quite passive. Others were remembering examples of PD sessions that really worked for them or where they learned a lot, due to the hands-on nature of the PD session. The following excerpt summarizes both perspectives:

Participant 1: "I've been to so many trainings where they give us the research. And they tell us how great it is. But really, we just want to see what it does. So, the ideal scenario for me is, am I going to get to play with it? Okay? Am I going to get to make mistakes with it? Are you going to let me hold that robot? Are you going to let me actually do what the kids are doing?"

In other words, this teacher pointed out that research without hands-on experience did not benefit them as much as when they were given the opportunity to actively engage with the tools.

PD that Avoids Cognitive Overload

Four of the teachers we interviewed protested against PD sessions that offered too much information in too short a time. Instead, they suggested that information should be "*split up,*" "*over a few sessions,*" and "*over a period of time*", so teachers could have the time to process the new concept, play with the new technology and potentially have access to knowledgeable colleagues, as they try to implement the tool in the classroom.

Tools and Skills Teachers Would Like to Learn

After examining the survey question, "If you could take a PD workshop or a class on technology integration, what would you like to learn more about?", which we asked to the larger population of 902 teachers, we found that teachers used 24 different words directly referring to tools or skills educators would like to acquire. Figure 1 represents a visual word cloud of those 24 words, while Table 4 provides more

information on them, such as their frequency and how many teachers used them. Word of the same root, such as "video" and "videos", were presented in the same row.

Figure 1

Word Cloud of Words Used by a Minimum of 1% of the Teachers

As it can be seen from the visual, the most frequently used word was Canvas (n=110), as it was named by 105 teachers (11.65%). Next were different Google [apps] (8.1%), Nearpod (6.55%), Adobe [products] (5.22%) and coding (4%). Table 4 provides more details on these words. Teachers also talked about compatible tools and or tools that "integrate" well with each other, as well as how to "integrate" them effectively. This theme was frequently discussed in connection to Canvas and tools that integrate well with Canvas. About 4.22% of teachers were interested in increasing "engagement" in their classroom, and or learning about "interactive" tools (3.22%), but did not mention which tools those would be. Other prominent tools and skills that emerged from this analysis were video [making and editing], usage of smart [boards and TVs], Flipgrid, iPads and [classroom] sites.

Table 4

Twenty most frequently used words to describe future goals for learning new technology

Word	Frequency	# Individual Survey Entries (aka Teachers)	% Teachers Who Used the Word
Canvas	110	105	11.65
Google [apps] and Slides	83	73	8.10
Nearpod	60	59	6.55
Integrate, Integration & Integrating	49	49	5.44

apps	49	47	5.22
Adobe (or specifically Spark)	49	47	5.22
Engagement, engaging or engage	38	38	4.22
coding	36	36	4.00
Online	32	32	3.55
Interactive	29	29	3.22
Video or Videos	26	24	2.66
Math	18	17	1.88
Smart [board/TV]	13	13	1.44
Music	11	11	1.22
Flipgrid	10	10	1.11
Sites	10	10	1.11
iPad	9	8	0.89

Discussion

When it comes to learning new technologies, most teachers in our study reported getting introduced to new technologies through formal training. The majority of them, however, reported developing a deeper understanding of a tool after formal training by engaging in self-exploration independently via trial and error and or by relying on online resources. Sometimes they also relied on other people, both teachers and technology specialists. This finding is aligned with other research (e.g., Jones & Dexter, 2014; Ottenbreit-Leftwich et al., 2018), which states that teachers' learning of technology included both formal, or district-initiated systems of PD, and informal, or teacher-initiated learning, with colleagues and or independently through self-exploration. Additionally, Ottenbreit-Leftwich et al. (2018) found that the teaching environment can serve as a barrier, which is something our participants did not talk about. We did, however, find the tools and skills teachers in Utah wanted to learn about, not many of which we found to be suggested by reputable education sites, such as Edutopia (e.g., Eckert, 2021). However, many of these tools are Utah statewide educational technology tools recommended and provided by Utah State Board of Education (Utah State, n.d.). We also found that teachers were invested in learning about "interactive" and "engaging" tools, which is interesting, as research on which technologies contribute to student engagement is lacking (Schindler et al., 2017). These findings are important because they testify to teachers' commitment to enhance learning, but also because they have the potential to steer the direction of available PD in our state.

When reporting on features of effective PD programs on technology, teachers in this study emphasized the importance of two particular features: engaging in active learning, and not experiencing cognitive overload. Active learning is one of the five core features of effective PD, according to Desimone (2009), and there is a lot of scientific evidence that supports its effectiveness (Lindvall & Ryve, 2019). While teachers' insistence on such experiences was not surprising, we were surprised that PD sessions still employ traditional instruction where students are not engaged in meaningful activities for learning (Bonwell

& Eison, 1991), especially when it comes to learning technology where teachers already have a lot of concerns about its ever-changing nature, time commitment, and energy commitment (Liu & Szabo, 2009). Traditional instruction usually provides a lot of information, which can lead to cognitive overload (Sweller, 1994), which is another thing that some of our teachers were concerned about. Similar to Desimone's (2009) suggestion, our teachers were insisting on planning PD in manageable chunks that allow them enough time to process the information, and consequently learn. Needless to say that the alternative is frustration and/or disengagement of teachers (Schimming, 2022; Sweller, 1994), which does not help us meet our goal of sustainable technology usage.

It is important to acknowledge that this study was conducted during the COVID-19 pandemic, and that as such it captured educators' needs at a unique moment in time. However, even though we acknowledge that the pandemic forced many teachers to suddenly learn and implement a range of new technologies and associated approaches to teaching (e.g., Anderson & Hira, 2020; König et al., 2020; Phillips & Cain, 2020; Rasmitadila et al., 2020; Roman et al., 2022; Trust & Whalen, 2021; Wagner, 2022; Yang et al., 2022), our study did not focus on changes in PD experiences and preferences teachers in Utah might have experienced as a result of pandemic-related experiences. Future research should examine how this unique moment in time affected teachers' attitude towards technology PD.

Implications

Based on the above findings, we make the following recommendations for the planning of teacher PD with technology tools:

- providing space for demonstration and practice,
- chunking sessions in order not to overwhelm working memory of teachers,
- modeling self-exploration strategies using online and peer resources.

In the following subsections, we provide greater detail on the recommendations.

Providing Space for Tool Demonstration and Practice

As noted in the interviews, the teachers recognized the importance of learning about the capabilities and affordances of a given tool, but they wanted to see more examples of application and time to spend exploring and using the tool. This insistence on proper duration of PD sessions and them being based on active learning are some of the core features of effective PD known and supported by literature (e.g., Desimone, 2009; Lindvall & Ryve, 2019). In addition, designing training to make space for application is consistent with one of the most widely used technology integration frameworks, TPACK, which states that technological knowledge without pedagogical and content knowledge is not enough for effective and sustainable technology integration (Kimmons, 2020; Koehler & Mishra, 2009). In other words, if we want our teachers to (effectively) use technology, showing them where to click is not enough. Whether we offer

online or face-to-face training, we have to make sure we model effective pedagogical practices that accompany those technologies, so teachers can envision how each tool can be used in the classroom.

Chunking PD Sessions Into Manageable Segments

As human working memory has limited capacity (Pugh, 2017), it is also very important that PD sessions do not cause cognitive overload (Sweller, 1994) for teachers, as this can lead to frustration and or disengagement (Schimming, 2022; Sweller, 1994). In other words, teachers might lose interest in using or learning more about the tool. Instead, we recommend that long direct instructions or demonstrations are chunked in several manageable sections combined with active learning (Bonwell & Eison, 1991). This would not only give teachers an opportunity to process new information, but would also create excitement for technology, as suggested by Bonwell and Eison (1991).

Supporting Independent Learning with Online and Peer Resources

While it may not be feasible for schools and districts to be constantly running technology PD sessions, teachers could be supported to develop self-directed learning strategies for technology integration and make sure that they have access to a community of knowledgeable peers, as suggested by literature (Jones & Dexter, 2014; Ottenbreit-Leftwich et al., 2018). This might involve running PD sessions where teachers practice searching for technology tutorials on sites such as YouTube, Pinterest, Instagram, Twitter, and or appropriate tool forums, or organizing forums and social media groups where teachers can ask for help. Since component effective searching includes using the correct terminology, teachers might work to crowdsource a glossary of terms in a shared document. Many schools have dedicated time during the week for professional learning, so some of these times could be used for practicing self-directed learning with technology tools.

Limitations & Future Research

Even though our questions were focusing exclusively on PD during COVID-19-related circumstances in education, we do acknowledge that for some teachers these same circumstances were the reason to learn technology. For that reason, we have to acknowledge that COVID-19 might have directly or indirectly influenced the learning process for some of these teachers. Furthermore, the interviews represent 10 teachers with the earlier word cloud in Figure 1 drawn from the larger sample of 902 teachers. Although we do not see the sample as a limitation, we also are not overstating our findings. Our three recommendations are based on what we learned for the specific context in Utah during the ongoing pandemic. Future research might investigate how prevalent the themes from the interviews are in a larger context. Additionally, it was not in the scope of our study to investigate the obstacles to learning technology at individual level, such as level of comfort or assumptions, and or program, institution and structural level. Future research should investigate these obstacles to PD in more detail.

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