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Quality EdTech professional development for K12 classroom practice

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ABSTRACT

As technology's influence deepens in educational settings, the need for enhanced guidance and support for educators grows. Frameworks for EdTech implementation exist, however a disconnect between theory and practice remains. To support educators, access to well-integrated, high-quality, teacher-designed EdTech PD will facilitate mindset shifts and EdTech integration for teachers. Findings highlight three themes: (a) quality of EdTech application in the classroom by the teacher matters, (b) quality of EdTech application in the classroom by the student matters and (c) quality PD matters. Furthermore, PD needs to highlight the student use of EdTech to enhance student engagement and learning.

Keywords: professional development, EdTech, pedagogy, technology integration

INTRODUCTION

Teachers and students rely increasingly on technology for education (Berrett et al., 2015; Falloon, 2020; Gray & Lewis, 2021; Scherer et al., 2019). COVID, in particular, served as a catalyst to incorporate technology into more facets of education (Pryor, 2020). However, opportunities for educators to learn about technology, and how to effectively leverage it for improved learning outcomes varies (Berrett et al., 2015; Clark, 2023; Kolb, 2017; Mcleod & Graber, 2019). Professional development (PD) often allows practicing educators to learn new methods and content. Emerging digital technologies provide opportunities for improved learner outcomes, sometimes referred to as *meaningful learning* (Clark, 2023), *smart education* (Huang, 2023), *relevant learning* (Merrill et al., 2020), *deep learning* (McLeod & Graber, 2019; Ostroff, 2016), measured by *student engagement* (Merrill et al., 2020; Meehan, 2019).

Purpose

The purpose of this study is to investigate the relationship of how current educators learn about and implement educational technology (EdTech) in the classroom. In particular, the researchers sought to identify: (a) quality of EdTech application in the classroom by the teacher, (b) quality of EdTech application in the classroom by the student and their relationship to (c) quantity of PD related to EdTech.

Key terms

EdTech (educational technology) for this research paper will refer to the use of technology in an educational setting for improved learner outcomes. A component of EdTech is instructional technology. This research paper will refer to instructional technology as technology used by learners and educators to interact with course content and pedagogical structure to drive learning.

Professional development (PD) for this research paper will refer to any form of professional training or learning that impacts outcomes for current teachers and their students. An important attribute of meaningful professional development is the ability to construct learning for the adult that in turn produces positive outcomes for student achievement (Hattie, 2011). Many schools require ongoing PD for educators. PD can be provided "in house" by the school or district for its own educators.

Context for Technology in Education

Teachers play a vital role in leveraging technology to increase instructional impact on student learning (Clark & Boyer, 2015). Technology can be a powerful tool for transforming learning; it can build and support relationships between educators and students, reinvent instructional approaches to learning and collaboration, close equity and accessibility gaps, and help teachers differentiate instruction for all learners (ISTE, 2023a; Petty, 2018; U.S. Department of Education: Office of Educational Technology, 2024). In order to harness the power of technology for transforming learning, teachers must provide deliberate practice for students to develop digital literacies. Digital literacy moves beyond keyboards, laptops, programs, and artificial intelligence towards deeper understanding and application of technology to shift paradigms, it is the ability to responsibly leverage skills to search, curate, and share information and ideas with fluency through the use of technology (U.S. Department of Education: Office of Educational Technology, 2024).

Increased Availability of Technology for Education

Students and educators must have access to reliable technology for it to be regularly implemented for learning (ISTE, 2023a; Krueger, 2021; Pryor, 2020; U.S. Department of Education: Office of Educational Technology, 2024). Technology availability requires both access and support for those technologies so that students can effectively use the technology that is made available (ISTE, 2023a; Pryor, 2020; U.S. Department of Education: Office of Educational Technology, 2024). COVID-19 highlighted the need for improved access to technology and it underscored the need for educator training in effective EdTech (Krueger, 2021; Pryor, 2020).

Access for Availability for EdTech Availability

Both students and educators need access to technology. Recently, the United States' Department of Education released a report detailing inequity in access to technology (U.S. Department of Education: Office of Educational Technology, 2024). Internet connection reliability for teaching and learning was "very reliable" according to 64% of schools (Gray & Lewis, 2021). The United States Technology Plan suggests that while devices and broadband connectivity are sufficient in most schools, there are some areas for growth to support instructional technology (U.S. Department of Education: Office of Educational Technology, 2017). Areas for growth were made even more noticeable during the school closures caused by COVID-19 (Krueger, 2021; Pryor, 2020). There have been recent updates to reports on digital discrepancies. The United States Department of Education released a report in early 2024 outlining a plan for supporting educational technology (U.S. Department of Education: Office of Educational Technology, 2024).

Improved Design for EdTech Availability

In order for students to be able to access available technologies, educators must know how to leverage them (U.S. Department of Education: Office of Educational Technology, 2024). Often, educators are the recipients of PD, but they are not often the designers of PD (Kennedy, 2016). The *National Educational Technology Plan* calls for educators to help author PD for EdTech training (U.S. Department of Education: Office of Educational Technology, 2024). Self-selected and immediate application of learning improves self-efficacy in adult learning (Hunzicker, 2019). Educators must continue to develop their skills and understanding for effective EdTech use in the classroom with students (ISTE, 2023a; Kennedy, 2016; McLeod & Graber, 2019; U.S. Department of Education: Office of Educational Technology, 2024).

EdTech Frameworks and Guidance

Technology's role has changed considerably as an educational medium. The evolution of technology's role in education, a rapidly changing paradigm, has three discernible stages: replacement era (1960s and prior), empirical era (1980s), and transformative era (current) (Spector, 2008). Each technology era supported learning and pedagogy uniquely; replacement era used technology to replace aspects of traditional classroom teaching, empirical era leveraged the availability of the personal computer to integrate technology into the classroom, and the transformative era of technology shifted the focus of technology to enhance learning and classroom interaction (collaboration, anytime/anywhere learning, and critical thinking) (Spector, 2008).

While the ubiquity of educational technology usage (educators) has increased in recent years, the varying degree of technology acceptance and usage continue to plague educational institutions (Berrett et al., 2015). Recently, actionable frameworks and theories about EdTech have emerged. These frameworks can provide evaluations like the *Triple E framework* (Kolb, 2017), *Four Shifts Protocol* (McLeod & Graber, 2019), while others like the *Technology Instructional Matrix* (*TIM*) (Florida Center for Instructional Technology, 2019) and *Technological Pedagogical Content Knowledge* (i.e. TPCK or TPACK) highlight an educators' knowledge of technology, pedagogy, and content. Similarly, in 2006, Puentedura developed the *Substitution Augmentation, Modification and Redefinition* (SAMR) framework, commonly found in K-12 settings, that focuses on the level of technology use rather than the type of technology.

Meaningful use of EdTech can elude educators who have not had the opportunity to structure lessons and intentionally consider which tools would be best to engage and create conditions for learners to succeed (McLeod & Graber, 2019). Intentional professional development and structured support are necessary to provide educators with skills and information to learn and teach with and about technology. PD can provide ongoing learning opportunities for educators to continue and update their knowledge and understanding of current EdTech (U.S. Department of Education: Office of Educational Technology, 2024).

Professional Development

It is widely accepted that educators should participate in PD in order to increase their knowledge and shift their practices to better address the needs and outcomes of their students (Hattie, 2011). This is evidenced by the roughly 18 billion dollars spent on PD a year in the United States by educational institutions (Kennedy, 2016; Short & Hirsh, 2020). The U.S. Department of Education underscores the need for PD to support stronger implementations and integration of instructional technology in their 2017 Technology Plan (U.S. Department of Education: Office of Educational Technology, 2017).

Benefits of PD

Several studies have found that improved teacher content knowledge and classroom pedagogy has a positive impact on student outcomes, supporting the need for continued professional development (Kennedy, 2016; U.S. Department of

Education: Office of Educational Technology, 2017). Research suggests that a structured professional development program may assist teachers with deeper applications of technology (Geer et al., 2015). In order to increase impact, teachers need to feel prepared and be confident in effective EdTech implementation. Properly prepared educators are more likely to leverage technology in their classrooms than those who are under-prepared (Foulger et al., 2020; Spaulding, 2013). However, while educators and researchers acknowledge the potential benefits of PD on student learning, there are caveats and qualifiers that can increase or diminish its effect (Hattie, 2011; McLeod & Graber, 2019).

Challenges for PD

Some educators describe their experience with PD as disjointed from their daily work as an educator, lackluster in content, minimal engagement and void of administrator support (Hill, 2009; Kennedy, 2016). Many pre-service teachers reported feeling unprepared to incorporate technology to support student learning as they transitioned to teaching and using technology effectively in the classroom (U.S. Department of Education: Office of Educational Technology, 2017). In 2007, over $2.5 billion in federal dollars were dedicated to support more effective integration of technology into instruction, later results would yield lower than expected outcomes regarding benefits of integrating technology in K-12 classrooms (Spaulding, 2013). Issues cited for failed technology integration include: top-down mandates from states and districts with minimal collective buy-in from educators, time consuming training, hardware/infrastructure issues, lack of support for implementation from administrators, and lackluster PD (Berrett et al., 2015).

PD Design Features

One common evidence based structure to support active learning is modeling. Modeling is defined as the intentional, purposeful learning strategy demonstrated by the educator to show a new idea, process, or skill (Salisu & Ransom, 2014). Short and Hirsh highlight the use of curriculum-based professional learning. This form of PD leverages modeling, experiential learning, teacher understanding of purpose and repeated exposure over time, as essential elements to implement impactful shifts in professional beliefs (Short & Hirsh, 2020). Maeng et al. (2020), as cited by Lowell and McNeil (2022), suggest that professional development structures that allow educators to experience the learning, collaborate in relevant work related to the curriculum being implemented in the classroom, and receive expert support throughout implementation has shown to improve teachers' confidence in their abilities. Educators exposed to this type of learning are more likely to successfully implement pedagogical changes (Short & Hirsh, 2020). Much like expertise in instructional technology integration does not happen through a singular technology course siloed from any other methods course; rather, expertise is fostered through the inclusion of experiences with instructional technology in all courses, modeled by faculty in teacher preparation programs (U.S. Department of Education: Office of Educational Technology, 2017).

Modeled technology is important in teaching, however, the quality of the model matters. Participants in one study noted that professors used technology sparingly and mostly in the format of presentation technology such as PowerPoint (Clark & Boyer, 2015). If educators are expected to implement transformative EdTech into their classrooms, they need to experience transformative technology. Falloon (2020) argues that technical skills and knowledge alone are insufficient, and teachers require a more comprehensive understanding of the socio-cultural stance, dispositions, implications, and effects of digital technology on individuals and society.

Just as there are effective practices for teaching children, there are effective practices for teaching adult learners: andragogy (Blackley & Sheffield, 2015). Maturing learners leverage their experiences to focus on learning that will be immediately applicable to the tasks of their social roles which create internal drive for self-directed learning (Blackley & Sheffield, 2015; Clark & Boyer, 2015). Andragogy provides a frame for PD providers and others who support teachers with technology integration in the classroom. These roles typically include the following: (a) educational technology experts (61%), (b) classroom teachers with training in technology (65%), (c) other types of school staff like library media experts (76%) (Gray & Lewis, 2021).

Effective PD provides support for both administration and teachers, focuses on subject content, is relevant to classroom practices, and is sustainable over time (Guskey, 2002; Hattie, 2011; Riordan et al., 2019; U.S. Department of Education: Office of Educational Technology, 2017). Just as active learning is important for students to construct understanding; it is equally important for teachers to construct understanding through their professional learning. In order to increase impact, teachers need to feel prepared and be confident in effective EdTech implementation. Properly prepared educators are more likely to leverage technology in their classrooms than those who are under-prepared (Foulger et al., 2020; Spaulding, 2013). Building teacher understanding and skill over time can also contribute to teacher self-efficacy, a critical step in professional development that takes time (Lowell & McNeill, 2022).

Current Research Study

Quality PD provides educators with knowledge and skills necessary to support their students' learning. EdTech is an integral component when designing deeper learning outcomes for students. As technology continues to change, PD must provide educators with the opportunity to grow their understanding to implement effective learning experiences for learners. The extent to which educators are supported and the extent to which they incorporate EdTech into their classroom varies from educator to educator.

METHODOLOGY

The purpose of this study is to investigate the relationship of how current educators learn about and implement EdTech in the classroom. In particular, the researchers sought to identify: (a) quality of EdTech application in the classroom by the teacher, (b) quality of EdTech application in the classroom by the student and their relationship to (c) quantity of EdTech PD.

Participants

All participants included in the research study were current classroom teachers in grades K-12. All participants were volunteers who completed the Qualtrics online survey. This research did not intentionally exclude or seek out participants based on gender, race, ethnic background, or age; these demographics were not collected.

Participants had the opportunity to share the link with fellow educators. While the researchers did not collect IP addresses, Qualtrics prevents multiple submissions from the same IP address. It is possible, though unlikely, that a single participant would submit multiple responses.

Prior to the data collection process, researchers received IRB approval. Participants were informed that participation was voluntary and there would be no compensation for their time or participation. While researchers could not guarantee anonymity, measures were taken to protect privacy; data was aggregated upon collection and no personally identifiable information was collected.

Researchers were particularly interested in schools within the university's service area and used contacts from school districts and cooperative learning institutes to share the survey link. The service area represents primarily smaller rural districts and schools. The majority of schools in this area have access to fiber connection and wifi devices for each student. School districts represented in this research have an average economically disadvantaged student population of 60% (Kentucky Department of Education, 2023). The communities in this service area deal with economic concerns; a 53.7% workforce participation rate, the fourth lowest workforce participation rate in Kentucky. In addition, Kentucky's per capita income in 2022 was reported at $52,109 compared to $65,423 per capita income for the U.S., a gap that continues to widen (Kentucky Center for Statistics, 2023).

Survey and Data

The survey consisted of questions about EdTech including attitudes, beliefs, usage, and professional learning experiences. Questions were based on findings from Rowston et al. (2021), and common existing EdTech surveys aimed to understand how personal use of technology might translate to use of technology in the classroom, proficiency rating for using instructional technology, and questions about beliefs that assess educators' openness to use various forms of technology to enhance learning (Schmidt et al., 2009; SETDA Metiri, 2004; Quick teacher technology survey, n.d.). Educators responded using Likert scale, text entry and side by side comparisons. Questions like, "Please rate your proficiency with instructional technology and your view of instructional technology impact on learning" captured the teacher's perception of their ability to implement instructional technology and their perception of the value of that instructional technology on learning that is important to establishing the quality of EdTech application in the classroom by the teacher and student. This question was answered through a side-by-side comparison where the teacher indicated their perceived proficiency in one column and their perceived impact in the other.

Additional questions sought to look at the quantity of EdTech the teacher had, simple questions like, "About how many hours of professional development have you had on technology or integrated technology, since you have started teaching". Other questions such as "How often does your professional development model technology integration?" provided context to the quality of professional development the teacher experienced.

To ensure clarity around specific phrases and terms such as "acquiring knowledge on how to use new applications" additional qualifiers were added to increase clarity. In the example given, "software and programs" were added to provide additional clarification to the phrase "acquiring knowledge on how to use new applications".

Once the survey was completed the researchers used SPSS to code the response and apply descriptive statistics to analyze key trends in the responses. Original data was aggregated, scrubbed and stored in accordance with IRB requirements. No identifiable information was retained.

RESULTS

Findings from the quantitative survey are coded as F for 'finding' and the number that corresponds to the specific survey question. The researchers used SPSS to manage calculations. Descriptive statistics were used to provide an overview for results. For several of the survey questions, responses were not normally distributed. The researchers used Shapiro-Wilk tests for normality; given the smaller sample size, this test is the most appropriate (Field, 2013).

Pearson product-moment correlation test was used to determine the relationship between two variables to measure correlation in their data values (Field, 2013). The researchers use Cohen to report effect size: $r = .10$ small, $r = .30$ medium, and $r = .50$ large (Field, 2013).

Demographics

All participants were current educators teaching in K-12 classrooms in the East South-Central Region of the United States. N = 73, 35 had a bachelor's degree; 17 had a master's degree; 16 had a specialist degree (including Ed.S. and +30 hours); and 5 reported having a doctoral degree. Of the 73 participants, 25% taught exclusively in the elementary grades; 18% taught exclusively middle school; 31% taught exclusively in high school; 26% taught multiple levels of students. Participant experience included 19 educators with 1-6 years teaching experience; 21 educators with 7-15 years teaching experience; 16 educators with 16-20 years teaching experience; and 17 educators with 21 years or more of teaching experience.

Descriptive Statistics

The researchers asked participants to rate their proficiency on integrating technology into daily lessons and designing opportunities for students to collaborate using technology. The majority of teachers indicated an adequate or strong proficiency with integrating technology into daily lessons, N = 73; M = 1.73. A normal distribution of self-scores was represented by this data. The majority of teachers indicated an

Table 1. Teacher perceived proficiency

Instructional technology statement	Proficiency Rating			Total Response
	Emerging	Adequate	Strong	
Integrating technology into daily lessons	16	36	21	73
Designing opportunities for students to collaborate using technology	29	35	9	73

Table 2. Teacher agreement

Instructional technology statement	Level of Agreement*						Total Response
	0	1	2	3	4	5	
Schools/Districts expect (educators) to learn new technology without formal training	8	30	11	8	9	1	67

* Level of Agreement (0=Strongly Agree, 5=Strongly Disagree)

Table 3. Teacher estimated PD hours

Instructional technology statement	Range (hours)							Total Response
	0	2-9	10-19	20-29	30-35	40-46	50	
Estimate the PD hours provided by school/district	8	16	18	9	5	8	9	73
Estimate the PD hours sought on own	16	19	14	9	4	3	8	73

Table 4. PD model technology integration

Instructional technology statement	Range					Total Response
	Never	Seldom	Half the time	Most the time	Every time	
How often does your professional development model technology integration	9	29	20	14	0	73

emerging or adequate proficiency with designing opportunities for students to collaborate using technology, N = 73; M = 2.06. Only 9 educators self-identified as 'strong'. **Table 1** shows the distribution of these ratings.

The researchers asked participants to rate their agreement (0=strongly agree; 5=strongly disagree) with the statement, "Schools/Districts expect (educators) to learn new technology without formal training", N = 67; M = 1.78. The data shows a positive skew of .753. When testing for normality, the researchers used the Shaprio-Wilk test, appropriate for the smaller sample size, the test indicates a deviation from normal distribution with a statistical significance of <.001, less than .05. Only 11 of the 67 respondents report either disagreeing or strongly disagreeing with this statement. **Table 2** shows the distribution of responses.

Participants were asked to estimate the professional development (PD) hours provided by their schools/districts on technology or integrated technology, N = 73; M = 20.16 with SD = 16.655. The range is 0-50. The interquartile range is 27. The skewness is .613 and kurtosis -.963 There is a wide range of hours of PD provided within a fairly small population. 8 educators reported receiving zero PD for technology. 16 educators reported between three and nine hours. 18 educators reported between 10 and 19 hours; 9 educators reported between 20-29 hours; 5 educators between 30 and 35 hours; 8 educators reported between 40-46; and 9 reported receiving 50 hours of PD related to technology. **Table 3** shows the distribution of responses.

The researchers asked the participants to estimate the professional development (PD) hours on technology or integrated technology that they sought on their own, N = 73; M = 15.95 with SD = 16.543. The range is 0-50. The interquartile range is 23. The skewness is .975 and kurtosis -.270 There is a wide range of hours of PD provided within a fairly small population. 16 educators reported not seeking technology training or professional development on their own; 19 educators reported between two and nine hours. 14 educators reported between 10 and 19 hours; 9 educators reported between 20-26 hours; 4 educators between 31 and 35 hours; 3 educators reported between 40-45; and 8 reported seeking 50 hours of training or PD related to technology. **Table 3** shows the distribution of responses.

Participants were asked, "How often does your professional development model technology integration (i.e. Jamboard, EdPuzzle, Hyperdocs, Polls…)", N = 73; M = 2.58. 9 participants responded with never; 29 responded as 'seldom,' 20 educators indicated having EdTech embedded half of the time in their PD. Only 14 educators reported having integrated technology embedded in their PD most of the time. No educators indicated that EdTech is embedded in every PD. **Table 4** shows the distribution of responses.

Relationships in Data Points

F1 & F6

The researchers conducted a Pearson product-moment correlation to examine the relationship between modeled EdTech in PD and educators' perceived proficiency in integrating technology into daily lessons for students, $r(72) = -.325$, $p = .005$. These findings suggest a small but negative correlation between the frequency of integrated EdTech in PD and proficiency in being able to integrate technology into classroom daily instruction.

F2 & F4

The researchers conducted a Pearson product-moment correlation to examine the relationship between educators' provided PD hours and proficiency in designing opportunities for students to collaborate using technology, $r(72) = -.276$,

Table 5. Relationships in data points

Relationship	Correlation (*r*)	*p*-value	Correlation
F1 & F6: Proficiency in integrating EdTech and the modeling of EdTech into PD	-0.325	0.005	Small negative
F2 & F4: Designing collaborative EdTech and hours of PD provided by schools/districts	-0.276	$p < 0.018$	negative
F2 & F5: Designing collaborative EdTech and hours of PD sought by educators	-0.294	$p < 0.012$	negative
F2 & F6: Designing collaborative EdTech and the frequency of EdTech being modeled during PD	0.377	0.001	positive
F3 & F4: Expectations of knowing new technology without being provided formal training and the hours of PD provided by schools/districts	-0.002	0.985	No correlation

$p < .018$. These findings suggest a statistically significant but negative correlation with the reported proficiency of designing opportunities for students to collaborate using technology.

F2 & F5

The researchers conducted a Pearson product-moment correlation to examine the relationship between educators' self-selected PD hours and proficiency in designing opportunities for students to collaborate using technology, $r(72) = -.294$, $p < .012$. These findings suggest statistically significant but negative correlation between the number of self-selected hours of PD and reported proficiency of designing opportunities for students to collaborate using technology.

F2 & F6

The researchers conducted a Pearson product-moment correlation to examine the relationship between educators' number of hours of PD and frequency of modeled technology integration in PD, $r(72) = .377$, $p = .001$. These findings suggest a statistically significant positive correlation between the number of provided PD hours and frequency of modeled technology integration in PD.

F3 & F4

The researchers conducted a Pearson product-moment correlation to examine the relationship between the number of provided PD hours and educators who reported high expectation for learning about technology with minimal support, $r(66) = -.002$, $p = .985$. These findings suggest that there is no correlation between the number of PD hours provided by a district and teachers feeling supported in technology. **Table 5** illustrates the relationship between question responses.

DISCUSSION

This research study investigates the relationship of how current educators learn about and implement EdTech in the classroom. As technology continues to evolve and permeate learning environments, educators indicate the need for increased support as they shift mindsets from consumer to producer. Post-COVID educators understand the benefits of technology but need better support and modeled technology. Findings from this study highlight three themes that are echoed in the literature: (a) quality of EdTech application in the classroom by the teacher matters, (b) quality of EdTech application in the classroom by the student matters and (c) quality PD matters. While the themes align with existing literature, there were some unexpected findings.

Educator Use of EdTech

Some educators are still not comfortable implementing effective EdTech, despite available resources (Berrett et al., 2015; U.S. Department of Education: Office of Educational Technology, 2024). When investigating educators' use of EdTech, the researchers noticed that while most educators felt proficient in integrating EdTech (F1), only nine of the 73 indicated feeling proficient in designing *student* use of EdTech (F2). This may suggest a further clarification of effective EdTech. For EdTech to impact student outcomes, the students need to use technology (Clark, 2023; ISTE, 2023; McLeod & Graber, 2019). A disconnect between the teachers' amount of EdTech PD and feeling supported in their technology use was indicated in the results of the study (F3). In order to increase impact, teachers need to feel prepared and confident in effective EdTech implementation (Spaulding, 2013).

Design for Student Use of EdTech

Technology allows learners to take an active role in their education. EdTech enables students to become creators, collaborators and to connect with content in ways not possible without technology (ISTE, 2023b). Findings from this research study indicate better support for educators as they incorporate better strategies for EdTech integration (F2). Student collaboration is one strategy teachers can leverage to move into the deeper levels of technology integration on the SAMR framework for technology integration (McLeod & Graber, 2019; Petty, 2018; Puentedura, 2006). By measuring student use of technology for collaborative learning demonstrates engaging and more active learning rather than passive receptive learning through a teacher-created presentation (McLeod & Graver, 2019). This is a better design for active student use.

EdTech PD

While it is widely acknowledged that professional development can improve learner outcomes, it is also acknowledged that professional development varies in its effectiveness (Hattie, 2011; Kennedy, 2016; McCleod & Graber, 2019; Riordan et al., 2019; Short & Hirsh, 2020). Teachers need access to high quality PD with integrated technology in order to shift mindsets and support integration of EdTech (Berrett et al., 2015; McLeod & Graber, 2019; U.S. Department of Education: Office of Educational Technology, 2024). The researchers were surprised that data revealed the amount of EdTech PD attended by teachers had a negative correlation to the teachers' perceptions of their ability to integrate technology into the classroom (F2 & F4).

A component of effective PD is teacher buy-in (Berrett et al., 2015; Kennedy, 2016) and PD relevance (Riordan et al., 2019). However, when teachers reported self-selected EdTech PD (F5) results were similar to provided PD (F4), indicating a negative correlation between self-selected hours of PD and designing opportunities for students to collaborate. These findings suggest the type of PD being delivered may lack some of the key characteristics of effective PD (Guskey, 2002; Hattie, 2011; Riordan et al., 2019; U.S. Department of Education: Office of Educational Technology, 2017). These results indicate that quantity of PD alone does not ensure implementation.

Modeling provides examples for the learner and has been an accepted and effective practice for PD (Salisu & Ransom, 2014; Short & Hirsh 2020). The research (F1& F6; F2& F6) indicated that teachers experienced modeled EdTech in PD but this negatively correlated with their feelings of proficiency at integrating technology and negatively correlated with their ability to design opportunities for student collaboration. The researchers were surprised by the negative correlation. This contradicts existing literature (Salisu & Ransom, 2014; Short & Hirsh, 2020).

Application of Findings

While teachers reported attending significant amounts of technology specific PD the impact of that PD on the teachers perceived ability to integrate technology into the classroom was low. Improved quality of professional development is paramount. Professional development should model technology integration in an authentic manner suitable for transfer into the classroom. Specifically, it should provide teachers a rationale for the work they are doing and seek to establish trust and help teachers understand the value of the learning (Lowell & McNeill, 2022). The findings of this research align with the recommendations from the U.S. Departmenf of Education: Office of Educational Technology in that educators need to have, and co-create, quality PD to support digital learning design so it can be effectively implemented in the classroom (U.S. Department of Education: Office of Educational Technology, 2024).

Individuals responsible for professional development should also consider factors like teacher self-efficacy, which can take time to change and may require more frequent professional development (Hill, 2009; Kennedy, 2016; Lowell & McNeill, 2022). Short and Hirsh (2020) found, "that through repeated cycles of learning, teachers try new instructional practices, reflect on and revise old habits, and change their practices and beliefs over time" this notion of learning cycles should include EdTech. Teachers need to be exposed often to EdTech in order to change their belief in their ability to integrate technology into the classroom. According to Lowell and McNeill (2022), changing teachers' beliefs and changing teachers' self-efficacy do not happen at the same time, rather it takes much longer to change teachers self-efficacy. This aligns to findings in this research, teachers believed in the value of EdTech but perceived their ability to integrate EdTech as low.

Professional developers need to also consider what they are modeling, and provide meaningful opportunities for implementation and opportunities for improved self-efficacy. Utilizing tools like the Four Shifts Protocol helps to ensure that the EdTech is authentic to the instructional vision set forth by the teacher(s) for specific student outcomes.

LIMITATIONS

This research study looked specifically at the service area of a university in the mid-south. Increasing the scope and number of the participant sample would provide a better understanding for more generalizable results. The attrition rate of the survey is approximately 10% which may impact findings by including responses of participants who may be more interested in the topic. More data points would minimize the overall impact of these responses on total results.

Additionally, five participants skipped question 7 (F4) and seven different participants skipped question 8 (F5), possibly due to inapplicability of the question or because of a readability error, the researchers used regression imputation for F4 and F5 to maintain sample size. Researchers looked at the patterns observed within the data of individual respondents and across the entire response data set for F4 and F5. The specific pattern used for F5 was to analyze the participants' response to F4 and F6. The same method was used for F4 but analyzing the participants' response from F5 and F6. The researchers calculated statistics for both sets of data and found minimal statistical difference, but they included these as a limitation.

CONCLUSION

Findings from this research study justify a deeper look into how EdTech PD is leveraged by districts and schools to increase teacher impact on student outcomes. The findings serve as a starting point to investigate, perhaps through qualitative surveys and interviews, the barriers to implementation of effective EdTech in the classroom. While frameworks for EdTech implementation already exist, a disconnect between theory and practice still exists. Additional research may help pinpoint the piece missing from the current models.

This research study highlights the need for a shift in EdTech PD. As John Dewey said, "If we teach today's students as we taught yesterday's, we rob them of tomorrow." Educators need effective PD to leverage available EdTech tools.

As technology evolves even further with advances like virtual reality (VR) and artificial intelligence (AI), it is critical that PD for EdTech also evolves to better support educators and student learning so that students today will have the skills for tomorrow.

Author notes: This study was conducting in Western Kentucky, United State of America.

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Ethics declaration: Murray State University Institutional Review Board approved the level 1 research on 4/24/2023, IRB#23-164, the

collection repository was Qualtrics, with restricted access through Murray State University credentials. No personally identifiable information was collected.

Declaration of interest: The authors declare that they have no conflicts of interest to disclose. The researchers followed IRB protocol and research procedures consonant with Murray State University. Furthermore, the authors acknowledge all work is original and written by humans without the use of AI.

Availability of data and materials: Data will be made available on request.

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