Teacher Beliefs, Integrating Information and Communication Technologies, and Professional Development Strategies

Bonnie M. Martinez University of North Texas, Learning Technologies, Denton, Texas, USA Email: bonniemartinez2@gmail.com

Abstract-Every year countless hours are spent on professional development (PD) for teacher growth. This is especially true when it comes to teacher PD specific to integrating information and communication technologies (ICT) in instruction. Teachers have reported that time invested in PD is not often useful or beneficial to instruction. What mode of delivery in PD have teachers found to be most useful when using ICTs in instruction? This comparative research analysis highlights teachers' opinions, beliefs, and perspectives about PD strategies teachers consider to be instructionally beneficial in PD specific to integrating ICTs in instruction. These strategies include peer collaboration, digital pedagogical focus, and meeting teacher needs. Identifying three common beneficial strategies to PD in ICT integration may lead to more useful PD for teachers and help improve the integration on technology in instruction.

Index Terms—digital pedagogy, peer collaboration, professional development, information and communication technologies, digital learning

I. INTRODUCTION

Professional Development (PD) can be described as continuing learning education for teachers; it may include learning opportunities such as workshops, seminars, or conferences. Professional development is typically required for teachers' continuing education; unfortunately, some teachers have reported that PD is not useful or relevant to their specific learning [1]. Teachers' opinions, beliefs, or perspectives about PD specific to ICT integration in instruction are important because they hold the potential to improve the integration of ICT in instruction as well as make the learning relevant for teachers and students. The use ICTs in the classroom should be used as a learning tool for both students and teachers, giving the opportunity to understanding learning topics and complete learning tasks. Teachers' opinions, beliefs, or perspectives about PD for ICT integration in instruction may hold the key to a deep understanding of valuable and relevant PD. Gathering data on teacher opinions and beliefs about ICT PD integration may help researchers and instructional designers identify and

address learning gaps to best support teachers' learning needs.

The research analysis will strictly adhere to research articles based on teachers' thoughts, experiences, and opinions of PD in integration ICTs in instruction. During the research analysis the researcher encountered a decrease in the number of research articles available that focus of PD ICT integration in instruction. There is a vast majority of articles and research case studies about digital tools in the classroom, but not as many could be found about PD in using ICTs in the classroom. Research articles and case studies of how ICTs are used in instruction are readily available, the researcher is more interested in the PD teachers receive in order to be successful in teaching in a digitally rich environment.

The aim of the comparative analysis is to identify PD strategies that teachers find to be most beneficial when learning about ICT integration in instruction. Identifying PD strategies that teachers find beneficial can be useful and helpful when instructionally planning and designing teacher PD for ICT integration in instruction. Designing and delivering PD that teachers find beneficial may have a higher impact of integration in the classroom.

The analysis concluded three PD strategies based on teacher perspective to be most beneficial in PD for ICT integration in instruction: 1- opportunities for peer collaboration, 2- a digital pedagogical focus, and 3meeting teachers' needs. These findings may help improve instructional design when developing teacher PD geared towards ICT integration in instruction.

II. METHODOLOGY

A comparative analysis of a collection of literature and research studies focused on teacher beliefs in integrating ICTs in instruction to help identify common PD strategies teachers find most beneficial. The research used for the analysis was from one population of K-12 teachers that completed a PD session about integrating ICTs in instruction. A time parameter was also added to the search criteria, the study had to be conducted within the last ten years. Using these parameters helped narrow the types of research studies used for this analysis, which helped identify the common PD strategies teachers found to be most beneficial in integrating ICTs in instruction. During the research analysis there was a limited number

Manuscript received June 20, 2018; revised November 5, 2018.

of research studies and articles available about teacher PD and the integration of ICTs in instruction. The majority of articles and studies found were based on classroom learning experiences for students and heavily focused on student achievement. While the success of student achievement is an ultimate goal in teaching, the researcher is more interested in learning about the PD that teachers receive in order to help them be successful in a digitally rich environment. It is important that teachers have the opportunity to learn about the technology that is readily available to their students and how that technology can be best used to maximize learning in the classroom. A number of teachers have experienced receiving digital learning devices for their students without receiving any formal or adequate training [2]. In many professions outside of education people are typically trained on how to use newly available technology, education should not be any different from that expectation. If schools are willing to invest money in technology infrastructure they also need to invest in teachers. When teachers do not feel comfortable, supported, or adequately trained in using digital tools, such as ICTs, in instruction they are not going to use them, which is a waste of money and valuable resources that could be of benefit to teachers and students. Therefore, it is important to support teachers with PD that is beneficial to their learning. The focus of this study is to identify PD strategies specific to ICT integration that teachers found be most beneficial in instruction. The PD strategies identified in the analysis include peer collaboration, digital pedagogy, and addressing teachers' needs.

Peer collaboration may be defined as a collaborative learning opportunity for teachers to plan, brainstorm, problem-solve and lesson design with their counterparts Teachers identified peer collaboration as a beneficial PD strategy for ICT integration in instruction, therefore, it may be interpreted that once teachers are trained on ICT integration they want an opportunity to collaborate with their peers and brainstorm, discuss, or plan how ICTs can be integrated in their classrooms. Allowing teachers time for peer collaboration also creates the opportunity for teachers to reflect on their personal learning and the possible impact it can have for their students.

An example of peer collaboration may include the practice of a professional learning community (PLC). Professional learning communities can be defined as, "a group of teachers coming together for a cycle of goal setting, data collection, planning, implementation and reflection to guide professional growth and future teaching practices" [3]. A PLC in an elementary school setting may include teachers from the same grade level or content area meet to collaboratively plan instructional designs of upcoming lessons at a designated given time and place. For example, the fourth and fifth grade math teachers may meet once a month to discuss data, brainstorm ICT integration, and plan for upcoming lessons. Collaborative processes are important because they support changes in practice [3]. If instructional designers, teacher mentors, or campus administrators were to build in more constructive time during PD sessions to include peer collaboration teachers may gain more insight and knowledge on how what was taught during the training may be relevant and useful for their classroom.

Digital pedagogy was also identified as a beneficial PD strategy for ICT integration in instruction. Digital pedagogy is a complex thought, different philosophies have different definitions. However, the definition used for the research analysis is the following, "[digital pedagogy] is as much about using digital tools thoughtfully as it is about deciding when not to use digital tools, and about paying attention to the impact of digital tools on learning" [4]. Essentially, the definition implies that an ultimate goal of digital pedagogy is for the learner to be autonomous in selecting and using appropriate digital tools, or not, when learning. This is a very abstract thought, it is extremely difficult to truly measure whether a learner has reached mastery level of autonomy with digital tools including when and how to use them for the purpose of learning. Teachers may be better suited to offer opportunities for students to choose amongst ICTs to complete specific learning tasks, or to reach a certain learning goal. Scaffolding students in this way may progressively lead learners to be digitally autonomous while practicing digital pedagogy in learning. Allowing teachers the opportunity to also be scaffolded and taught about digital pedagogy during PD sessions about ICTs may help teachers bridge when and how to use technology for learning.



Figure 1. The four quadrants of the teacher's choice framework (Diaz-Maggioli, 2004).

Addressing teachers' needs is probably a strategy most would say is common sense, yet teachers may encounter PD sessions that are irrelevant and do not meet their classroom or instructional needs. Addressing every teachers' needs in the room is challenging, to say the least, but it is important that teachers feel their time is valued and that teachers actually experience professional growth in PD sessions that address their needs. Diaz-Maggioli shares a structured framework (see Fig. 1) for teachers to work collaboratively with other educators and with instructional designers to come to an agreement in addressing teacher needs. The framework models that the more teachers gain in knowledge and awareness, preferably through PD, the more opportunity for teachers to collaborate on addressing their professional needs. Maggioli's [5] Teacher Choice framework is an example of teacher-centered PD. Teacher-centered PD is a way to address teacher needs during professional learning, "Effective professional development should be understood as a job-embedded commitment that teachers make in order to further the purposes of the profession while addressing their own particular needs" [5].

The collection of research studies used to analyze and compile the top three PD strategies in ICT integration in instruction are presented in Table I. The data is ordered according to author, publication year, teacher population, type of digital learning PD, and the common PD strategy for ICT integration identified in the literature. During the literature research the researcher heavily focused on articles and research studies based on PD for K-12 teacher that target ICT integration in instruction. Using research databases such as EBSCO, ProQuest, Google Scholar, and university libraries the researcher was able to collect a number of research articles and studies. The amount of applicable literature, based on the set parameters by the researcher, was limited in comparison to literature that focused on collecting student and teacher data that were already using ICT in instruction. The decrease of articles and research studies available about PD that focuses on ICT integration in instruction may be interpreted as an area that may have potential for research expansion. Servicing teachers with PD to be successful in a digitally rich environment is just as important as making the technology readily available. When technology is given before support systems are put in place it is like putting the horse before the cart.

Author	Publication Year	Teacher Population	Type of Digital Learning PD	Common PD Strategy
Prestridge, S., & Tondeur, J.	2015	12 K-12 teachers	Online PD, ongoing, 1 year	Peer collaboration, digital pedagogy
Gisbert, M., & Lazaro, J.L.	2015	10 K-12 teachers	Online and Face-to-Face, ongoing, 3 years	Peer collaboration
Fenton, D.	2017	191 K-12 teachers	Face-to-face, ongoing, 1 year	Peer collaboration
Matzen, N.J., & Edmunds, J.A.	2007	148 K-12 teachers	Face-to-face, ongoing, 1 year	Digital pedagogy
Laurillard, D. et al.	2011	10 K-12 teachers	Face-to-face, n.d.	Digital pedagogy, addressing teacher needs
Kopcha, T.J.	2012	30 teachers	Face-to-face, ongoing, 2 years	Addressing teacher needs

TABLE I: LITERATURE RESEARCH FOR COMMON BENEFIT FACTOR OF PD

III. RESEARCH QUESTION AND LIMITATIONS

1. Across similar research studies what are the three common PD strategies teachers report as beneficial in PD to improve ICT integration in instruction?

2. The analysis specifically targeted empirical research findings from the years 2007-2017.

3. Research studies used are based on methodological choices such as sample size, research focus, research measurement, and years of when study was conducted.

4. The research databases used for the literature collection include the following: EBSCO, ProQuest, Google Scholar, and the University of North Texas library catalog.

IV. LITERATURE REVIEW

Teacher professional development (PD) may be defined as ongoing learning opportunities for teachers [6] that relates to teachers' daily work [7]. Professional development may look different depending on its instructional design such as, workshops, cohorts, virtual, book studies, small group, whole group, keynote speakers, live observations, and/or conferences, to name a few [7]. It is important to align the type of PD offered with teacher needs. For example, if teachers are going to engage in ongoing PD with other teachers from the same grade level throughout the school year, a good fit for this type of support would be a cohort. A cohort would allow the same group of teachers to meet at a designated time and place to learn and work together. It is important to understand the goal and learning objectives of the PD being offered to teachers. Once there is an established understanding of what needs are to be addressed and with whom, the type of PD will support those needs.

Teachers, administrators, and PD instructional designers invest time, money, and energy in planning and delivering PD in hopes that it will be effective, beneficial, and useful to teacher instruction. Gaining insight from teachers' perspectives and opinions may be useful and beneficial to grow and help create an instructional PD focus that targets the effective integration of ICT in instruction. Teachers are the individuals who are receiving the PD and choosing what pieces to apply or discard in their classroom instruction, therefore, their perspectives, beliefs, and opinions should be highly valued and collected for data analysis. In education student data is highly valued and regarded, the same should be happening with teacher data. Collecting and analyzing teachers' feedback about PD is crucial to move towards a PD model that focuses on creating opportunities for designing meaningful and relevant PD.

The body of research conducted in this analysis identified peer collaboration as a common PD strategy beneficial to teacher PD in improving the integration of ICTs in instruction. Peer collaboration is, "...[an] engagement that is collegial [and] establishes a context (community) that enables critical discussion to be formulated and actioned" [8]. Based on the research analysis teachers value peer collaboration. Working alongside peers that plan and brainstorm towards similar goals and expectation of students and campus culture is an invaluable asset that should be tapped into as a PD strategy. Teachers are more willing to share information when they feel confident and comfortable working collaboratively with colleagues [9], which is why it is important to cultivate a culture of collaboration amongst teachers during PD learning opportunities. Creating support structures of peers also allows for ongoing support throughout the school year. Teachers may continue to support each other even after the PD has ended.

A culture of collaboration grows when the audience truly listens to one another and support each other's learning in a fair and reciprocal fashion. In reciprocal relationships of learning, peer collaboration, in the form of feedback, helps guide and set expectations for meaningful learning [10]. Utilizing peer collaboration during PD gives teachers the chance to evaluate and develop current teaching practices with other teachers [11]. To maintain a sustainable collaborative PD environment open communication to share knowledge and experiences with one another calls for a degree of trust and relationship amongst teachers; [12] maintaining those collaborative PD environment.

Digital pedagogy is the second PD strategy identified by teachers as being beneficial to PD integration of ICTs in instruction. Digital pedagogy is, "as much about using digital tools thoughtfully as it is about deciding when not to use digital tools, and about paying attention to the impact of digital tools on learning" [4].

When discussing PD, specifically for the integration of ICTs in instruction, teachers express the necessity of learning about digital pedagogy to integrate digital tools and skills in instruction [8]. Digital pedagogy combines technical skills with procedural and cognitive skills, skills that are necessary for living, learning, and working in the 21st century [9]. Digital pedagogy is the core of digital learning PD; the power of digital age learning is not in a digital tool, but in how the tool is used in instruction [8]. Digital pedagogy focuses on the process of learning and how technology can enhance that process, it does not focus on the tool itself [13].

The knowledge of digital pedagogy teaches classroom educators the distinction between using digital tools for the sake of the tool and using digital tools to enhance learning. When teachers believe in the value of digital pedagogy they adopt digital pedagogical practices in their instruction [3]

Teachers that practice digital pedagogy utilize technological skills that impact content and knowledge in student learning [3]. Part of understanding digital pedagogy includes constructivist and sociocultural learning theories, which focus on understanding how children learn in the digital age [12]. Understanding learning theories helps understand the why and the how behind a lesson, which may lead to a mindset shift in improved beliefs of digital pedagogy [14] and teacher beliefs have the potential for evolutionary changes in teaching practices [12].

It is imperative that teachers in digitally rich environments receive PD in ICT integration that teaches about digital pedagogy. Preparing teachers by providing support in these areas may set them up for success in a tech-rich classroom.

Digital pedagogy is promoted through organizations such as the Partnership for 21st Century Skills [15] and the International Society for Technology in Education (ISTE). These organizations focus on critical digital pedagogy and provide standards for learners, teachers, and support faculty.

P21 has a digital pedagogy framework titled, P21 Framework for 21st Century Learning, see Fig. 2. The framework is described as, "P21's Framework for 21st Century Learning was developed with input from teachers, education experts, and business leaders to define and illustrate the skills and knowledge students need to succeed in work, life and citizenship, as well as the support systems necessary for 21st century learning outcomes" [15]. The core of P21's framework is digital pedagogy, teachers that are expected to teach with ICTs should at be provided with the knowledge and understanding of support frameworks like this one. Learning about this framework in PD sessions can help empower teachers to integrate ICTs, develop a deeper understanding of critical digital pedagogy, and help support continuous 21st century skills development with students [15].



© 2007 Partnership for 21st Century Learning (P21)

Figure 2. P21 Framework for 21st century learning (P21, 2007)

ISTE also promotes critical digital pedagogy on a global platform. ISTE describes its framework as, "The ISTE Standards are a framework for students, educators, administrators, coaches and computer science educators to rethink education and create innovative learning environments. The standards are helping educators and education leaders worldwide re-engineer schools and classrooms for digital age learning, no matter where they are on the journey to effective edtech integration" [16]. Learning about the student and educator ISTE standards during PD empowers teachers to integrate ICT in meaningful and critical ways that support 21st century learning. The ISTE standards support digital pedagogy through student-driven learning. The student standards, see Fig. 3, are, "designed to empower student voice and ensure that learning is a student-driven process" [16].



Figure 3. ISTE student standards (ISTE, 2016)

P21 and ISTE are great for promoting ICT integration in instruction because both frameworks align the use of ICTs in instruction with meaningful, relevant, and 21st century learning.

The third identified PD strategy beneficial in integrating ICTs in instruction is addressing teachers' needs. Traditional PD is often seen as standardized "onesize fits all" learning; this approach does not take into consideration individual teacher and learner population needs [17]. Differentiated PD is teacher centered; it meets the needs of the whole teacher by addressing individual needs, [10], [17]-[20] making PD learning a relevant experience for teachers [12]. A common practice to target teacher needs during PD is to survey the audience with a needs assessment [14], [19]. Data gathered from the needs assessments are then used to develop a PD plan for those teachers, developing a training plan that is tailored to teacher needs helps improve teachers' digital competence [9], [21]. The use of a needs assessment allows for flexible PD because it supports addressing teachers' needs even when they change over time [19]. Teacher needs are best served when digital PD is aligned with teacher daily work, which leads to a higher use of integrating technology in instruction [10], [21]. Tapping into teachers' personal needs and interests helps maximize learning experiences through PD [14].

V. DISCUSSION

The purpose of this analysis was to identify common beneficial PD strategies for the integration of ICTs in instruction, which may lead to more relevant PD for teachers and help enhance the integration of technology in instruction. The research analysis identified three beneficial PD strategies as follows: peer collaboration, digital pedagogical focus, and meeting teacher needs. The findings would suggest embedding these three PD strategies in teacher PD sessions this may lead to successfully enhanced teacher trainings that may improve technology integration in instruction.

Professional development through peer collaboration is powerful in creating an environment of autonomy and mutual respect amongst teachers. Teachers are given the opportunity to talk with each other and design instructional plans together, which makes room for developing existing teaching strategies, including strategies and best practices for digital learning. Digital pedagogy is the foundation to learning and it includes the teachers' philosophy about how students learn. Therefore, it is important for teachers to understand their own philosophy on learning to integrate digital pedagogical practices in instruction and that teachers have the opportunity to have their voices heard and needs addressed.

VI. CONCLUSION

Time is an invaluable commodity that should be respected and used wisely, this should be reflective in the time teachers spend in PD. Professional development should not feel like a waste of time, it should feel like time has been invested for meaningful and professional growth. The three PD strategies identified in this analysis- peer collaboration, digital pedagogy, and teacher needs, are what teachers are stating as the most important pieces of a beneficial PD, where teachers feel their time was invested in something useful and beneficial. It is important to listen and address learner needs, and in the case of PD teachers are the learners.

Professional development is important to build instructional and leadership capacity in teachers and in helping teachers reach their highest potential. In order to best service teachers' PD the research in teacher PD must continue. Professional development in digital pedagogy is an area that continues to rise in teacher PD, teachers need the learning support to best service 21st century learners. Teachers often teach in the manner in which they were taught. A number of modern teachers did not learn in the digital age, the classroom has dramatically evolved, and teachers are asking for support in this area to reach their highest potential. As instructional designers, trainers, and human developers, it is our job and responsibility to see that through. Teachers are expressing what they would like to see and experience in PD, and what they have found to be most beneficial in PD; it is time to respond to that call accordingly.

REFERENCES

- A. Crawford. (2014). The huge problem with professional development for teachers. *Washington Post.* [Online]. Available://www.washingtonpost.com/news/answersheet/wp/2014/09/06/the-huge-problem-with-professionaldevelopment-for-
- teachers/?noredirect=on&utm_term=.390acff6a430
- [2] L. Willen. (2014). What do teachers want even more than new technology? Training on how to use it. Future of Learning [Online]. Available: https://hechingerreport.org/teachers-wanteven-new-technology-training-use/ P. L. Cheng, "Professional learning community (plc): Technology
 - integration at a title I elementary school," San Jose State University, 2017.
- [3] L. Bennett, "Learning from the early adopters: Developing the digital practitioner," *Research in Learning Technology*, p. 22, 2014.

- [4] B. Croxall. (2013). The digital pedagogy lab. Hybrid Pedagogy. [Online] Available:
- https://guides.library.utoronto.ca/digitalpedagogy G. Diaz-Maggioli, "Teacher centered professional development," [5]
- Association for Supervision and Curriculum Development, 2004. A. Rebora. (2011). Professional development. Education Week [6]
- Teacher. [Online]. Available: https://www.edweek.org/tm/contributors/anthony.rebora.html.
- [7] H. Mizell. (2010). Why professional development matters? [Online] Learning Forward Available: www.learningforward.org/advancing/whypdmatters.cfm
- [8] S. Prestridge and J. Tondeur, "Exploring elements that support teachers engagement in online professional development," Journal of Education Sciences, vol. 5, pp. 199-219, 2015. M. Gisbert and J. L. Lazaro, "Professional development in teacher
- [9] digital competence and improving school quality from the teachers' perspective: A case study," New Approaches in Educational Research, vol. 4, no. 2, pp. 115-122, 2015.
- [10] D. Fenton, Recommendations for professional development necessary for ipad integration (White paper). College of St. Benedict and St. John's University, St. Joseph, Minnesota. International Society for Technology in Education, 2017.
- [11] J. H. L. Koh, C. S. Chai, and W. Y. Lim, "Teacher professional development for TPACK-21CL: effects on teacher ICT integration and student outcomes," Journal of Educational Computing Research, vol. 55, no. 2, pp. 172-196, 2017.
- [12] P. Twining, J. Raffaghelli, P. Albion, and D. Dnezek, "Moving education into the digital age: the contribution of teachers' professional development," Journal of Computer Assisted Learning, vol. 29, pp. 426-437, 2013.
- [13] N. J. Matzen and J. A. Edmunds, "Technology as a catalyst for change: the role of professional development," Journal of Research on Technology in Education, vol. 39, no. 4, pp. 417-430, 2007
- [14] K. Xie, M. K. Kim, S. L. Cheng, and N. C. Luthy, "Teacher professional development through digital content evaluation," Educational Technology and Research Development, vol. 65, pp. 1067-1103, 2017.
- [15] P21. (2007). Framework for 21st Century Learning. [Online]. Available: http://www.p21.org/about-us/p21-framework
- [16] ISTE (2016). International society for technology in education student standards. [Online]. Available: https://www.iste.org/standards/for-students
- [17] E. Tour, "Teachers' personal learning networks (PLNs): Exploring the nature of self-initiated professional learning online," UKLA Literacy, vol. 51, no. 1, pp. 11-18, 2017.

- [18] J. P. Carpenter, "Teachers at the wheel," Educational Leadership, vol. 73, no.8, pp. 30-35, 2016.
- [19] T. J. Kopcha, "Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development," Journal of Computers and Education, vol. 59, pp. 1109-1121, 2012.
- [20] T. Trust, D. G. Krutka, and J. P. Carpenter, "Together we are better: professional learning networks for teachers," Computers and Education, vol. 102, pp. 15-34, 2016.
- [21] C. Vrasidas and G. V. Glass, "Teacher professional development and ICT: Strategies and models," *National Society for the Study of* Education, vol. 106, no. 2, pp. 87-102, 2007.



Bonnie Martinez was born in Oklahoma City, Oklahoma in 1986. Education:

Ph.D. Candidate, Learning Technologies (Exp. Grad Fall 2019).

M.Ed., Curriculum and Instruction, University of Texas at Arlington. May 2015

B.S. Early Childhood Education, University of Central Oklahoma. May 2010 Current Position:

PK-12 Title I Technology Specialist- Garland Independent School District

Garland, TX. June 2015- present

Research Interest:

My research interests include professional development, specifically focused on teachers and educational administrators, such as principals. These interest stem from my professional career, which comprises of designing and developing training programs for teachers and principals. Professional development has the potential to impact how teachers teach and how principals lead. It is a personal passion to see educational leaders thrive to best serve students and teachers.

Another area of research interest includes technology based learning environments, specifically integrating information and communication technologies (ICT) in instruction. It is of personal interest to learn more about barriers to technology integration, as well as, learning about the most recent technology adoption models for integration ICTs in instruction that have the potential to impact teaching and student learning. The ever-evolving learning environment infused with technology is something that continues to grow in our society therefore, it is important for educational leaders to understand developmentally appropriate practices and provide adequate and meaningful PD for teachers and educational administrators.