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Influence of Online Professional Learning Networks on Teacher Self-Efficacy for Using Information Communication Technology

Jeremy A. O'Toole
Walden University

Walden University

College of Education

This is to certify that the doctoral study by

Jeremy O'Toole

has been found to be complete and satisfactory in all respects,
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Review Committee
Dr. Amy Adcock, Committee Chairperson, Education Faculty
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Walden University
2021

Abstract

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Jeremy O'Toole

MA, Walden University, 2012

BS, University of Pittsburgh at Bradford, 2010

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Information communication technology (ICT) is increasingly used to enhance teaching and learning, but many teachers lack mastery-level experiences using these computing technologies in the classroom. To further their knowledge, some teachers have turned to online professional learning networks (PLNs) for development, but further research is needed to explore how and why these networks change teachers' practice. Framed by Albert Bandura's theory of self-efficacy, the purpose of this study was to explore the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom. The research question of this basic qualitative study with interviews addressed how online PLNs influence teacher perceptions of their technological self-efficacy for implementing ICT instructional practices into the classroom. Purposive sampling was used to recruit eight teachers who had contact with an online PLN for over a year. The questions in the interview protocol were based on Bandura's four sources of influence for self-efficacy. Interviews were conducted using video conferencing software, and data were analyzed using two rounds of in vivo coding and NVivo software to confirm the results. Results indicate that online PLNs influence teachers' technological self-efficacy by providing resources, relationships, and opportunities to problem-solve. It is recommended to conduct a similar study with a larger sample across more geographical areas in varying school districts. Positive social change includes possible increase in administrator support of PLNs for teachers. Teachers' participation in these networks may allow them to implement ICT more consistently. It may also reduce professional development costs for districts.

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Dedication

I want to dedicate this dissertation to my wife and children, Jacqueline, Declan, and Finley. I could not have done it without their support, particularly my wife, who spent many days and nights with our children while I wrote. I hope this can motivate you, Declan and Finley, to know that even the hardest tasks in life are possible with perseverance, hard work, and a positive attitude.

I would also like to dedicate this dissertation to my friends and family, who jokingly disregard this accomplishment by refusing to accept my new title. I will be sure to correct your salutations whenever you address me.

Acknowledgments

I cannot thank Dr. Adcock enough for her continuous positive and constructive feedback throughout this whole process. I believe I lucked out with probably the best chair available to all doctoral students. Thank you, Dr. Bullock, for your continuous support in overcoming this obstacle; you helped ensure my methodology met every aspect of this process.

Thank you, Dr. Seymour and Dr. Kachgal, for going above and beyond with your feedback and providing additional insights while offering your time to provide clarification. I cannot thank you enough.

I also need to thank Dr. Harland for being present during my oral defense and providing feedback.

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Chapter 1: Introduction to the Study

In this basic qualitative study, I explored the influence of online professional learning networks (PLNs) on teachers' technological self-efficacy for implementing information communication technology (ICT) in the classroom. Research shows that teachers are not receiving enough individualized attention to confidently implement ICT into the classroom, indicating a lack of technological self-efficacy (Christie, 2016; Cook et al., 2017; Yin-Chan et al., 2017). To combat the lack of training, some teachers are using online PLNs to stay abreast of continuous changes, particularly regarding ICT (Carpenter et al., 2019; Krutka et al., 2017). There is evidence showing that online PLNs provide teachers with ongoing, personalized, professional development (PD), but further research is needed to explore online PLNs and their influence on teachers' practice, according to my review of the literature. To address this gap in the literature, I explored how online PLNs influence US teachers' technological self-efficacy using ICT.

The study contributes to the body of research on online PLNs and their influence on teachers' practice, specifically their technological self-efficacy (Liu et al., 2018; Tour, 2017c; Trust, 2016; Trust et al., 2018). I conducted this study to investigate alternative methods by which teachers develop their skills, especially regarding the implementation and use of ICT in their teaching practice. This investigation may effect positive social change by contributing additional research that administrators can use to develop and/or revise preservice and continuing teacher programs. With this training, teachers may be more effective in incorporating ICT in their classroom teaching, which may further

student success. As I discuss in Chapter 5, additional opportunities exist to further investigate how online PLNs can contribute to teacher growth.

In Chapter 1, I provide background information and present the problem and purpose of the study. The research question follows. This chapter also includes overviews of the conceptual framework and nature of the study and definitions of key terms. I also discuss the assumptions, scope and delimitations, limitations, and significance of the study. The chapter ends with a summary and transition to Chapter 2.

Background

Research shows that the provision of traditional PD does not support teachers' ability to master the implementation of ICT (Prestridge, 2019). This negatively impacts their technological self-efficacy. An online PLN may provide a better avenue to support mastery-level experiences and technological self-efficacy for ICT. This is important because ICT has the potential to support learning in engaging ways, transferring knowledge actively rather than passively (Cherner & Curry, 2017, 2017; Christensen et al., 2018; Lee et al., 2017). However, ongoing changes in technology and pedagogical strategies, coinciding with the growing pressures for teachers to develop technologically savvy students, have resulted in teachers becoming inundated with demands for continuous professional development (Adjapong et al., 2018; Azorín et al., 2020; Christie, 2016; Cook et al., 2017; Edwards, 2017; García Espinosa et al., 2015; Hatlevik, 2017; Krutka et al., 2017; Longhurst et al., 2016; Prestridge, 2017). Also, researchers have criticized teacher PD for a lack of evidence that it changes teachers' practice due to

its one-size-fits-all approach with little teacher buy-in and poor implementation (Bowe & Gore, 2017; Parsons et al., 2019; Trust, 2016; Trust et al., 2018).

There is evidence showing that these situations are harming teachers and their ability to implement ICT consistently, leading to a gap in teacher and student skill levels (Christie, 2016; Cook et al., 2017; Kwon et al., 2019; Lee et al., 2017; Tilton & Hartnett, 2016; Tour, 2017a; Yildiz Durak, 2019). Online PLNs provide teachers opportunities to reflect and collaborate, which can increase their technological self-efficacy by building mastery-level experiences, indicating a possible solution to combat the gap in practice (Anders, 2018; Bandura, 1997; Durksen et al., 2017; Greenhow et al., 2019; Hivner et al., 2019; Krutka et al., 2017, 2017; Kwon et al., 2019; Oddone et al., 2019; Prestridge, 2017, 2019; Tilton & Hartnett, 2016). This study was needed because there is a recognized need for further investigations into the effectiveness of online PLNs for teachers' practice (Liu et al., 2018; Tour, 2017c; Trust, 2016; Trust et al., 2018)

Problem Statement

The problem that I addressed in this study was a lack of knowledge on how online PLNs influence teachers' technological self-efficacy when using ICT in their practice. Many teachers struggle to stay abreast of the continuous changes in ICT and classroom practices; meanwhile, school leaders attempt to provide ICT PD for teachers but often have limited time and budgets due to the growing demands for other mandated training leaving roughly 60% of teachers in the U.S. receiving PD in ICT in a year (Bowe & Gore, 2017; Organisation for Economic Co-operation and Development [OECD], 2020; Tour, 2017a, 2017c). Meanwhile, only 44% of teachers feel "well prepared" or "very

well prepared" to use ICT for teaching (OECD, 2019). According to a secondary administrator at the study site, many teachers lack confidence in using ICT, which results in teachers struggling to implement ICT instructional strategies in their classrooms. As research has shown, participation in collaborative communities such as online PLNs could change teachers' practice by promoting higher self-efficacy towards ICT use (Adjapong et al., 2018; Christie, 2016; Durksen et al., 2017; U.S. Department of Education, 2017).

PLNs are unique learning environments where teachers create a personal network to connect through social media and other collaborative technologies to learn informally without geographical constraints (Tour, 2017a). As noted by the secondary administrator, social studies and language arts teachers at the study site have created online PLNs to stay current with the changes and build confidence in implementing ICT in the classroom. PLNs can be beneficial for teachers because of their informal, personalized, collaborative, and self-paced learning opportunities (Edwards, 2017; Yin-Chan et al., 2017). However, due to the unique attributes of online PLNs, experts argue whether they are an effective method for teacher professional growth (Edwards, 2017; Prestridge, 2019; Tour, 2017a, 2017c; Trust, 2016; Trust et al., 2018). Researchers recognize the need for further investigations into how PLNs can influence teachers' practice (Liu et al., 2018; Tour, 2017a; Trust, 2016; Trust et al., 2018). The knowledge from this research may inform the development of resources to better prepare teachers to use ICT for teaching.

Purpose of the Study

The purpose of this basic qualitative study was to explore the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom. Many teachers lack the confidence to use ICT in the classroom efficiently because of its continuous changes and their lack of mastery-level experiences, requiring further professional growth to develop such skills (Adjapong et al., 2018; Alberth et al., 2018). They have turned to online PLNs because of their ability to create collaborative, anytime, anywhere, informal learning spaces to grow their skill, confidence, and consistency in implementing ICT in the classroom (Kwon et al., 2019; Lee et al., 2017; Tilton & Hartnett, 2016; Yildiz Durak, 2019). Researchers recognize the need for further investigations into how online PLNs influence teachers' practice (Liu et al., 2018; Tour, 2017a; Trust, 2016; Trust et al., 2018). I conducted this study to address this gap in the literature.

Research Question

I sought to answer the following research question to determine how online PLN influence teacher self-efficacy:

> How does the use of online PLNs influence teacher perception of their technological self-efficacy in implementing ICT instructional practices in the classroom?

Conceptual Framework

I framed the study using the contextual lens of social learning and self-efficacy (Bandura, 1997). A tenet of social learning is humans are naturally social, and through

social interactions and observations, they develop their behavior (Bandura, 1971). Albert Bandura's (1997) social cognitive theory suggests that children and adults acquire attitudes, emotions, and behaviors through observing others. Society thus plays a role in molding individuals' attitudes and behaviors. An online PLN community, I believe, can serve a similar role in developing teachers' attitudes and behaviors, thereby changing their teaching practice. Through this channel, teachers can develop their use of ICT by creating an online PLN where other teachers share their experiences. With the development of social media and other mass communication tools, users can significantly impact individuals by promoting their views and ideas to audiences across the world by changing social systems (see Bandura, 2002). Bandura contended that there is a cycle of influences between human behaviors, cognition, and environments.

Reflecting this view, Bandura (1986) developed the concept of triadic reciprocal causation, an interplay of cognitive, social, and environmental factors. The environmental and social influences will likely change cognition for humans and, therefore, change their behavior. One of these cognitive changes is described by Bandura's (1997) theory of self-efficacy, which defines a relationship between human beliefs and motivation. The higher the self-efficacy, the greater the motivation and likelihood to cope with consequences resulting in behavior changes (Bandura, 1997; Hall & Trespalacios, 2019; Hivner et al., 2019). Thus, social networks involving ICT have the potential to change a teacher's social system and promote their technological self-efficacy, subsequently improving their motivation and attitudes towards ICT.

Teachers often struggle to use ICT consistently in the classroom because of a lack of technological self-efficacy (Christie, 2016; Cook et al., 2017; Kwon et al., 2019; Lee et al., 2017). Online PLNs can influence technological self-efficacy by providing teachers with experiences that build their confidence and attitudes towards ICT (Edwards, 2017; Prestridge, 2019; Tour, 2017a, 2017c; Trust, 2016; Trust et al., 2018). In this study, I interviewed online PLN users to determine whether online PLNs influence their perceptions of their technological self-efficacy.

Nature of the Study

The purpose of this study was to explore the influence of online PLNs on teachers' perceptions towards ICT and their technological self-efficacy. I used a basic qualitative study design with semistructured interviews to allow participating teachers to explain their experiences using an online PLN and their attitudes, beliefs, motivation, and perseverance using ICT in the classroom. The use of such a design allowed for a greater understanding of the phenomena and how teachers interpreted their experiences (see Merriam & Tisdell, 2016). Purposive sampling was used to identify eight kindergarten to 12th grade teachers who had a well-developed online PLN. Nonprobability sampling allowed for an expert sample of the population of teachers who use online PLNs (see Lavrakas, 2008). The data collected were analyzed using two rounds of in vivo coding, followed by thematic analysis. These data analysis methods align with the study's purpose to explore participants' experiences with online PLNs (see Saldaña, 2016).

Definitions

Informal learning: Learning that occurs outside of a formal structure or set of guidelines (Sharma & Raghuvanshi, 2020).

Information communication technology (ICT): Computing technologies that are used to enhance teaching and learning (Cherner & Curry, 2017; Christensen et al., 2018)

Online professional learning networks: A series of connections and resources used to develop skills informally through collaboration and knowledge exchange, including, but not limited to, social media platforms and Web 2.0 tools (Prestridge et al., 2019).

Teacher professional development: A process in which teachers develop their skills over time to better understand pedagogy (Lee et al., 2017; Thacker, 2017).

Technological self-efficacy: An individual's beliefs of their capabilities to use technology (Kwon et al., 2019; Yoo, 2016).

Assumptions

I assumed that each teacher in the study would answer the questions honestly and thoughtfully, as it was essential for them to convey their experiences with the phenomena. I also assumed that each participant had a fully developed online PLN and had honestly answered the prescreening questions about this important aspect of the study. Last, I assumed that teachers who have developed online PLN share the common goal of developing their skills to become better teachers and have the skills to develop a quality online PLN. The accuracy of such assumptions is necessary to the study's validity and trustworthiness and overall accuracy of its findings (see Ravitch & Carl, 2016).

Scope and Delimitations

The study's primary focus was on teachers' technological self-efficacy and whether online PLNs can influence such, subsequently encouraging teachers to implement ICT in the classroom more consistently. Online PLNs encourage teachers to develop their skill sets; however, further investigations are needed to determine their influence on teachers' practice and self-efficacy, particularly technological self-efficacy (Liu et al., 2018; Tour, 2017a; Trust, 2016; Trust et al., 2018). Eight K-12 teachers in a northwest Pennsylvania school district comprised the sample for this study; each teacher in the study had an established online PLN for over a year. To best understand participating teachers' experiences with online PLNs, I determined that a basic qualitative design with interviews was most appropriate (see Merriam & Tisdell, 2016). Teachers who are novice users or have never used an online PLN were not included in the sample. The focus of the study was primarily on those who had an established online PLN to provide insight into their perceptions of technological self-efficacy.

Exploring the influence of online PLNs on teachers' technological self-efficacy required active engagement and participation. This required a constructivist approach rather than a behaviorist or cognitive approach because learning through online PLNs is social and personal (see Ifenthaler & Schumacher, 2021). I considered but opted against using connectivism because of criticism that the theory is not based on scientific peer-reviewed research (Ifenthaler & Schumacher, 2021). I also drew from social learning theory because I sought to explore the influences of social networks on teachers' technological self-efficacy. As Ravitch and Carl (2016) suggest, a conceptual framework

such as this may broaden the applicability of the research. The emerging themes may provide descriptive influences of online PLNs that can also be transferable to other online PLN users for PD purposes outside of ICT.

Limitations

The sampling strategy, sample size, and research site have limitations. Purposeful sampling presents limitations as another researcher may select a different group of participants for the study based on other characteristics (Lavrakas, 2008). The sample size was small but appropriate for a basic qualitative research study as long as the data collection reached saturation (see Burkholder et al., 2016; Merriam & Tisdell, 2016). To address this limitation, I continued collecting additional data until saturation was achieved. Another limitation of the study site is that the community is rural and does not represent those who reside in urban areas; however, through purposeful sampling, the sample can highlight the average teacher using online PLNs regardless of geographical area (see Merriam & Tisdell, 2016). To address this limitation, I strove to be transparent and include the rural context in the description of the study.

The use of semistructured interviews may also have presented limitations as participants may not have provided complete and truthful accounts of their experiences. However, this limitation was countered by developing questions that prompted respondents to reveal their successes and positive experience regarding the phenomena (Merriam & Tisdell, 2016). I sought to do so, as illustrated in the interview guide (see Appendix A). Basic qualitative research designs with interviews have limitations because they do not permit triangulation or data collection from multiple sources to assure

validity. Reflexivity and data saturation can be used to confirm validity (Merriam & Tisdell, 2016). Additionally, reliability and consistency can attest to the study's validity, providing transferability (Burkholder et al., 2016). To further transferability, future researchers should investigate the influence of online PLNs in other geographical areas.

Significance

This study contributes to the body of literature on the study topic in several ways. For example, research has shown that ICT and instructional strategies for implementing such technologies will continue to change, requiring teachers to continuously develop their skills to implement such technologies in the classroom (Cherner & Curry, 2017; Christensen et al., 2018; Delić-Zimić & Gadžo, 2018). This study adds to this knowledge by providing insight on whether PLNs are a useful way to help teachers keep up with the changing landscape in ICT. Additionally, research has shown that teachers with higher technological self-efficacy implement ICT more consistently (Bandura, 1997; Hatlevik, 2017; Kwon et al., 2019; Moreira-Fontán et al., 2019; O'Neil & Krause, 2019; Tilton & Hartnett, 2016). Building on these findings, I investigated whether PLNs can improve teacher technological self-efficacy. Finally, research has shown that online PLNs can potentially influence teachers' technological self-efficacy by encouraging collaboration, reflection, and other opportunities through anytime, anywhere learning and by encouraging teachers to stay abreast of these changes, which subsequently may allow them to implement ICT more consistently (Carpenter et al., 2019; Czerkawski, 2016; Edwards, 2017; Kearney & Maher, 2019; Krutka et al., 2017; Nicholas et al., 2018; Noble et al., 2016; Oddone et al., 2019; Prestridge et al., 2019; Trust, 2016). In summary,

this study extends the research on PLNs and their ability to help teachers negotiate the changing landscape of ICT, develop more self-efficacy, and benefit from PLN experiences.

The study also provides further insights into online PLNs and their influence on teachers' practice. In conducting the study, I sought to advance knowledge regarding teachers and their technological self-efficacy and opportunities to develop their skills informally. This knowledge may lead to changes in preservice teacher preparation programs by informing school district leaders of the value of implementing teacher development regarding ICT and potentially other developmental areas. This study may also clarify additional research opportunities on uses of online PLNs for improving teaching practice.

Online PLNs can encourage teachers to learn informally through collaboration with other teachers outside of their geographical area. School district leaders can encourage teachers to utilize online PLNs to complement their current PD opportunities, potentially reducing the districts' burden to provide PD.

Summary

Teachers may lack the confidence of mastery-level experiences to implement ICT into the classroom consistently (Kwon et al., 2019; Lee et al., 2017; Tilton & Hartnett, 2016; Yildiz Durak, 2019). Online PLNs have the potential to increase teachers' technological self-efficacy and desire to implement ICT more consistently (Adjapong et al., 2018; Bandura, 1997; Christie, 2016; Durksen et al., 2017; OECD, 2020; U.S. Department of Education, 2017). The purpose of this basic qualitative study was to

explore the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom. I wanted to contribute to the body of research on online PLNs and their influence on teachers' practice. In Chapter 2, I will review literature on the gap in practice and justify the chosen methodology and conceptual framework.

The potential positive social impact of this study is that it may provide encouragement to principals and curriculum directors to allow and provide PLN support to their teachers to develop ICT skills and technological self-efficacy. It may also elucidate if and how PLNs are able to encourage the development of these skills and technological self-efficacy. This knowledge may be useful to PLN coordinators as they design their interfaces and support structures.

Chapter 2: Literature Review

The problem addressed in this study was the lack of knowledge on how online PLNs influence teachers' technological self-efficacy when using ICT in their practice. The purpose of this basic qualitative study was to explore the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom. Many teachers lack confidence in implementing ICT in the classroom due to the lack of necessary experience to transform such skill sets (Durksen et al., 2017; Lee et al., 2017; Parsons et al., 2019; Prestridge, 2017; Slagoski, 2019).

A lack of teacher PD for ICT results in a lack of mastery-level experiences, resulting in less confidence and negative attitudes towards ICT. According to TALIS 2018 data, 40% of U.S. teachers reported not receiving PD for ICT in the past year (OECD, 2019). The PD that is offered has been extensively criticized for having one size fits all, traditional approaches that yield little to no benefit, mostly due to growing demands for other mandated training and lack of time and resources (Bowe & Gore, 2017; Carpenter et al., 2019; Christensen et al., 2018; Christie, 2016; Krutka et al., 2017; Tour, 2017a, 2017b). As a result, 66% of teachers feel they are not prepared to use ICT in the classroom (OECD, 2019). Positive teacher experiences with technology have a positive effect on teachers' technological self-efficacy, which can be an internal factor influencing teachers' abilities to implement ICT in the classroom (Bandura, 1997; Hatlevik, 2017; Kwon et al., 2019; Lee et al., 2017; Moreira-Fontán et al., 2019; O'Neil & Krause, 2019; Prestridge, 2017; Tilton & Hartnett, 2016; Yoo, 2016). In this basic

qualitative study, I explored the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom.

In this chapter, I will review Albert Bandura's social learning theory (1971) and application of self-efficacy to human agentic perspectives. This theory may clarify why teachers are not implementing ICT in the classroom consistently and how technology can influence social systems resulting in behavioral changes through technology (see Bandura, 2001). In addition, I will review the literature search strategy and review the conceptual framework and key variables. Key topics include Bandura's social learning theory, online PLNs, and teacher PD as they relate to the key variables and concepts of the study. The chapter will conclude with a summary and conclusions section.

Literature Search Strategy

EBSCOhost, Academic Search Premier, and Google Scholar were the primary databases used to obtain information from peer-reviewed journals. SAGE Knowledge was an additional database that was used to obtain seminal works regarding social learning theory. I used the following keywords in multiple combinations to find seminal works and peer-reviewed journal articles: *self-efficacy, technological self-efficacy, social learning theory, social cognitive theory, Albert Bandura, PLN, professional learning network, personal learning network, ICT, information communication technology, teacher professional development, teacher learning growth, teacher informal learning, social networked learning,* and *technology integration*.

I used SAGE Knowledge primarily to find Alert Bandura’s seminal works regarding social cognitive theory and social learning theory related to self-efficacy. The

search strategy for finding peer-reviewed articles involved using EBSCOhost and Academic Search Premier in a tiered method by searching for literature on teacher PLNs and any combination of PLN. The second-tier search included combinations of *teacher technological self-efficacy* and *ICT*. The third tier then focused on combining *teacher technological self-efficacy*, *ICT*, and *online PLNs*, which did not include many studies. All searches were limited to a publication date of 3-5 years. Additional resources were located following the reference list of researchers who have consistently published research relating to the key topics. Researched ceased when reoccurring evidence indicating saturation of the literature was observed.

Conceptual Framework

For the contextual lens framing this study, I used Bandura's social learning theory. Bandura (1962) recognized that learning occurs in natural settings and argued that social agents could not be ignored when analyzing how humans learn. Bandura (1971) identified a reciprocal influence process between environmental and personal factors that affects behaviors. According to social learning theory, changes in behaviors do not occur unless humans know the outcome, which influences the expectation, and therefore, changes the behavior.

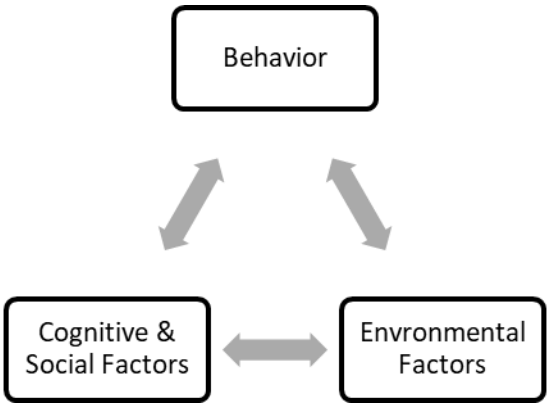
Bandura (1977) later identified these expectations involved in the reciprocal influence process and termed them *self-efficacy*. Self-efficacy is defined as a level of confidence in expected results. Perceived self-efficacy affects motivation and abilities to cope; thus, high perceived self-efficacy results in innate abilities to deal with consequences. On the contrary, low perceived self-efficacy will likely result in a lack of

humans' ability to cope with the behavior's consequence. Eventually, with little perceived self-efficacy, behaviors will not likely change and result in "self-debilitation expectations" (p. 288) indicating that perceived self-efficacy is a predictor of performance (Bandura & Adams, 1977).

Bandura recognized motivation through consequences, cognition, and social factors as a key to learning and changing behaviors. These processes are presented as triadic reciprocal causation, where learning occurs through the interplay of cognitive, social**,** and environmental factors that influence behaviors (Bandura, 1989). These findings resulted in Bandura (1986) changing the theory from social learning theory to social cognitive theory. Nonetheless, Bandura recognizes a series of processes that influence the cognitive phase and self-efficacy within triadic reciprocal causation (see Figure 1).

Figure 1

Triadic Reciprocal Causation



Note. The figure shows the interplay of social, cognitive, and environmental factors affecting behavior. Adapted from "Social Cognitive Theory of Mass Communication," by A. Bandura, 2001, *Media Psychology*, 3(3), p. 266 (https://doi.org/10.1207/S1532785XMEP0303_03). Copyright 2001 by Taylor and Francis, LTD. Reprinted with Permission (see Appendix B).

Self-Efficacy and Cognitive Processes

Cognitive, affective, and selective processes comprise the overarching cognitive process found within the triadic reciprocal causation cycle. These subsets of processes influence perceived self-efficacy and determine whether individuals will change their behaviors based on their beliefs, consequences of behaviors, motivation, and confidence (Bandura, 1989). For example, if an individual had a positive experience using technology, it would positively influence their belief that they can use technology and therefore, build their motivation and confidence to continue to use technology.

The cognitive process recognizes that humans have internal self-efficacy beliefs, and these beliefs affect thought patterns, which can be self-aiding or self-hindering. This cognitive process recognizes that perceived self-efficacy strongly influences the behaviors' outcome (Bandura, 1989). Such a process leads to motivation; for example, a higher perceived self-efficacy will likely lead to higher motivation and greater perseverance towards a behavior. On the contrary, low perceived self-efficacy will likely result in less motivation and a greater acceptance of mediocrity (Bandura, 1989).

The affective process relates to humans and their ability to handle stress or negative consequences, which they experience before foregoing the behavior. A positive experience influences the affective process and leads to better perseverance and the ability to handle adversity. This experience also influences their motivation and the likelihood of participation in a similar experience. The affective process relates directly to motivation and confidence (Bandura, 1989). Therefore, a person who has motivation and confidence from similar experiences through the affective process will likely have a greater perceived self-efficacy and more likelihood to change behavior.

The last process is the selective process, which refers to what endeavors individuals choose to undergo. Individuals will select endeavors based on their confidence in success; if they feel they will not succeed, they will likely elect to forego such an endeavor. The success rate for the selective process is determined by perceived self-efficacy (Bandura, 1989). The greater the self-efficacy, the greater the confidence and the greater the likelihood of choosing such an endeavor.

The cognitive phase encompasses all the influences individuals undergo when changing behavior. Motivation, confidence, and perseverance influence behaviors based on the cognitive phase of reciprocal causation. The other process influencing behaviors is the environmental process. Technology and social interactions can influence the environmental process and, therefore, influence behaviors (Bandura, 1989).

Mass Communication as an Environmental Processes

Social cognitive theory recognizes the shifts between behavioral, environmental, and social influences, specifically from an agentic perspective. Humans are self-regulating, self-reflecting, and proactive in developing and adapting to social systems and, therefore, are social system products (Bandura, 2001). Social systems influence behavior changes through direct and observation experiences. Similarly, mass communication technologies can also alter human behaviors because of their ability to change social systems (Bandura, 2001). As new technologies emerge, connecting humans without geographical boundaries, such technologies can also lead to human behavioral changes because humans motivate and regulate their behaviors based on their beliefs (Bandura, 2002). Not only does technology allow for the expansion of information, but it also enables individuals to create social networks allowing the sharing of knowledge and information for problem-solving and learning (Bandura, 2002). Therefore, through triadic reciprocal causation, individuals can learn from each other through technological channels, which influence their behavior by changing social systems; this is an environmental influence. The cognitive factors include self-efficacy and the cognitive, affective, and selective processes, which play a significant role in this learning process.

Because self-efficacy is a predictor of success, teachers can potentially change their social system through technology, build their self-efficacy, improve their teaching practice, increase motivation, and develop abilities to cope with adversity (Bandura, 2002).

In this qualitative study, I explored the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom. According to Bandura (1993), teachers' perceived self-efficacy significantly impacts their ability to use ICT in the classroom consistently. The theory utilizes processes in which self-efficacy affects outcomes of behaviors. If teachers have a high perceived self-efficacy regarding their ability to implement ICT, their cognitive process will conclude a positive attitude and motivation, leading to a more likelihood the teacher implements ICT consistently. Mass communication tools such as social media can change teachers' social systems by influencing their processes. Social media is an environmental influence in the reciprocal causation and influences the social and cognitive processes. Thus, online PLNs can positively influence teachers' perceptions of their technological self-efficacy for using ICT in the classroom.

Self-Efficacy and Social Cognitive Theory in Education

Social cognitive theory and self-efficacy are used frequently in the field of education as theoretical frameworks. Quantitative research indicates relationships among multiple variables and self-efficacy. Arslan (2019) completed a correlation study that measured the relationship between teachers' teaching self-efficacy sources, teaching self-efficacy, and attitude towards teaching. The study found that teacher emotional states,

mastery level, and verbal persuasion predict teacher self-efficacy and attitudes towards teaching. Also found were relationships between teacher work engagement, job satisfaction, and work engagement (Granziera & Perera, 2019; Perera & John, 2020), indicating high self-efficacy leads to better work engagement and job satisfaction. Other variables relating to self-efficacy are principal support, collective efficacy, and school affiliation, positively influencing teacher self-efficacy, while principal support and available instructional resources positively impact job satisfaction (Aldridge & Fraser, 2016). Teachers with higher perceived self-efficacy have better classroom management, are more organized, utilize student-centered instructional strategies, and provide student feedback at a higher rate (Perera & John, 2020). However, other research has found less significant relationships between student outcomes to teacher self-efficacy (Zee et al., 2018). Other research expresses the difficulties in quantitively measuring student outcomes as they correlate to teacher self-efficacy (Pajares, 1996), indicating a need for further investigations that match perceived capabilities to specific behavioral outcomes (Bandura, 1986). Moreover, most research regarding social cognitive theory focuses on teacher professional development and its influence on teacher self-efficacy.

Teacher collaboration is the most critical factor influencing teacher self-efficacy. The greater teacher collaboration, the more positive effect teachers have on student learning and achievement (Durksen et al., 2017; García-Martínez et al., 2020). Personalized professional learning also significantly influence teachers' technological self-efficacy (Hall & Trespalacios, 2019). Other influences exist between personalized teacher PD, teacher self-efficacy, and technology integration (Hall et al., 2019). Like

personalized professional learning, school district leaders that create high-functioning professional learning communities (PLCs) develop higher teacher collective efficacy, improving student achievement (Voelkel, 2019; Voelkel & Chrispeels, 2017). Teachers' attitudes and technological self-efficacy also affect student motivation and engagement (Zhang, 2019). Other research supports social network-supported microteaching (SNSM) and increased teacher self-efficacy (Kelleci et al., 2018). More specifically, social networking can potentially contribute to teacher self-efficacy and attitudes.

Social learning networks are a popular method for which teachers use for PD. Social networked learning through social media platforms, blogs, or learning communities allows teachers to develop professionally by building mastery-level experiences and self-efficacy (Anders, 2018). Networked learning is valuable when teachers can develop instructional strategies, receive feedback, and develop coping skills, which coincide with Bandura's social cognitive theory (1997). As a result, when teachers have such opportunities to collaborate and reflect on teaching, their self-efficacy increases (Yoo, 2016). More specifically, when teachers have opportunities to discuss their experiences on effective teaching strategies and how they overcome barriers, their self-efficacy increases, raising their motivation and ability to teach more effectively (Hivner et al., 2019).

Social cognitive theory's triadic reciprocal causation indicates that individual behaviors change when influenced by social, cognitive, and environmental factors (Bandura, 1986). According to the theory, mass communication tools such as social media can change social systems (Bandura, 2001). The theory suggests that individual

behaviors change through direct and observational experiences through mass communication, leading to a change in social systems. The theory also recognizes that humans are motivated and self-regulated through their perceived self-efficacy. Thus, mass communication tools can change behaviors because of their ability to improve an individual's perceived self-efficacy. Therefore, online PLNs can change teachers' social system, serving as a form of networked learning, increasing teachers' technological self-efficacy and attitudes.

This basic qualitative study explored the influence of online PLNs and teachers' self-efficacy for implementing ICT into the classroom. Teacher collaboration can influence self-efficacy (Adjapong et al., 2018; Cook et al., 2017; Greenhow et al., 2019; Prestridge, 2019). This study contributed to the existing body of research exploring variables that influence teacher self-efficacy. Online PLNs can change social systems and allow teachers to grow their technological skills by changing their social system and providing opportunities to collaborate without the constraints of geographical borders; both are vital aspects to teacher development (Bandura, 2001; Durksen et al., 2017).

Literature Review Related to Key Concepts and Variable

ICT in Education

Educational Technology in education is a relatively new phenomenon, and the industry continues to grow rapidly. Federal initiatives in 1996 encouraged the implementation of technology in the classroom (Department of Education, 1996). This initiative responded to the technical revolution and prepared students for post-graduation by developing their technological skills in the classroom. Initially, computers in

education were used to automate print, which coincided with basic instructional methods of drill and practice (Siegle, 2004). With the development of new technologies that encompass the ability to collect, share, and create new information through communication technologies, instructional practices focused less on delivering instruction and more on utilizing ICT as a learning tool (Siegle, 2004). Today, technologies permit teachers to develop collaborative learning experiences for students far beyond a projector's use in the early 1990s (Cherner & Curry, 2017). The rapid growth of ICT and other federal and state initiatives for implementing ICT into the classroom have made technology an essential aspect of teaching and learning (Christensen et al., 2018).

ICT can be used in a variety of manners for teaching and learning. The implementation of educational technology encourages student motivation (Delić-Zimić & Gadžo, 2018). Additionally, technology allows for more efficient delivery of instruction, permits students to develop creative works while using the internet, and opens communication channels and collaboration through interactive technologies (Delić-Zimić & Gadžo, 2018). Such efforts support learning in engaging ways, transferring knowledge actively rather than passively (Christensen et al., 2018).

Much research supports ICT use in the classroom, prompting additional research examining teachers' use rather than the technological tools themselves (Cherner & Curry, 2017). In many classrooms, ICT supports traditional teaching, such as delivering instruction rather than using technology as a learning tool. It is often only used for administrative purposes, such as taking attendance or email (Lee et al., 2017). Raising

essential questions on whether using technology enhances students' learning and better prepares students for post-graduation or has adverse effects. Student learning has a significant advantage when students utilize technology with guided or active learning strategies compared to those who use technology with traditional forms of instruction (Lee et al., 2017). However, encouraging teachers to develop such strategies can be difficult.

Technology continues to change, requiring teachers to stay abreast of those changes while meeting the demands of high-quality teaching (Parsons et al., 2019; Thacker, 2017). Teachers' pressure to increase student achievement by improving their skills is paramount (Trust, 2017). School district leaders emphasize teacher development of ICT (Edwards, 2017), but because schools are inundated with vast PD requirements, many teachers do not gain necessary ICT skills, creating a skill level gap (Christie, 2016; Longhurst et al., 2016). Changes in technology, federal and state initiatives, new teaching strategies, district initiatives, and teachers' expectations to produce technologically savvy students contribute to teacher PD demands (Christie, 2016; García-Martínez et al., 2020; Hatlevik, 2017). The term PD can include various formal and informal learning activities that provide teachers with skills to create better learning experiences for students (Longhurst et al., 2016; Tour, 2017c). Teacher PD is critical to the education industry as teachers need to develop their skills to stay abreast of technology changes.

Teacher PD

Researchers have attempted to find the most effective method to deliver teacher PD, but the results differ (Longhurst et al., 2016). Ideally, teacher PD should operate as a

change agent, changing a teacher's practice to improve student outcomes (Azorín et al., 2020; Edwards, 2017); however, such change does not always occur (Cook et al., 2017; Krutka et al., 2016). Much research suggests teacher PD should focus on student outcomes (Parsons et al., 2019), but changing teachers' practice requires a support system for teachers to receive help and feedback (Adjapong et al., 2018). Without such support systems, changing a teacher's practice may be challenging (Trust, 2016). Traditionally, the delivery for most teacher PD is through one-size fits all approaches, such as workshops, seminars, or expert presentations, causing less measurable results as all topics are not applicable for every teacher (Adjapong et al., 2018; Cook et al., 2017; Durksen et al., 2017; Edwards, 2017; Kearney & Maher, 2019; Krutka et al., 2017; Parsons et al., 2019; Prestridge, 2017; Slagoski, 2019; Thacker, 2017; Tour, 2017a). Although challenging to meet the needs of every teacher (Kennedy, 2016), traditional forms of teacher PD have few measurable effects on teacher practices (Bowe & Gore, 2017; Longhurst et al., 2016; Oddone et al., 2019; Slagoski, 2019), indicating an unlikeliness of changing teachers' practice (Christie, 2016; Slagoski, 2019). Most traditional PD forces teachers to be passive receivers of information and do not engage teachers as experts (Krutka et al., 2016; Nicholas et al., 2018), reducing the likelihood of change (Edwards, 2017; Krutka et al., 2016). Mainly because this form of learning "de-skills teachers from their intellectual work (Krutka et al., 2016; Slagoski, 2019)" as learning is taking place through a single educational source rather than a plethora of scholarly sources through ongoing development (Goria et al., 2019). Other research has found that most traditional

forms of PD are sporadic and inconsistent (Noble et al., 2016). Changing teachers' practice is complex, and therefore, delivering teacher PD is also challenging.

Changing a teacher's practice is challenging, but researchers are discovering changes through personalization and motivation. Examining teacher beliefs and providing an appropriate, personalized development plan is critical to changing a teacher's practice (Adjapong et al., 2018; Parsons et al., 2019). When this personalization, or teacher agency, coincides with ongoing, active, and collaborative PD, teachers are more likely to change their practice (Oddone et al., 2019; Parsons et al., 2019; Thacker, 2017). This personalized plan influences teacher experiences, attitudes, values, and behaviors towards the profession (Adjapong et al., 2018; Edwards, 2017) and school culture and leadership (Parsons et al., 2019). Other research argues that teacher PD lies specifically within the teacher's motivation and should be a process that nurtures teachers' intrinsic motivation (Durksen et al., 2017; Parsons et al., 2019). These teacher attributes relate to their technological self-efficacy, suggesting further investigations into whether teachers' technological self-efficacy can influence their ICT use in the classroom.

ICT and Self-Efficacy

There are external and internal factors affecting teachers' consistency using ICT. The internal factor is teachers' technological self-efficacy and belief system (Lee et al., 2017). Technological self-efficacy refers to teachers' beliefs in their ability to effectively use ICT in the classroom (Moreira-Fontán et al., 2019). Teachers can overcome these internal obstacles by developing their skills while collaborating with other teachers on

best practices, increasing their beliefs and self-efficacy (Prestridge, 2017; Yoo, 2016). Teacher PD is shown to have a positive influence on teacher self-efficacy (Yoo, 2016).

Self-efficacy is a predictor of outcomes; the higher the self-efficacy towards a specific behavior, the more significant the behavior changes (Bandura, 1997; Tilton & Hartnett, 2016). Therefore, a teacher with high technological self-efficacy should implement ICT more in their classroom than a teacher with low self-efficacy (Kwon et al., 2019; O'Neil & Krause, 2019). The same concept applies to ICT and the evaluation of digital information. Self-efficacy for simple ICT skills predicts whether a teacher can evaluate digital information (Hatlevik, 2017). The higher the self-efficacy, the greater the motivation to persevere (Bandura, 1997; Hatlevik, 2017; Moreira-Fontán et al., 2019; Tilton & Hartnett, 2016). As a result, teachers have positive emotions when using ICT in the classroom (Moreira-Fontán et al., 2019). Additional variables, such as self-efficacy in online collaboration and digital competence, can also predict teachers' use of ICT (Hatlevik, 2017). Many teachers do not use ICT in the classroom because of their lack of ICT knowledge, low technological self-efficacy and beliefs, and negative cultures around teaching with technology (Kwon et al., 2019).

Teacher beliefs, attitudes, and self-efficacy are related (Lee et al., 2017; Tilton & Hartnett, 2016). A teacher who has a high self-efficacy regarding ICT will tend to have a more powerful belief system for using ICT in the classroom (Kwon et al., 2019; Lee et al., 2017; Tilton & Hartnett, 2016). Teachers who have more positive attitudes towards ICT show more success using ICT in the classroom (Yildiz Durak, 2019). Effecting these variables are the teachers' years of experience and technical skills, indicating the more

years of experience a teacher has, the less technical skills and self-efficacy, therefore, less implementation of ICT in the classroom (Kwon et al., 2019). Technology continuously changes, and teachers with less technical experience are more likely to lack mastery-level skills, resulting in less technological self-efficacy (Tilton & Hartnett, 2016). Others argue that teacher beliefs and attitudes towards ICT develop during their experiences in primary and secondary education (O'Neil & Krause, 2019). However, there is a difference in teacher beliefs and self-efficacy, as self-efficacy refers to a teacher's competence to achieve specific behaviors while using ICT. In contrast, their beliefs would involve the appropriateness of technology for learning (Kwon et al., 2019). Researchers also argue that environmental factors influence ICT use, such as support from administration and technical assistance (Kwon et al., 2019; Lee et al., 2017; O'Neil & Krause, 2019).

Lack of time, limited PD and resources, administrative and technical support, high expectations, and lack of technological infrastructure are all variables that affect teachers' technological self-efficacy (Kwon et al., 2019; Lee et al., 2017; O'Neil & Krause, 2019). Indicating that a teacher who believes ICT is essential for teaching and has technical and administrative support will likely have higher technological self-efficacy, even though they may lack technical skills (Kwon et al., 2019). Further, research indicates the most influential type of teacher PD for efficacy and beliefs is through collaboration with other teachers, which also influences collective efficacy (Durksen et al., 2017; Prestridge, 2017, 2019). Other researchers indicate that mastery experiences, observations of successful ICT use, mentorship, and physiological symptoms can affect technological self-efficacy (Tilton & Hartnett, 2016; Yildiz Durak, 2019). Teacher collaboration can be

essential for teacher PD, influencing self-efficacy and collective efficacy (Durksen et al., 2017; Prestridge, 2017, 2019). Other researchers indicate that feedback, observation of exemplary teaching also influence self-efficacy (Yoo, 2016). Therefore, providing collaborative opportunities, technical and administrative support, and opportunities to use technology results in higher technological self-efficacy, as social cognitive theory indicates (Bandura, 1989). There are slight changes in teacher ICT beliefs in one year of teacher ICT PD; however, a significant increase in beliefs after two years of collaborative PD. On the contrary, teacher technological self-efficacy has a significant growth every year of collaborative teacher ICT PD (Lee et al., 2017; Longhurst et al., 2016).

Specific changes in teacher beliefs occur when they have successful personal experiences with ICT over a more extended period (Lee et al., 2017; Longhurst et al., 2016). The same is correct for teacher technological self-efficacy; more extended periods of teacher technological PD usually yield higher technological self-efficacy (Lotter et al., 2018). Other experiences, such as observing other teacher's successful use of ICT in the classroom, can also change a teacher's belief regarding ICT while participating in collaborative PD can also influence a teacher's ICT beliefs (Lee et al., 2017; Longhurst et al., 2016; Lotter et al., 2018; Tilton & Hartnett, 2016). The process in which teachers reflect on their teaching and modify their instruction with collaboration and feedback results in higher self-efficacy (Lotter et al., 2018; Prestridge, 2017) by changing teachers' beliefs regarding ICT in the classroom (Prestridge, 2017). This process is identical to the constructs of an online PLN (Adjapong et al., 2018; Carpenter et al., 2016; Edwards, 2017; Greenhow et al., 2019; Kearney et al., 2020; Krutka et al., 2017, 2016; Oddone et

al., 2019; Prestridge, 2019). Teachers who use an online PLN have the potential to change their beliefs and technological self-efficacy through ongoing, collaborative PD, which encompasses reflection and content sharing, are more likely to implement ICT into their classroom more consistently.

Online PLNs

To change teachers' practice using ICT in the classroom, teachers must go through ongoing PD, forcing reflection instead of short, one-time events such as traditional PD (Lee et al., 2017; Prestridge, 2019; Slagoski, 2019). Teacher PD for ICT is critical as the technologies change (Moreira-Fontán et al., 2019). However, focusing teacher PD on teachers' abilities to implement ICT in the classroom is more important than learning to use the tool (O'Neil & Krause, 2019). Teachers are actively seeking PD opportunities for ICT outside of the traditional PD formats, which is why they are turning to digital technologies such as PLN (Prestridge, 2017). Online PLNs provide teachers personalized, anytime, anywhere learning (Carpenter et al., 2019; Kearney & Maher, 2019; Krutka et al., 2017; Oddone et al., 2019; Parsons et al., 2019; Prestridge, 2017, 2019). Others are finding collaboration to be a significant factor in the development of teachers.

Traditional PD leaves many teachers in isolation, leaving teachers to solve problems independently with limited time and a lack of access to knowledgeable professionals in the field (Edwards, 2017; Nicholas et al., 2018; Slagoski, 2019). There tends to be a disconnect for those teachers left in isolation, the changes in technology, and best practices for using ICT in the classroom (Nicholas et al., 2018). However, those teachers left in isolation are beginning to utilize technology to build collaborative

opportunities to solve classroom problems (Adjapong et al., 2018; Christie, 2016; Durksen et al., 2017; García-Martínez et al., 2020; Lantz-Andersson et al., 2018; Prestridge et al., 2019; Slagoski, 2019; Trust, 2017). Such discoveries indicate that teacher collaboration is a crucial aspect of teacher PD (Adjapong et al., 2018; Cook et al., 2017; Greenhow et al., 2019; Prestridge, 2019). Other teachers indicate feedback being an essential aspect of teacher PD (Parsons et al., 2019). These digital connections are permitting teachers to create personalized, bottom-up, active learning experiences that facilitate communication beyond the borders of the school district (Cook et al., 2017; Forbes, 2017; Greenhow et al., 2019; Kearney et al., 2020; Prestridge, 2017; Slagoski, 2019; Trust, 2017).

Teachers are creating PLNs so that they can create additional professional development opportunities to grow their teaching skills by staying abreast of best practices and trends in the developments of education and technology (Dene Poth, 2020; Greenhow et al., 2019; Krutka et al., 2017; Lantz-Andersson et al., 2018; Trust, 2017). These social networks provide teachers an opportunity to develop their skills and interact with peers in similar situations without geographical barriers (Carpenter et al., 2019; Colwell & Hutchison, 2018; Edwards, 2017; Greenhow et al., 2019; Nicholas et al., 2018; Noble et al., 2016; Prestridge, 2019; Tour, 2017a; Trust, 2016, 2017). Much research indicates teachers moving to PLNs because of instant access to materials, resources, and professionals to improve their skills (Trust, 2017). A PLN is a personalized space where teachers engage in dialogue with professionals across the globe to support professional learning (Adjapong et al., 2018; Brown & Flood, 2020; Colwell &

Hutchison, 2018; Kearney & Maher, 2019; Krutka et al., 2016; Tour, 2017a, 2017b). Other researchers define the term "innovative, organic, collaborative, self-directed approach to professional learning enacted by educators" (Carpenter et al., 2016, p. 25). PLNs typically consist of two significant aspects; collaboration and retrieval of information (Cook et al., 2017; Goria et al., 2019). Some teachers must produce and share content for other teachers to retrieve information, promoting creativity (Forbes, 2017). Often, when teachers are seeking PD, they utilize their PLN to acquire resources specific to their development needs (Greenhow et al., 2019; Krutka et al., 2017, 2016; Lantz-Andersson et al., 2018; Noble et al., 2016; Oddone et al., 2019; Prestridge et al., 2019). Some teachers indicate that the essential aspect of their PLN is the involvement of sharing information, which helps teachers in numerous ways (Krutka et al., 2016; Nicholas et al., 2018; Noble et al., 2016; Oddone et al., 2019; Parsons et al., 2019; Prestridge et al., 2019; Tour, 2017a; Trust, 2016). Sharing information can benefit teachers holistically by increasing the knowledge base and enhancing the profession (Krutka et al., 2016; Prestridge, 2019).

These networks often use social media such as blogs, Edmodo, Twitter, Facebook, Pinterest, LinkedIn, and Teachers Pay Teachers as a platform to engage in such dialogue quickly and easily (Colwell & Hutchison, 2018; Greenhow et al., 2019; Kearney et al., 2020; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Prestridge, 2017). Many of the PD topics consist of technology, educational issues, teaching strategies (Adjapong et al., 2018; Czerkawski, 2016; Forbes, 2017; Greenhow et al., 2019; Krutka et al., 2016; Trust, 2016) and other teaching perspectives such as career

promotion and feedback (Czerkawski, 2016; Oddone et al., 2019). These discussions and interactions can be synchronous or asynchronous, leading to collective thinking and the development of new knowledge (Forbes, 2017; Krutka et al., 2017; Parsons et al., 2019). For example, a teacher seeking information on a specific ICT tool can turn to their PLN for advice and feedback from teachers who have successfully used the same tool (Krutka et al., 2017; Prestridge et al., 2019). Nonetheless, these informal learning networks are also known to influence more engaging and self-directed experiences (Czerkawski, 2016; Kearney et al., 2020).

Contrary to traditional teacher PD, online PLNs afford teachers the opportunities to engage in prolonged participation with peers applying new ideas and the results of those ideas (Edwards, 2017; Noble et al., 2016), providing anytime, anywhere learning (Carpenter et al., 2019; Kearney & Maher, 2019; Krutka et al., 2017; Oddone et al., 2019; Parsons et al., 2019; Prestridge, 2019; Trust, 2016). Such engagement and dialogue do not have to occur specifically online; face-to-face interactions are also part of a PLN (Carpenter et al., 2019; Nicholas et al., 2018). Mentorships, edcamps, Massive Open Online Courses (MOOCS), online courses, certificate programs, online conferences, and other "unconference initiatives (Kearney & Maher, 2019, p. 136)" are all part of a PLN. Traditional PD can also be part of a PLN (Krutka et al., 2017; Nicholas et al., 2018), which provides teachers opportunities to collaborate (Noble et al., 2016). These instances provide teachers with opportunities to grow and innovate beyond traditional-based PD (Noble et al., 2016; Trust, 2016). PLNs can also benefit forms of traditional PD by

extending the PD time and increasing teacher collaboration on the specific topic (Kearney & Maher, 2019; Nicholas et al., 2018).

PLNs build a sense of belonging and create opportunities to build relationships without the constraints of geographical borders. They encourage teachers to be more engaging educators, reflecting on their instructional practice (Adjapong et al., 2018; Goria et al., 2019; Greenhow et al., 2019; Kearney et al., 2020; Kearney & Maher, 2019; Krutka et al., 2017, 2017; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Slagoski, 2019; Trust, 2017). Reflection is essential for the teachers to change their practice as it forces teachers to discover better ways to improve their skills (Krutka et al., 2016; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Noble et al., 2016; Parsons et al., 2019; Prestridge, 2017). Teachers have extended time to experiment and collaborate through PLNs (Edwards, 2017; Krutka et al., 2016, 2017), which also increases motivation (Goria et al., 2019), generates new ideas for teaching (Kearney & Maher, 2019; Krutka et al., 2016; Lantz-Andersson et al., 2018; Noble et al., 2016; Parsons et al., 2019), and increases confidence (Krutka et al., 2016; Noble et al., 2016; Prestridge et al., 2019). More importantly, successful teacher collaboration afforded through their PLN turns teachers into "lifelong, connected learners" (Nicholas et al., 2018, p.171). Researchers have also found PLNs to successfully support school improvement (Brown & Flood, 2020) and classroom effectiveness (Greenhow et al., 2019).

Personalizing teacher PD is the most significant benefit to teachers using PLNs (Carpenter et al., 2016; Cook et al., 2017; Goria et al., 2019; Kearney & Maher, 2019). PLNs provide teachers with immediate access to instructional materials because of the

expansion of social (García-Martínez et al., 2020; Goria et al., 2019; Greenhow et al., 2019; Noble et al., 2016; Tour, 2017a), which enhances teachers' understanding of instructional strategies (Kearney et al., 2020; Noble et al., 2016; Tour, 2017a). PLNs also encourage a sense of connectedness (Cook et al., 2017; Forbes, 2017; Goria et al., 2019) and empowerment (García-Martínez et al., 2020). This process of discussing, sharing, collaborating, and reflecting helps teachers grow professionally (Noble et al., 2016; Slagoski, 2019). PLNs can also help teachers with burnout and social and emotional needs.

PLNs can help with teacher burnout by permitting teachers to build a sense of connectedness and empowerment (Greenhow et al., 2019; Kearney et al., 2020; Lantz-Andersson et al., 2018; Trust, 2017). Many teachers also indicate turning to their PLN for feedback from their connections, showing a sense of trust through strong relationships (Greenhow et al., 2019; Johnson et al., 2017; Kearney & Maher, 2019; Lantz-Andersson et al., 2018; Noble et al., 2016; Oddone et al., 2019; Parsons et al., 2019). Thus, increasing their emotional levels (Krutka et al., 2016; Noble et al., 2016). This connectedness increases quality teacher collaboration forcing greater understandings of pedagogy and instructional strategies (Kearney et al., 2020; Krutka et al., 2016; Parsons et al., 2019). It also helps rejuvenate teacher motivation causing a resurgence in excitement (Krutka et al., 2017). Additionally, these meaningful relationships and interactions are essential for teachers to develop professionally (Parsons et al., 2019; Slagoski, 2019). Teachers indicate that their PLN is where they can celebrate their classroom successes and discuss their failures (Krutka et al., 2016; Lantz-Andersson et

al., 2018). These relationships built from trust allow teachers to have an open mind regarding pedagogical changes and teaching strategies, helping them innovate new best practices (Noble et al., 2016; Oddone et al., 2019). PLNs are a form of informal learning, which is also a crucial aspect for teachers to develop professionally.

Due to technology and social media, PLNs create an informal learning experience (Czerkawski, 2016). Informal learning requires teachers to remain atop their skills in a society that continues to change through technology (Czerkawski, 2016). Many teachers learn informally and have expanded their knowledge, beliefs, motivation, and self-efficacy (Durksen et al., 2017; Prestridge, 2019). This ongoing, informal learning process is gaining popularity because of its effectiveness for teacher PD (Kearney & Maher, 2019; Parsons et al., 2019; Prestridge, 2019; Thacker, 2017). PLNs create "the notion of knowledge construction, distribution, and redistribution (Oddone et al., 2019, p. 114)." Some research has coined "unintentional learning (Tour, 2017a)" when teachers engage in digital content relating to their lives or work. An essential characteristic of informal learning is socialization, which is at the forefront of teacher PD and the purpose of online PLNs (Adjapong et al., 2018; Christie, 2016; Durksen et al., 2017). This socialization also aligns with Albert Bandura's social cognitive theory (Bandura, 1989). As social technologies advance and teaching moves online, some researchers find it harder to delineate formal and informal learning processes (Czerkawski, 2016; Prestridge, 2019). Aligning with Bandura's theory of mass communication (Bandura, 2001), technology provides opportunities for change through social systems.

There are, however, factors that can negatively influence teacher professional development. Some teachers may take time to develop such a learning network, and some inadvertently create an echo chamber (Cho, 2016). Echo chambers cause teachers to connect with colleagues who share similar cultural and ideological beliefs leading to fewer quality opportunities to learn new teaching strategies and pedagogical tools (Krutka et al., 2017). This concept can also lead to specific individuals dominating the conversations, preventing other teachers from contributing and reducing new knowledge transfer (Lantz-Andersson et al., 2018). The plethora of information and sources found in these networks can also be overwhelming for novice users (Carpenter et al., 2016), not to mention the overwhelming feeling of sharing information as a novice teacher with those who are more experienced (Kearney et al., 2020). Some may also struggle to manage personal networks and professional networks (Kearney & Maher, 2019), while others may fear criticism (Kearney et al., 2020; Parsons et al., 2019). Other aspects of PLN development can also have adverse effects, such as locating acceptable individuals to interact with, defining the network's outcome, and defining self-learning styles, influencing professional development (Czerkawski, 2016). Some teachers may also fear the time it takes to create and develop such comprehensive learning networks and the possibility of mixing personal and professional lives (Forbes, 2017). Researchers also indicate that for online PLNs to be effective, school districts should not merely provide the platforms for creating such informal networks as these may not necessarily be effective (Edwards, 2017). Ethical dilemmas may arise, such as student confidentiality and safeguarding student and teacher information (Forbes, 2017).

Previous Studies of Teacher Self-Efficacy

Quantitative research exists measuring the relationship of teacher self-efficacy with other variables such as student success or integration of ICT into the classroom. Each study has its strengths, for example, using proven, scholarly peer-reviewed data collection instruments to measure changes in self-efficacy. However, these studies have a limitation in that they include no recommendations for either qualitative or mixed-method designs to research subjective variables that might influence research findings (Arslan, 2019; Durksen et al., 2017; Granziera & Perera, 2019; Hall & Trespalacios, 2019; Lantz-Andersson et al., 2018; Lee et al., 2017; Perera & John, 2020; Yoo, 2016; Zee et al., 2018; Zhang, 2019).

Many researchers studying online PLNs and self-efficacy have used a mixed-methods design or qualitative design to collect data through interviews or observations, which adds to the study's strength and provided additional insights into the phenomena (Anders, 2018; Carpenter et al., 2016; Greenhow et al., 2019; Krutka et al., 2017; Parsons et al., 2019; Tour, 2017a; Trust, 2016). Such designs permit researchers to delve deeper into the phenomena to make further inferences regarding teacher self-efficacy (Saldaña, 2016).

The phenomena in this study are justified in the research as it will further qualitative investigations into how online PLNs can influence teachers' practice. Researchers have indicated that teachers with a higher technological self-efficacy are more likely to deliver instruction at a higher success rate, implement ICT more consistently, and positively influence student achievement because they have greater

confidence, motivation, and abilities to overcome adversity (Aldridge & Fraser, 2016; Bandura, 1986; Hatlevik, 2017; Mahler et al., 2018; Moreira-Fontán et al., 2019; Perera & John, 2020; Tilton & Hartnett, 2016; Zee et al., 2018; Zhang, 2019). Teachers who collaborate and are active in their professional growth have greater technological self-efficacy and, subsequently, are successful at implementing ICT into their practice (Durksen et al., 2017; García-Martínez et al., 2020; Hall et al., 2019; Hall & Trespalacios, 2019). Online PLNs can provide teachers the platform to develop professionally by building technological self-efficacy (Adjapong et al., 2018; Czerkawski, 2016; Forbes, 2017; Greenhow et al., 2019; Krutka et al., 2017; Oddone et al., 2019; Parsons et al., 2019; Trust, 2016). Researchers indicate that online PLNs have the potential to influence teachers' technological self-efficacy; however, further investigations are needed to explore how online PLNs influence teachers' technological self-efficacy (Carpenter et al., 2016; Hall & Trespalacios, 2019; Liu et al., 2018; Tour, 2017a, 2017b; Trust, 2016; Trust et al., 2018).

Gap in Literature

What is known about teacher technological self-efficacy and ICT PD with online PLNs is that online PLNs can increase teacher technological self-efficacy and provide teachers with a platform to grow their skills. Online PLNs allow teachers to collaborate, reflect, retrieve information, and build a sense of connectedness which increases emotional needs, confidence, and empowerment, all necessary in developing teacher growth (Adjapong et al., 2018; Brown & Flood, 2020; Colwell & Hutchison, 2018; Edwards, 2017; Hall & Trespalacios, 2019; Kearney et al., 2020; Krutka et al., 2016;

Noble et al., 2016; Slagoski, 2019; Tour, 2017a, 2017b) . What is controversial is that online PLNs challenge formal education systems and force school district leaders to trust teachers in their professional learning choices and consider those choices for credit towards continuing education credits (Carpenter et al., 2016; Krutka et al., 2016; Tour, 2017a, 2017b; Trust, 2016). What is unknown is how and why online PLNs influence teacher technological self-efficacy (Carpenter et al., 2016; Hall & Trespalacios, 2019; Liu et al., 2018; Tour, 2017a, 2017b; Trust, 2016; Trust et al., 2018).

The research related to the question how the use of online PLNs influence teacher perception of their technological self-efficacy in implementing ICT instructional practices in the classroom included the research on key principles of online PLNs, frameworks for developing online PLNs, and relationships between self-efficacy for ICT and online PLNs, and other influences online PLNs have on teachers' practice. This research is meaningful because further investigations are needed to explore how and why online PLNs influence teachers' technological self-efficacy (Carpenter et al., 2016; Hall & Trespalacios, 2019; Liu et al., 2018; Tour, 2017a, 2017b; Trust, 2016; Trust et al., 2018). Such questions force researchers to investigate online PLNs through qualitative approaches, allowing researchers to delve deeper into this new form of learning (Burkholder et al., 2016; Saldaña, 2016).

Summary and Conclusions

The major themes in this literature review included teacher technological self-efficacy as a predictor of performance, documenting that teachers with a more significant technological self-efficacy will implement ICT more consistently in the classroom

(Bandura, 1997; Tilton & Hartnett, 2016). Another major theme included teacher PD, which documented that many teachers lack mastery-level experiences using ICT and, therefore, struggle to implement ICT in the classroom confidently (Hatlevik, 2017; Kwon et al., 2019; Lee et al., 2017; Tilton & Hartnett, 2016; Yildiz Durak, 2019). Online PLNs can combat such lack of PD and increase teacher technological self-efficacy (Carpenter et al., 2016; Kearney et al., 2020; Krutka et al., 2017; Moreira-Fontán et al., 2019; Oddone et al., 2019; O'Neil & Krause, 2019; Parsons et al., 2019; Prestridge et al., 2019; Slagoski, 2019). The last major theme included online PLNs positively influencing teachers and their skill levels, but further research is needed to explore how they influence teachers' practice (Adjapong et al., 2018; Christie, 2016; Durksen et al., 2017; Lantz-Andersson et al., 2018; Tour, 2017a, 2017b, 2017c; Trust, 2016; Trust et al., 2018).

What is known about self-efficacy for ICT and PLN support includes that teacher self-efficacy affects multiple aspects of teaching and learning. Self-efficacy is a predictor of performance, a teacher with high self-efficacy is more likely to deliver instruction at high success rates, positively influencing student achievement because they have greater confidence, motivation, and ability to overcome adversity (Aldridge & Fraser, 2016; Bandura, 1986; Mahler et al., 2018; Perera & John, 2020; Zee et al., 2018; Zhang, 2019). The same applies to teachers' technological self-efficacy; the higher the technological self-efficacy, the greater the motivation and perseverance to learn new ICT and best practices for implementing such technologies (Bandura, 1997; Hatlevik, 2017; Moreira-Fontán et al., 2019; Tilton & Hartnett, 2016).

Teachers who have mastery-level technical experiences have better attitudes towards ICT and therefore have higher technological self-efficacy and implement ICT more consistently (Kwon et al., 2019; Lee et al., 2017; Tilton & Hartnett, 2016; Yildiz Durak, 2019). Technical and administrative support, feedback, and observation of exemplary teaching also affect technological self-efficacy and attitudes towards ICT (Kwon et al., 2019; Lee et al., 2017; O'Neil & Krause, 2019; Yoo, 2016). Successful teachers with high technological self-efficacy engage in collaboration and are active in developing their skills through personalized learning (Durksen et al., 2017; García Espinosa et al., 2015; Hall et al., 2019; Hall & Trespalacios, 2019). Such learning opportunities allow teachers to reflect and expand on their teaching strategies, increasing their self-efficacy and pedagogy (Hivner et al., 2019; Lantz-Andersson et al., 2018; Yoo, 2016).

Online PLNs are personalized informal learning opportunities where teachers engage in dialogue with peers across the globe (Adjapong et al., 2018; Brown & Flood, 2020; Colwell & Hutchison, 2018; Kearney & Maher, 2019; Krutka et al., 2016; Tour, 2017a, 2017b). Teachers are collaborating and reflecting on educational issues, teaching strategies, current technology trends and are providing feedback and retrieving information, which leads to enhancing collective thinking and the development of new knowledge (Adjapong et al., 2018; Czerkawski, 2016; Forbes, 2017; Greenhow et al., 2019; Krutka et al., 2017, 2016; Oddone et al., 2019; Parsons et al., 2019; Trust, 2016). Teachers are engaging in prolonged participation with peers on applying new ideas and the results of those ideas (Edwards, 2017; Noble et al., 2016). Such connectedness

enhances the social and emotional needs of teachers by building a sense of belonging, encouraging reflection, and increasing motivation, confidence, and empowerment, all of which are essential for teachers' development (Adjapong et al., 2018; Edwards, 2017; Goria et al., 2019; Greenhow et al., 2019; Kearney et al., 2020; Krutka et al., 2017, 2017; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Parsons et al., 2019; Prestridge, 2017; Slagoski, 2019).

Teachers' technological self-efficacy influences their consistency in implementing ICT into the classroom; it can be self-aiding or self-hindering (Bandura, 1986). Teacher PD influences teachers' technological self-efficacy (Bandura, 1997; Hatlevik, 2017; Kwon et al., 2019; Lee et al., 2017; Moreira-Fontán et al., 2019; O'Neil & Krause, 2019; Prestridge, 2017; Tilton & Hartnett, 2016; Yoo, 2016), and online PLNs influence teacher PD (Carpenter et al., 2019; Colwell & Hutchison, 2018; Edwards, 2017; Greenhow et al., 2019; Nicholas et al., 2018; Noble et al., 2016; Prestridge, 2019; Tour, 2017a; Trust, 2016, 2017). Online PLNs provide teachers with opportunities to collaborate and develop their skills to become better teachers. The process in which teachers reflect on their teaching and modify their instruction with collaboration and feedback results in higher technological self-efficacy and positive teacher PD (Adjapong et al., 2018; Edwards, 2017; Goria et al., 2019; Greenhow et al., 2019; Kearney et al., 2020; Krutka et al., 2017, 2017; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Parsons et al., 2019; Prestridge, 2017; Slagoski, 2019). Teacher collaboration is the most influential aspect of teacher PD influencing technological self-efficacy (Adjapong et al.,

2018; Cook et al., 2017; Durksen et al., 2017; García Espinosa et al., 2015; Greenhow et al., 2019; Hall et al., 2019; Hall & Trespalacios, 2019; Prestridge et al., 2019).

What is not known in relation to this topic is how and why online PLNs influence teachers' practice. The present study fills the gap in the literature of exploring these specific influences by collecting data regarding teachers' experiences using PLNs. The study will also extend the knowledge relating to online PLNs and their influences on teachers' practice. Online PLNs can be an effective form of teacher PD, but it is challenging to study their influences because they are personalizable; every PLN is different. Further, there is scarce empirical evidence supporting online PLNs and their influence on technological self-efficacy, mainly because online PLNs are a new development. This study will contribute to the ongoing investigations into the influence of online PLNs on teachers' practice implementing ICT into the classroom.

In Chapter 3, I present the study design and rationale. The role of the researcher, methodology, trustworthiness, ethical procedures, and summary are included in the chapter. The purpose of this study was to explore online PLNs influences on teachers' perceptions of their technological self-efficacy by collecting data through semi-structured interviews. Data analysis through thematic analysis provided further insights into such explorations.

Chapter 3: Research Method

The purpose of this basic qualitative study with interviews was to explore the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom. In this chapter, I will explain the research design and its rationale while also providing information on the interview protocol, sample recruitment process, data analysis, and the study's trustworthiness. I conducted semistructured interviews to explore participating teachers' experiences with the phenomena. The sample was recruited using a recruitment email sent to all school district teachers inviting them to participate in the study if they had used an online PLN for over a year; if prospective participants responded indicated their interest to participate, an additional email was sent for consent. Interviews were conducted via video conferencing software and were recorded. I shared the preliminary findings with the participants and asked them to inform me of any inaccuracies to ensure validity. Additionally, I developed the interview protocol and had it evaluated by an expert panel.

Research Design and Rationale

This study's guiding research question was, How do online PLNs influence teachers' technological self-efficacy for implementing ICT in the classroom? Online PLNs provide teachers opportunities to develop their skills, but further research is needed to determine how these experiences influence teachers' practice (Liu et al., 2018; Tour, 2017a; Trust, 2016; Trust et al., 2018). In this study, I explored those experiences and whether they influence teachers' perceptions of their technological self-efficacy. Teachers with higher perceptions of their technological self-efficacy are more likely to

implement ICT (Adjapong et al., 2018; Christie, 2016; Durksen et al., 2017; OECD, 2020; U.S. Department of Education, 2017). A basic qualitative design with interviews was the most appropriate design because it allowed for a greater understanding of the phenomena and how teachers interpret their experiences (see Merriam & Tisdell, 2016). Qualitative research allows the researcher to analyze complex experiences people have with phenomena (Ravitch & Carl, 2016). Additionally, qualitative researchers focus on making meaning from those experiences requiring rich data to seek complexity in how participants view their experiences (Ravitch & Carl, 2016). I did not use a phenomenological design; the reason is that online PLNs are not "intense human experiences" (Merriam & Tisdell, 2016, p. 26) and the lived experiences of each participant did not need to be examined.

Role of the Researcher

My role as the researcher was to gather, organize, and analyze the sample's experiences while using online PLNs. Each participant in the sample was a colleague who works within the school district where I am currently employed. The participants and I share the same level of hierarchy and do not hold superiority in rank. I do not have any personal relationships with participants; all relationships are professional. To avoid bias, I did not guide participants to answer questions, I did not avoid questions, and I did not make facial expressions or gestures (see Burkholder et al., 2016). Furthermore, I did not encourage participants to answer questions, share participant stories with other participants, or provide personal experiences with the phenomena (see Burkholder et al., 2016).

Methodology

The purpose of this basic qualitative study with interviews was to explore the influence of online PLNs on teachers' perceptions of their technological self-efficacy for implementing ICT into the classroom. I selected eight individuals from an email inviting teachers to participate in the study. The email requested participants who have had a year of experience using an online PLN. Purposeful sampling was used to select participants who have used an online PLN for over a year. Purposeful sampling allowed for detailed and context-rich experiences of a population that has used an online PLN (see Ravitch & Carl, 2016). In qualitative research, reaching saturation is critical for validity; therefore, more participants would have been selected if the sample size did not reach saturation (see Merriam & Tisdell, 2016). Teachers who replied to the recruiting email then received another email inviting them to participate in the study. These individuals were then asked to respond to the invite email with "I consent."

Participant Selection

I used purposive sampling to identify eight teachers from kindergarten to 12th grade who had at least a year of contact with an online PLN. I established this time frame for experience with an online PLN to exclude novice online PLN users. This subjective method of nonprobability sampling allowed for a knowledgeable sample of the population of teachers who use online PLNs. Nonprobability sampling is most appropriate when selecting small samples within a limited geographical area (Lavrakas, 2008). I sent a recruitment email to the entire school district that contained information on the eligibility criteria. Teachers then responded to the recruitment email indicating

their interest; a follow-up email was sent inviting them to participate. Teachers were required to respond to the invitation email with "I Consent." A sample size of 10-12 is appropriate if the participants are similar (Burkholder et al., 2016). This was the case in this study, which included teachers who are veteran online PLN users.

Instrumentation

I conducted semistructured interviews with participants. As Merriam and Tisdale (2016) noted, semistructured interviews include open-ended questions permitting respondents to delve deeper into their experiences with the phenomena. The interview protocol included questions on teachers' beliefs, motivation, confidence, and perseverance for implementing ICT in the classroom and whether their online PLN has influenced their technological self-efficacy characteristics (see Appendix A). The interview protocol featured questions that prompted participants to provide examples and opinions of their experiences relating to beliefs, motivation, confidence, and perseverance (see Merriam & Tisdell, 2016). Each interview was recorded for data analysis. An expert panel of veteran online PLN users reviewed the interview protocol. The reviewers indicated that they had experiences where their online PLN influenced their use of ICT and often referred to their online PLN for assistance regarding ICT and to gather instructional materials.

I developed the interview protocol using the four sources of influence for self-efficacy: mastery experiences, vicarious experiences, social persuasion, and emotional states (Bandura, 1994). Mastery experiences occur through successes, the more successful endeavors will likely create a stronger belief in self-efficacy, failure would

contribute to the contrary (Bandura, 1994). If people only experience easy successes, they will be more likely to quit due to a lack of perseverance; others who have built resiliency through successes will have a greater desire to persevere. Adversity and setbacks serve as a valuable purpose for building resiliency when developing self-efficacy. Those who overcome and persevere are more likely to have greater self-efficacy and are less likely to fail (Bandura, 1994). Vicarious experiences can also influence self-efficacy.

Vicarious experiences occur through observations. Observing professionals in similar positions who have success through sustained efforts raise the observer's beliefs that they possess the skills to succeed (Bandura, 1994). The same concept applies to those who observe other professionals' failures, despite their continued efforts, negatively influencing the observer's self-efficacy. Social persuasion also affects self-efficacy; people who have received positive social persuasion that they carry the capabilities to be successful are more likely to have higher self-efficacy than those without persuasion (Bandura, 1994). It is unlikely that social persuasion alone can raise self-efficacy; however, negative social persuasion can quickly diminish self-efficacy. People who have been negatively influenced coincided with challenging outcomes are more likely to fail often (Bandura, 1994). Last, mood can influence personal efficacy; a positive mood will enhance self-efficacy, while a negative mood will diminish self-efficacy. Thus, reducing negative stress reactions and interpreting those reactions positively will result in higher self-efficacy (Bandura, 1994). On the contrary, those who interpret their failures negatively will likely reduce their self-efficacy.

I designed the interview protocol to gather opinions and experiences relating to the four sources of influence for self-efficacy. An expert panel was used to evaluate the protocol for sufficiency. Panelists indicated that they had a plethora of experiences using their online PLN that encouraged them to adopt ICT and consistently use it within the classroom. The purpose of the study was to explore these experiences and whether they influenced teachers' technological self-efficacy for implementing ICT into the classroom.

Procedures for Recruitment, Participation, and Data Collection

I sent an email to every educator in the study site's district. The recruiting email invited teachers to participate in the study if they have used an online PLN for over a year. Teachers who have used a PLN for over a year were selected for the study and were requested to respond to an additional email for consent. Also included were an attached informed consent disclosing the purpose of the study, participants' role, the duration of the interviews, notification that the interviews would take place virtually, an option to rescind their participation, and confidentiality. If individuals elected to proceed, they responded to the email with "I Consent." For confidentiality, participants were only given fake first names.

Approximately 45-minute semistructured interviews occurred via Zoom. I began each interview by thanking the participants and explained that the meeting would be recorded for coding purposes. Participants were also informed to turn off their webcam for confidentiality. Each participant was also informed that they had the right to withdrawal from the interview at any point. Once the interviews concluded, I thanked the participants again and explained that they had concluded the interview.

Data Analysis Plan

I analyzed the collected data using two rounds of in vivo coding, followed by thematic analysis. The data were also analyzed using NVivo software. The purpose of the study was to explore whether online PLNs influence teachers' technological self-efficacy. By using in vivo coding, I was able to ground the analysis from the perspective of the teachers being interviewed by using the language of the participants rather than the researcher's (Saldaña, 2016). Therefore, the aim of the analysis was to determine whether the participants have experienced any influences of self-efficacy (mastery experiences, vicarious experiences, social persuasion, or emotional levels). The data analysis methods aligned with the study's purpose to explore participants' experiences with online PLNs (see Saldaña, 2016). Additionally, The second cycle of in vivo coding allowed for reanalysis, permitting further examinations of the codes resulting in potential categories to delve deeper into the data (Saldaña, 2016). NVivo software then allowed for further data engagement to contribute to the study's confirmability (Merriam & Tisdell, 2016).

I used discrepant case analysis to support alternative explanations of the phenomena (Merriam & Tisdell, 2016). This process added to the study's validity and supported the reanalysis as the purpose of the study was to explore the influence of online PLNs. Additionally, this process ensured that the data had reached saturation (Merriam & Tisdell, 2016).

Trustworthiness

All research is required to follow and produce credible, valid, and reliable findings in an ethical manner (Merriam & Tisdell, 2016). The purpose of qualitative

research is to become closer to reality through interviews and observations. Therefore, strategies should be used to validate research while ensuring the study is credible and reliable (Burkholder et al., 2016). I used semistructured interviews to delve deeper into the sample's experiences and discrepant case analysis to contribute to credibility. Detailed and thick descriptions, member checks, and data saturation were also used to contribute to the study's trustworthiness.

Credibility

Basic qualitative research designs with interviews have limitations that do not permit triangulation or data collection from multiple sources to assure validity. Given the research design, the interview protocol with semistructured interviews was appropriate for collecting data exploring human experiences with a phenomenon (Merriam & Tisdell, 2016). I used semistructured interviews to become closer to the reality of the sample's experiences with the phenomena adding to the study's rigor (Ravitch & Carl, 2016). Other strategies such as discrepant case analysis, member checks data saturation, and reflexivity were added to strengthen the study's credibility (Burkholder et al., 2016; Ravitch & Carl, 2016).

Transferability

Thick descriptions of the setting, participant recruitment, and assumptions of the study contributed to this study's transferability (Burkholder et al., 2016). I produced a descriptive analysis of how online PLNs influence teachers' technological self-efficacy. These descriptions allowed the study to be transferable to participants in other geographical areas (Ravitch & Carl, 2016). Additionally, I did not produce true

statements but descriptive, content-relevant statements regarding the participant's experiences (Merriam & Tisdell, 2016; Ravitch & Carl, 2016).

Dependability

Member checks, data saturation, and discrepant case analysis are strategies used to establish dependability. Failing to find supporting evidence for alternative explanations and receiving feedback from study participants on the findings will ensure that they would conclude similar explanations if the study is replicated with a different sample (Ravitch & Carl, 2016). An expert panel reviewed the interview protocol, and two rounds of in vivo coding also contributed to the study's dependability (Burkholder et al., 2016).

Confirmability

This study's results did not represent the researcher's viewpoints; instead, this study's results were a representation of the sample's viewpoints. Confirmability requires reflexivity strategies to remove bias from the researcher (Merriam & Tisdell, 2016). I kept a research log documenting notes during interviews and as a reflective journal to contribute to the study's reflexivity (Ravitch & Carl, 2016). The journal was used to document codes during the data analysis phase. Those codes and transcribed interviews were sent to the corresponding participants through member checks (Merriam & Tisdell, 2016). These strategies contributed to the reflexivity of the study, adding to its confirmability.

Ethical Procedures

I emailed informed consent to each participant who responded to the recruitment email indicating they had participated in an online PLN for over a year. The consent form

required participants who elected to participate to consent (Burkholder et al., 2016). Included in the form was information regarding the interview, their option to rescind participation at any time, disclosure of the interviews taking place digitally, confidentiality, the role of the interviewer and interviewee, and Walden University's Internal Review Board approval number 07-15-21-0319642. The participants who sent consent were added to the sample.

The participants were confidential, and each participant was only known as a fake name. The data collected remained confidential and only shared between the interviewer and interviewee (Burkholder et al., 2016). All research logs were confidential and stored in a password-protected folder on a personal computer. Walden University requirements allow for the data to be stored for five years and then destroyed.

Summary

In Chapter 3, I outlined the research methods used in the study. An introduction provided a synopsis, including the purpose of the study to explore online PLNs and their influences on teachers' technological self-efficacy. The study followed a basic qualitative design with interviews so that the researcher could gain a greater understanding of the participant's experiences using online PLNs. The role of the researcher was to gather, organize, and analyze the sample's experiences and did not guide participants to answer questions or avoid questions. Moreover, the methodology used purposeful sampling to select participants who were recruited using a district-wide email. Semistructured interviews provided open-ended questions using the four sources of influence for self-

efficacy to gauge whether online PLNs influenced participants' technological self-efficacy.

The procedure for recruiting, identifying, and contacting participants was through the study site's email accounts. I sent an email to all the teachers, and those interested responded to the email electing to participate; I then sent a formal invitation. Teachers then replied to the email, consenting to their participation. 45-minute semistructured interviews took place via Zoom. Two rounds of in vivo coding were used for data analysis. Data was also added to NVivo software to contribute to the study's confirmability by ensuring the in vivo coding analysis was aligned with that of NVivo. Additionally, adding to the study's trustworthiness, discrepant case analysis, detailed thick descriptions, member checks, and data saturation was used.

Thick descriptions of the research methodology and design allowed for greater transferability. The study's dependability included member checks, data saturation, and discrepant case analysis to support alternative explanations and receive feedback from the participants. A research log was used to add to the study's confirmability. Lastly, informed consent was provided to each participant to ensure the study followed ethical procedures, including the consent, the option to rescind consent, the confidentiality of their name and the district, and the role of the interviewer and interviewee.

Chapter 4: Results

In this basic qualitative study, I explored the influence of online PLNs on teachers' technological self-efficacy for implementing ICT in the classroom. Many teachers lack the confidence to effectively implement ICT in the classroom due to a lack of mastery-level experiences requiring further PD to develop such skills (Christie, 2016; Cook et al., 2017; Yin-Chan et al., 2017). Teachers are turning to online PLNs because of their anytime, anywhere learning opportunities without the confinements of geographical borders. Researchers recognize the need for further investigations into how online PLNs influence teachers' practice (Liu et al., 2018; Tour, 2017a; Trust, 2016; Trust et al., 2018). The research question that I sought to answer in this study was, How does the use of online PLNs influence teacher perception of their technological self-efficacy in implementing ICT instructional practices in the classroom? In this chapter, I will review the setting, data collection, and data analysis for the study. I will also present results, provide evidence of trustworthiness, and conclude with a summary of key points.

Setting

COVID-19 influenced many teachers in the United States to adopt technology as many districts required teachers to quickly move from traditional face-to-face environments to online learning (Dhawan, 2020). I used purposive sampling to exclude novice online PLN users so the pandemic should have had little effect; however, veteran users may have been influenced by using their online PLN more frequently to stay abreast of the sudden changes due to COVID-19. Such subjective nonprobability

sampling permitted a knowledgeable sample who have had contact with online PLNs for over a year (Lavrakas, 2008).

All participants were tenured teachers. In the study setting, tenure requires 3 consecutive years of proficient evaluations. Participants were both male and female and had had contact with an online PLN specific to using ICT in the classroom for at least a year. The participants taught a wide range of content areas such as music, history, math, language arts, science, art, and business ranging from kindergarten to high school. Participants have taught for 5-25 years with experiences in rural and urban areas, and one participant had experience teaching internationally.

Data Collection

I sent an invitation email to the study site's faculty, inviting them to participate in the study if they had contact with an online PLN for over a year. Faculty members were requested to send an email back, indicating their interest in participating. The next email was sent with the consent form, indicating participation would require a returned email stating "I Consent." The subsequent interactions with participants included scheduling dates and times for interviews.

Before the start of each interview, I reviewed the consent form again, indicating that each participant has the right to rescind their consent at any moment during the study. Further information such as the background of the study, procedures, voluntary nature of the study, risks of being in the study, payment, and privacy were all reviewed with each participant. For the semistructured interviews, I used an interview protocol based on Bandura's (1994) four sources of influence for self-efficacy: mastery

experiences, vicarious experiences, social persuasion, and emotional states. The interview protocol was designed to delve deeper into the participants' experiences with the online PLNs by using open-ended questions (see Merriam & Tisdell, 2016).

I selected eight volunteers who met the selection criteria as participants. Participants were interviewed for roughly 20-45 minutes using the online video conferencing software Zoom. One 20-minute interview took place, while all other interviews were nearly 45 minutes. Zoom Business permitted me to use closed captioning and transcription to record the interview and transfer the data to other technologies for data analysis. Semistructured interviews allowed me to gather in-depth experiences of the participants with the phenomena (Merriam & Tisdell, 2016).

Some variations from the data collection plan outlined in Chapter 3 occurred while conducting the study. For example, I sent multiple recruiting emails to teachers to entice their decision to participate. However, due to COVID-19, responses to the emails were limited as many teachers were overwhelmed by the workload caused by teaching online and in person. Only eight participants were interviewed. Therefore, the sample size did not include 10-12 teachers as recommended by Burkholder et al. (2016). Walden University's methodologist office and the study's committee methodologist approved the low sample size because data saturation was reached as the same codes kept reappearing. Therefore, the study's validity should not be jeopardized (see Burkholder et al., 2016; Ravitch & Carl, 2016).

Data Analysis

I downloaded data transcriptions from Zoom and copied and pasted them into a Microsoft Word document where they were highlighted and coded. Once each participants' transcription was coded, the codes were then placed in a Microsoft Excel worksheet. Categories were then generated from the in vivo codes within the same Microsoft Excel spreadsheet. The second round of this process ensured that I delved deeper into the data (see Saldaña, 2016). Themes emerged using two rounds of in vivo coding. NVivo was also used to generate word frequencies to compare the themes generated from in vivo coding; the word frequencies are words frequently used by participants, which matched the codes used from in vivo coding. A new Microsoft Word document was created that did not include the in vivo codes but only included the transcriptions; this document was imported into NVivo before running the word frequency query.

The coding process included nine categories: resources sharing, confidence, encouragement, problem solving, connections, feedback, collaboration, support, and skill development. I then organized these categories into three themes: resources, relationships, and problem-solving. I performed discrepant case analysis to ensure that the analysis did not provide misinformation regarding the data. However, the two rounds of in vivo coding, along with the analysis from NVivo and member checking, were sufficient, I believe, to ensure the validity and credibility of data findings (see Ravitch & Carl, 2016).

Results

The research question for this study was, How does the use of online PLNs influence teacher perception of their technological self-efficacy in implementing ICT instructional practices in the classroom? Following an interview protocol, I explored teachers' beliefs, motivation, confidence, and perseverance for implementing ICT in the classroom and whether their online PLN influenced their technological self-efficacy characteristics (see Appendix A). The interview protocol included questions that prompted participants to provide examples and opinions of their experiences relating to beliefs, motivation, confidence, and perseverance to elicit a greater understanding of the phenomena (see Merriam & Tisdell, 2016). Table 1 provides an overview of the themes and codes that emerged from data analysis. The table also includes illustrative participant quotations.

Table 1

Technological Self-Efficacy Themes

Theme	Category of codes	Quotes from participants
Resources	resources resource sharing	"led everybody else to be more comfortable in using either a particular platform or a particular strategy"
	encouragement	"it has influenced me to try new things"
		"take risks with technology in the classroom"
		"overcome obstacles"
Relationships	connections	"small tweaks to make something go smoother or, better, you know it might not have been the technology that was the problem, it could have been the delivery"
	feedback	
	collaboration	
	troubleshooting	"not feeling alone"
		"it is not like you're here by yourself"
Confidence	problem solving	"support them and tell them not to worry about it and that it will become more comfortable for them"
	observers	
	support	"So do they encourage you saying hey, this is an excellent tool with this"
	confidence	"you know I want to be relevant in the classroom I don't want to be that person that students are like oh yeah they're still doing things that my parents did in school"

Resources

The first theme is resources, which is defined as teachers sharing resources and receiving encouragement to use ICT in the classroom. The following categories were related to the theme resources: including resources, resource sharing, and encouragement.I asked participants how their online PLN influenced their use of ICT in the classroom and their ICT obstacles and how their online PLN influenced their ability to overcome such obstacles. Every participant in the study described experiences where their online PLN provided them with resources. For example, Participant 7 stated that her online PLN provides her with “ideas, other teachers share of the resources that have worked for them, so that I have an idea of what I’m doing.” Participant 2 said, “I find the resources, but they also demonstrate how to use them. I would normally shy away from it. So, by having that group it's kind of nice that they show you and they kind of take you through things a little step by step.” In addition, Participant 6 talked about not only receiving resources that her peers shared but also “knowing that I can share my resources and my learning, you know, pictures of student work or something that I'm excited about that my students are doing.” Participant 5 mentioned that his online PLN “brings my attention to resources that I may not know exists on my own or may not be able to find.”

In addition to resource sharing, members of the participants' online PLN provided encouragement to overcome obstacles and provided explanations on how to best use specific ICT tools in the classroom. Participant 1 explained that she feels less alone “because I’m excited about overcoming the obstacle of delivering instruction online, different ways to gather information that was going to make teaching online less scary for

both teachers and students." Participant 3 stated that their online PLN is "where I do not just find the resources, but they also demonstrate how to use them." Participant 2 had experiences where her online PLN "led everybody else to be more comfortable in using either a particular platform or a particular strategy." Participant 8 also mentioned that she taught her entire year based on a strategy she learned through her online PLN, stating, "That was when I first saw Bitmoji virtual classroom was on a Facebook music Facebook group. And also a course that went into how we were able to teach. This entire last year was using that foundation of that classroom." This encouragement not only happens from the text but also occurs when teachers see relevant resources and utilize those resources to implement ICT.

In all, every participant had a story to tell about overcoming obstacles, receiving resources or ideas to help implement ICT into the classroom. These experiences indicated that their online PLN provided them with a better belief system to use ICT in the classroom and provide encouragement, indicating an increase in their technological self-efficacy. For example, Participant 3 said their online PLN "has influenced me to try new things" and "take risks with technology in the classroom" due to the conversations taking place within their online PLN as well as the encouragement from members. Participant 8 stated about her online PLN, " It's just been a great resource of people asking questions… And, you know, people using like the same programs and then they ran into an issue. And it saves me from having to run into that issue, like I could fix it in advance."

One participant, referring to themselves as an observer, had experiences where she utilized her online PLN to share resources, which encouraged her to implement ICT

and influenced her technological self-efficacy, even though she rarely contributes to the conversations. She explained, “but what we've been able to find out from Facebook and Instagram, and some of them, the learning possibilities through Canvas, it has been very helpful.” She also explained, “Even on Instagram and Facebook, there's a lot of camaraderie support from other teachers, and it just has been a huge influence.” Indicating that, even though she rarely contributes to the conversations, she benefits from others having conversations that offer her support and encouragement, changing her beliefs regarding ICT and influencing her technological self-efficacy.

Relationships

The second theme is relationships as it relates to the categories connections, feedback, and collaboration. Participants were asked what kind of experiences they had with members of their online PLN encouraging them to use ICT in the classroom. Three participants talked about “not feeling alone” and turning to their online PLN for support and feedback. For example, Participant 6 said, “I'm catching everything that some of the younger teachers already know. I think the biggest thing is knowing that I'm not alone.” Indicating the participant had experiences where she built connections through her online PLN that support her use of ICT in the classroom, which develops a positive attitude towards ICT.

These connections also lead to discussions relating to troubleshooting issues. For example, Participant 3 discussed encouragement they receive, stating she often turns to online PLN to “troubleshoot if you need help trying out something new, and it's been encouraging just like to have the extra support and taking risks in the classroom.” In

terms of the first category of connections, participants indicated that they have built relationships with members of their online PLN and often refer to them for troubleshooting technological issues in the classroom. For example, Participant 8 mentioned, “if I have an issue, I can turn to the group and see if others have a similar experience.” All participants mentioned having experiences where they could turn to their online PLN to help with issues; however, one participant stated that she typically would search through the group discussion threads to allocate resources to help with troubleshooting. These connections begin to build relationships that positively influence the participants’ attitudes and beliefs regarding ICT.

In addition, all the participants have turned to their online PLN for support in troubleshooting, but five of the eight participants have shared their failures while looking for support from other members. A sign of collaboration and development of deep connections with members, for example, is expressed in the following participant response: “Again I could you know I would throw it out to the group hey I tried this. This was the obstacle today, but I think it has potential, you know, can somebody help with what might you know why it might have gone wrong or how to make it better.” Participant 1 stated. Participant 2 indicated some of her online PLN members offer “small tweaks to make something go smoother or, better, you know it might not have been the technology that was the problem, it could have been the delivery.” Such experiences show deep connections of trust to seek feedback and reflection from their peers, which positively influences teachers’ technological self-efficacy (Yoo, 2016). Three participants

mentioned “not feeling alone,” another said, “it is not like you’re here by yourself” because of their PLN.

Three participants were more active in building deep relationships as they turned to their online PLN for not just support, encouragement, or troubleshooting, but they shared their instructional failures. These connections created through their online PLN provide them with feedback at a greater level than receiving support. They collaborate to make their instruction more efficient using ICT, which indicates trust and has a significant impact on teachers’ technological self-efficacy by building their belief system around ICT. For example, Participant 4 explained her online PLN is “always reminding each other, that it's okay and that you will share your failures. Your first attempt in learning, and let others learn from those and let yourself learn from those.” Participant 8 had similar experiences regarding what she shares with her online PLN, stating, “you used a piece of technology and it wasn't successful.” These experiences where teachers feel comfortable sharing their teaching failures with their online PLN indicated they had built deep connections with other members, positively influencing their technological self-efficacy.

Confidence

Participants expressed through collaboration that they problem solve and offer support to other users, which positively influences their confidence in using ICT in the classroom. Participant 7 mentioned “support them and tell them not to worry about it and that it will become more comfortable for them,” indicating that they have confidence towards ICT. Still, they also offer the support to help others gain the same confidence.

All participants in this study mentioned receiving encouragement in using ICT in the classroom because of their experiences with their online PLN. Participants build trust with members when they use the resources allocated from members within the network, which builds their confidence in implementing ICT in the classroom. For example, Participant 5 stated, “if someone had a good experience enough to share it out to the world, then I would think I'm more apt to try it on my own.”

Another participant, when discussing implementing software to accommodate musical recordings for large groups of students, Participant 6 stated, “definitely made it quicker in Twitter to implement things or like easier to bring something into the classroom. Instead of me having to try it out on my own and figure everything out I can, I can talk with those people are I can read about their experience or watch a video on their experience and then immediately see the benefits of it.” Participants’ trust in members of their online PLN helped them develop their confidence to implement ICT in the classroom. Trust permitted participants to implement ICT because another member of their network successfully implemented the technology, but also the ease of access helped their confidence to implement ICT. Both trust and ease of access positively influenced attitudes and beliefs regarding ICT.

Three of the eight participants mention that they turn to their online PLN for problem-solving because it is faster and more efficient to find solutions to their ICT problems. Problem-solving should not be confused with support, as problem-solving requires some form of collaboration among members of their online PLN. When participants problem-solve with their PLN, they indicated that they had more confidence

to persevere and continue using ICT in the classroom. For example, when struggling with student self-portraits, one teacher turned to their PLN and immediately got the answer she needed and stated, “yeah, so there was one member who was showing examples of students self-portraits that they used in Google draw, and it kind of was step by step of how they did it within their classroom on a large scale, because that's easy to do with individual students, which I had done in the past, but to apply it to a whole class or a whole grade level, with the members support, it was good.” Two other participants mentioned problem-solving as well. Participant 4 immediately turns to her online PLN whenever she has an issue with ICT, stating, “I often search that on in the closed wall Facebook group search feature, seeing if other people had that similar problem. Of course, helping others out too, commenting on, you know, a question that was already posted.” Both experiences created opportunities for participants to collaborate with their online PLN resulting in greater confidence for using ICT in the classroom.

Evidence of Trustworthiness

All research is required to follow and produce credible, valid, and reliable findings in an ethical manner (Merriam & Tisdell, 2016). The purpose of qualitative research is to become closer to reality through interviews and observations. Therefore, strategies were used to validate this study while ensuring the study was credible and reliable (Burkholder et al., 2016). I used semistructured interviews to delve deeper into the samples’ experiences, and discrepant case analysis contributed credibility. Detailed and thick descriptions, member checks, and data saturation are all strategies contributing to the study’s trustworthiness.

Credibility

Basic qualitative research designs with interviews have limitations that do not permit triangulation or data collection from multiple sources to assure validity. Given the research design, the interview protocol with semistructured interviews is an appropriate method to collect data exploring human experiences with a phenomenon (Merriam & Tisdell, 2016). Additionally, semistructured interviews allowed me to become closer to the reality of the samples' experiences with the phenomena adding to the study's rigor (Ravitch & Carl, 2016). Discrepant case analysis was used to ensure validity for both the results of the study and data analysis. The results were shared with participants of the study for member checking. Data saturation was reached when reoccurring codes were emerging from interviews with a sample of eight participants; however, as described in Chapter 3, an initial sample size included 10-12 participants. Using NVivo to compare the codes and categories discovered through in vivo coding contributed to the reflexivity of the study (Burkholder et al., 2016; Ravitch & Carl, 2016).

Transferability

Thick descriptions of the setting, participant recruitment, and assumptions of the study contribute to the study's transferability (Burkholder et al., 2016). I produced a descriptive analysis of how online PLNs influence teachers' technological self-efficacy. These descriptions allowed the study to be transferable to teachers in other geographical areas (Ravitch & Carl, 2016). Additionally, I did not produce true statements but descriptive, content-relevant statements regarding the participant's experiences (Merriam & Tisdell, 2016; Ravitch & Carl, 2016).

Dependability

Member checks, data saturation, and discrepant case analysis are strategies used to establish dependability. I failed to find supporting evidence for alternative explanations. I also received feedback from the participants ensuring that they would conclude similar explanations if replicated with a different sample (Ravitch & Carl, 2016). Additionally, many participants in the sample shared that they experienced the same issues with ICT as other teachers across the country. An expert panel reviewed the interview protocol, and two rounds of in vivo coding, NVivo analysis all contributed to the study's dependability (Burkholder et al., 2016).

Confirmability

This study's results do not represent the researcher's viewpoints; instead, this study's results represent the participants' viewpoints. Confirmability requires reflexivity strategies to remove bias from the researcher (Merriam & Tisdell, 2016). I kept a research log documenting notes during interviews and as a reflective journal to contribute to the study's reflexivity (Ravitch & Carl, 2016). The journal was used to document codes during the data analysis phase. Those codes and transcribed interviews, including data analysis, were sent to the corresponding participants through member checks (Merriam & Tisdell, 2016). These strategies contributed to the reflexivity of the study, adding to its confirmability.

There were two significant adjustments to these strategies regarding credibility and transferability. The study initially described a sample size of 10-12, but only eight participated in the study. This change did not influence the study's credibility, as data

saturation was reached when reoccurring categories and themes emerged. I also used member checks and discrepant case analysis to address the study's credibility and combat the smaller sample size. Participant recruitment was also modified during the recruiting process. Additional emails were sent to recruit participants and receive consent, which otherwise was not planned as described in Chapter 3.

Summary

The research question for this study was, How does the use of online PLNs influence teachers' perceptions of their technological self-efficacy in implementing ICT instructional practices in the classroom? Online PLNs influence teachers' perceptions of their technological self-efficacy for implementing ICT in the classroom through resource sharing, building relationships, and increasing their confidence through problem-solving. When teachers utilize their online PLN for resources, they develop beliefs and attitudes for implementing ICT because they have enough resources to feel successful. Participants built trust with members of their online PLN when they utilized the resources found within the network and successfully implemented the ICT into the classroom. Therefore, building trust where participants can turn to their online PLN for feedback or support using ICT in the classroom.

The theme resources indicated that participants shared and gathered resources to support ICT implementation in the classroom. Teachers received motivation when they saw other teachers within their online PLN share resources they had successfully implemented in the classroom. Such instances encourage teachers to try new tools. These resources are also beneficial because they also provide demonstrations on using the

technology within the classroom best. Additionally, participants turned to their online PLN for encouragement to overcome obstacles with ICT, which influenced their beliefs, attitudes, and motivation to successfully use ICT in the classroom, positively influencing their technological self-efficacy.

Relationships results indicated that teachers built connections with other teachers in similar situations within their online PLN. Making these connections also influenced their beliefs and attitudes using ICT as they turned to their connections for support. Such connections also permitted teachers to turn to their online PLN to troubleshoot issues requiring further collaboration. Furthermore, some participants built deep relationships by relying on their online PLN to provide feedback on their instructional strategies. These relationships indicated that participants trust the members within their network and reflect on their teaching deeper than those who only sought support. However, all participants built a relationship that positively influenced their technological self-efficacy by increasing their attitudes and perseverance towards ICT.

Confidence results indicated that when teachers had the support of their online PLN to help resolve ICT issues, they had greater confidence to implement ICT in the classroom. When teachers collaborate and build relationships with members of their online PLN, they begin to develop confidence in their ability to use ICT. They developed experiences where they collaborated with others to problem solve and receive encouragement. Such relationships build trust and when a member of the participant's online PLN showcases a piece of ICT and its successes in the classroom, the participants

trust they too can implement such technologies and, therefore, have greater confidence and positive influences on their technological self-efficacy.

Participants shared experiences where they were encouraged by members of their online PLN to implement ICT. Three participants created deep relationships which promoted collaboration for problem-solving and built trust to receive feedback from their peers. These connections and conversations provided teachers with adequate resources and demonstrations for using such tools in the classroom. These experiences also afforded teachers the confidence to implement such tools into the classroom. Through encouragement and problem-solving, the participants in the sample experienced positive influences of their technological self-efficacy for using ICT in the classroom.

In Chapter 5 I will extend the results of the study by discussing the interpretations of the findings. I will also provide the limitations of the study, recommendations, implications, and conclusions.

Chapter 5: Discussion, Conclusion, and Recommendations

The purpose of this basic qualitative study was to explore the influence of online PLNs on teachers' technological self-efficacy. Many teachers lack the confidence to consistently implement ICT in the classroom because of a lack of mastery-level experiences due to ongoing changes to technology and instructional strategies (Bowe & Gore, 2017; Trust, 2016). Teachers are turning to online PLNs because of their ability to create collaborative, anytime, anywhere, informal learning spaces to grow their skill, confidence, and consistency in implementing ICT in the classroom (Krutka et al., 2017; Trust et al., 2018b). However, due to the unique attributes of online PLNs, experts are uncertain whether they are an effective method for teacher professional growth (Edwards, 2017; Prestridge, 2019; Tour, 2017a, 2017c; Trust, 2016; Trust et al., 2018). Researchers recognize the need for further investigations into how online PLNs influence teachers' practice (Liu et al., 2018; Tour, 2017a; Trust, 2016; Trust et al., 2018). I conducted this study to address the gap in the literature.

The theme of resources influenced participating teachers' perceptions of their technological self-efficacy. All participants shared experiences where they utilized their online PLN for resources to help them implement ICT in the classroom. For example, Participant 1 stated, "it's kind of nice that they show you and they kind of take you through things a little step by step, and they give you examples of what they've done, and it makes it easy to take what they've done and transform it so that it's easier to use." These experiences influenced participants' attitudes towards ICT and their beliefs

regarding ICT. Participants also received encouragement from their online PLN to overcome obstacles, also positively influencing their technological self-efficacy.

Participants' perceptions of their technological self-efficacy were influenced by the theme of relationships, as all participants built some kind of relationship with members of their online PLN. Three participants, each of whom had been teaching for over 20 years, talked, respectively, about “not feeling alone,” “then I don’t feel so alone,” and “made you feel like you weren't going at it alone,” indicating that they have developed relationships with members of their online PLN. All other participants indicated that they turn to their online PLN for resources, which also indicates that they have developed trust in the members of their network. Five of the eight participants shared their ICT failures, seeking support from members, and three of those five participants indicated they share their instructional failures. For example, Participant 2 stated, “small tweaks to make something go smoother or, better, you know it might not have been the technology that was the problem, it could have been the delivery.” All participants indicated that they had built relationships with members of their online PLN and trusted them enough to utilize their resources. Five of the participants who shared their failures indicated that they have created a deeper relationship with members of their online PLN and trusted their guidance and feedback, positively influencing their beliefs regarding ICT.

Participating teachers' perceptions of their technological self-efficacy were also influenced by the theme of confidence as all participants utilized their online PLN for support or to gather resources. The resources provided through their online PLN offered

detailed explanations on how to best use ICT in the classroom and, therefore, positively influenced the participant's confidence. Three of the eight participants mentioned problem-solving with another member of their online PLN, indicating that they had collaborated to resolve issues rather than using their online PLN for resource gathering. These collaborative experiences built the participants' confidence in implementing ICT and provided additional influences such as perseverance and trust, positively influencing their technological self-efficacy.

Interpretation of the Findings

Resources

Teachers are turning to online PLNs because they are actively seeking PD opportunities for ICT outside of traditional PD formats (Prestridge, 2017). These educators are creating PLNs so that they can create additional professional development opportunities to grow their teaching skills by staying abreast of best practices and trends in the developments of education and technology (Dene Poth, 2020; Greenhow et al., 2019; Krutka et al., 2017; Lantz-Andersson et al., 2018; Trust, 2017). For example, Participant 2 stated, “you know I want to be relevant in the classroom.” All participants turned to their online PLN to find resources to help them implement ICT in the classroom. PLNs have the ability, because of the expansion of social media, to provide teachers with immediate access to instructional materials (García-Martínez et al., 2020; Goria et al., 2019; Greenhow et al., 2019; Noble et al., 2016; Tour, 2017a), which enhances teachers' understanding of instructional strategies (Kearney et al., 2020; Noble et al., 2016; Tour, 2017a). All participants turned to their online PLN because of instant

access to materials, resources, and professionals to improve their skills (Greenhow et al., 2019; Krutka et al., 2017; Krutka et al., 2016; Lantz-Andersson et al., 2018; Noble et al., 2016; Oddone et al., 2019; Prestridge, 2019; Trust, 2017). Participant 3 explained that her online PLN provides her with support, such as "troubleshoot[ing] if you need help trying out something new, and it's been encouraging just like to have the extra support and taking risks in the classroom." Sharing information can benefit teachers holistically by increasing the knowledge base and enhancing the profession, indicating an increase in skill development for participants (Krutka et al., 2016; Prestridge, 2019).

Three participants, veteran teachers, indicated that their online PLN makes them feel less alone and that technology is less scary because they can use the resources within their online PLN. Participant 8 taught an entire year using a piece of technology she found via her online PLN. All participants also indicated that they received encouragement to overcome obstacles while using ICT. PLNs also encourage a sense of connectedness (Cook et al., 2017; Forbes, 2017; Goria et al., 2019) and empowerment (García-Martínez et al., 2020). This process of discussing, sharing, collaborating, and reflecting helps teachers grow professionally (Noble et al., 2016; Slagoski, 2019).

The theme of resources confirms the existing research showing that teachers who use online PLNs seek support from other teachers by utilizing these networks for resources. Through this process, participants built trust with other members of their network in that they trust such members and the resources they share. Trust was also built when participants received encouragement to overcome obstacles to implement ICT in

the classroom, confirming existing research. Trust also influenced their attitudes towards ICT and positively influenced their technological self-efficacy.

Relationships

All participants had experiences where they built trust with members of their online PLN as they used their online PLN to gather resources and seek encouragement for overcoming obstacles. Extensive research shows that when teachers collaborate with others in similar situations, it helps boost their beliefs regarding their ability to use ICT in the classroom, permitting them to become more engaging educators and to reflect on their instructional practices (Adjapong et al., 2018; Goria et al., 2019; Greenhow et al., 2019; Kearney et al., 2020; Kearney & Maher, 2019; Krutka et al., 2017, 2017; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Slagoski, 2019; Trust, 2017). The process of discussion and interaction leads to collective thinking and the development of new knowledge (Forbes, 2017; Krutka et al., 2017; Parsons et al., 2019). For example, Participant 3 stated, “peers working together to figure out how to navigate ICT and by doing so, it wasn't everybody having to recreate the wheel.”

The relationships participants built developed a sense of connectedness, which forced a greater understanding of pedagogy and instructional strategies (see Kearney et al., 2020; Krutka et al., 2016; Parsons et al., 2019). For example, Participant 4 explained, “putting the objectives with that technology, not just using technology for the sake of technology.” Participant 6 stated, “I think I'm good with Google, and the know-how of Google, but when is it appropriate when is it best to implement and have students engage with the technology versus engaging in a different manner.” Both are examples of

participants having a greater understanding of using ICT to support pedagogical strategies because of their collaborations within their online PLN.

Three participants indicated that they feel less alone because of the support and encouragement they receive from their online PLN, even though all participants reported turning to their online PLN for resources and support to best-implementing ICT. All participants used their online PLN to find solutions to issues with ICT as they all had experiences where their online PLN helped them overcome adversity for using ICT. However, five of the eight participants shared failures in which they sought support to resolve ICT issues from members of their online PLN, while three participants engaged in collaborative problem-solving. For example, Participant 4 had an experience where she turned to her online PLN to seek support using Photoshop: “I was having a negative experience in photoshop, they were working in the same version they knew like a trick to help me that I didn't know.” These experiences indicate that participants reflected on their teaching, which is essential to change teachers’ practice and develop their skills (Krutka et al., 2016; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Noble et al., 2016; Parsons et al., 2019; Prestridge, 2017). All instances indicate that participants have developed trust with their online PLN, which influences their belief system and perseverance for using ICT in the classroom. These digital connections are permitting teachers to create personalized, bottom-up, active learning experiences that facilitate communication beyond the borders of the school district (Cook et al., 2017; Forbes, 2017; Greenhow et al., 2019; Kearney et al., 2020; Prestridge, 2017; Slagoski, 2019; Trust, 2017).

The theme of relationships confirms existing research regarding online PLNs and the relationships in which teachers create. Participants used these networks to gather resources that developed a sense of trust and connectedness to other members, particularly the five participants who sought feedback regarding their teaching and not just ICT support. When participants created these relationships, it influenced their belief system regarding ICT and influenced their technological self-efficacy.

Confidence

Teachers have extended time to experiment and collaborate through PLNs (Edwards, 2017; Krutka et al., 2016, 2017), which also increases motivation (Goria et al., 2019), generates new ideas for teaching (Kearney & Maher, 2019; Krutka et al., 2016; Lantz-Andersson et al., 2018; Noble et al., 2016; Parsons et al., 2019), and increases confidence (Krutka et al., 2016; Noble et al., 2016; Prestridge et al., 2019). For example, Participant 3 stated, “when somebody figured out and was able to troubleshoot. You know, whatever the area was depending on the group, then that led everybody else to be more comfortable, I think in using either a particular platform or a particular strategy with students.” Participant 2 had an experience that through collaborating with her online PLN, she developed the confidence to implement multiple Google Meets to accommodate smaller group discussions. She stated, “And I was comfortable enough in trying it through some discussions with some other folks.”

All participants used their online PLN for resources and built relationships with members. Five participants collaborated to solve problems, and three created deeper connections where they sought feedback from their peers. Through these relationships,

participants had opportunities to develop their confidence to use ICT in the classroom. If their implementation was not efficient, participants turned to their online PLN and sought assistance. Participants indicated that their PLN is where they can celebrate their classroom successes and discuss their failures (Krutka et al., 2016; Lantz-Andersson et al., 2018). This process confirmed existing research when teachers have time to experiment and collaborate through their online PLN, it increases their motivation and confidence, which generates new ideas for teaching, and turns teachers into lifelong learners (Edwards, 2017; Goria et al., 2019; Greenhow et al., 2019; Kearney & Maher, 2019; Krutka et al., 2017; Krutka et al., 2016; Lantz-Andersson et al., 2018; Nicholas et al., 2018; Noble et al., 2016; Prestridge, 2019).

Conceptual Framework: Self-Efficacy

Social cognitive theory recognizes the shifts between behavioral, environmental, and social influences, specifically from an agentic perspective. Humans are self-regulating, self-reflecting, and proactive in developing and adapting to social systems and, therefore, are social system products (Bandura, 2001). Social systems influence behavior changes through direct and observational experiences. Similarly, mass communication technologies can also alter human behaviors because of their ability to change social systems (Bandura, 2001). As new technologies emerge, connecting humans without geographical boundaries can also lead to behavioral changes because humans motivate and regulate their behaviors based on their beliefs (Bandura, 2002). Not only does technology allow for the expansion of information, but it also enables humans to

create social networks allowing the sharing of knowledge and information for problem-solving and learning (Bandura, 2002).

The three themes from this study, resources, relationships, and confidence, compare closely to the four sources of influence for self-efficacy developed by Albert Bandura (1994). According to Bandura (1994), self-efficacy is influenced by mastery experiences, vicarious experiences, social persuasion, and emotional levels. Mastery experiences occur through successes; the more successful endeavor will likely create stronger beliefs in self-efficacy. People who have greater perseverance have experienced successes after adversity and are more likely to overcome and succeed. Vicarious experiences occur when people observe others in similar positions who have continued success through sustained efforts; such experiences raise the observer's belief that they have the skills necessary to succeed. Social persuasion also influences self-efficacy, which occurs when people receive social persuasion that they carry the capabilities to be successful. Lastly, emotional states can also influence self-efficacy; a person with a positive mood will more likely persevere and carry the confidence to succeed compared to those with negative emotional levels.

The theme resources closely resembled that of social persuasion and vicarious experiences. Participants had experiences where they used their online PLN for resources, support, and encouragement to implement ICT into the classroom. During these experiences, participants received social persuasion to implement ICT through encouragement, influencing their beliefs that they carry the skills to succeed. Additionally, when members of their online PLN shared their resources and their success

for using such tools, through vicarious experiences, participants had a positive influence on their beliefs and attitudes towards ICT, therefore, influencing their technological self-efficacy.

Mastery-level experiences and social persuasion have similar characteristics to the theme relationships. All participants had experiences where they used resources from their online PLN in the classroom; this process indicated that they had mastery-level experiences where they succeeded using ICT because of the resources found within their online PLN. All participants also received encouragement to overcome barriers from their online PLN. Five participants created deep relationships with members of their online PLN, where they sought feedback from their network. All these experiences indicated they had mastery-level experiences, received positive social persuasion, and experienced adversity. Therefore each participant had greater technological self-efficacy as they were more likely to succeed and persevere.

The last theme is confidence and is closely related to the emotional-level factor of influence for self-efficacy. Each participant had positive experiences with members of their online PLN. They all shared experiences of encouragement and sought to be relevant in the classroom, which positively influences their emotional levels and, therefore, their technological self-efficacy. The participants' experiences increased their confidence to use ICT because of their relationships and the support and resources found within their networks, increasing their technological self-efficacy.

This study confirmed that teachers who use an online PLN could be influenced by other teachers who share similar teaching duties. Teachers who collaborate and are active

in their professional growth have greater technological self-efficacy and, subsequently, are successful at implementing ICT into their practice (Durksen et al., 2017; García-Martínez et al., 2020; Hall et al., 2019; Hall & Trespalacios, 2019). This study also confirmed that online PLNs could provide teachers the platform to develop professionally by building technological self-efficacy (Adjapong et al., 2018; Czerkawski, 2016; Forbes, 2017; Greenhow et al., 2019; Krutka et al., 2017; Oddone et al., 2019; Parsons et al., 2019; Trust, 2016). Each participants' technological self-efficacy was influenced by their online PLN, confirming that because these networks permit teachers to develop resources, relationships and allow teachers to problem-solve for using ICT in the classroom (Durksen et al., 2017; García Espinosa et al., 2015; Hall & Trespalacios, 2019).

Limitations of the Study

The study's limitations included researcher bias, sample size, and geographical area. The study planned to have 10-12 teachers, an adequate sample size for a basic qualitative study, but only eight participants could be recruited (Burkholder et al., 2016; Merriam & Tisdell, 2016). Data saturation was reached with eight participants and, therefore, should not affect the study's credibility as reoccurring themes emerged. I copied and pasted the transcriptions immediately following the interviews to eliminate researcher bias, contributing to the study's accountability. To decrease bias, I also spoke neutrally when asking interview questions so that the participants were not persuaded. The study results were shared with the participants through member checking to avoid such biases and misrepresentations. Each participant confirmed the findings reflected

their experiences. Geographical location was also a limitation as the study site is in a small northwestern Pennsylvania school district.

Recommendations

Recommendations for future studies include using a different conceptual framework to study how and why online PLNs influence teachers' practice. Connectivism argues that learning occurs through developing social and informational networks, both voluntary and involuntary, through self-directed, informal learning, based on opinions developed through relationships, work experience, education, personal interests, and culture, people (Paulin & Gilbert, 2018; Siemens, 2005). This conceptual framework may provide additional insights into how or why online PLNs influence teachers' practice.

Replicating the study to include teachers worldwide or different parts of the US would be another suitable avenue for additional research. Online PLNs are challenging to study because they are unique and personalized, different for each person. A larger sample to include other demographics, such as geographical areas, would be appropriate. It would be interesting to see how elementary or secondary teachers use online PLNs as well. Another recommendation would be a comparative study using correlation or control groups to compare online PLN users to those who do not use online PLNs against their use of technology. This study recognized "observers" within online PLNs who experienced increased technology self-efficacy. A study comparing more active users within their network to those who are less active or comparing those active users to nonusers could provide additional insights into online PLNs and how they influence

teachers' practice. Further, online PLNs offer a platform for teachers to develop professionally but gaining a deeper understanding of their effectiveness, based on the frequency in which users interact, can also help provide additional insights into the phenomena.

Implications

The study results indicate that online PLNs influence teachers' technological self-efficacy and provide teachers with resources that allow them to build relationships and problem-solve when using ICT in the classroom. These networks provide teachers with a plethora of resources and opportunities to receive support and encouragement from other members in their network. They also allow teachers to collaborate, problem-solve, and develop deep connections that build confidence for using ICT in the classroom. These themes showed that teachers who use an online PLN reflect on their teaching, an indicator of teacher PD, and stay abreast of technology changes, therefore, indicating these networks can change social systems as noted by Bandura (2001). As technology continues to develop and instructional strategies for using such change, teachers need to stay abreast of these changes to remain effective in the classroom. This research could provide leaders of school districts with concrete evidence that online PLNs can influence teachers' technological self-efficacy, permitting school administrators to encourage teachers to develop such networks. The study can potentially influence preservice programs and teacher PD programs by changing the way teachers receive annual PD.

Conclusion

Technology will continue to change, teachers' responsibilities to educate our youth will not. It is important that we continue to research teaching strategies, technology, learning and development, and administrative procedures as our schools are essential to our future success. Online PLNs have permitted teachers to go beyond their geographical boundaries to learn from their colleagues. They are continuously learning from each other so that they can provide the best education for their students. The purpose of this study was to explore online PLNs, and their influences on teachers' technological self-efficacy, and the results provide concrete evidence that these networks influence teachers. School administrators should encourage teachers to develop online PLNs to help them stay abreast of the changes in technology, but also to encourage the development of resources, relationships with other teachers, and confidence.

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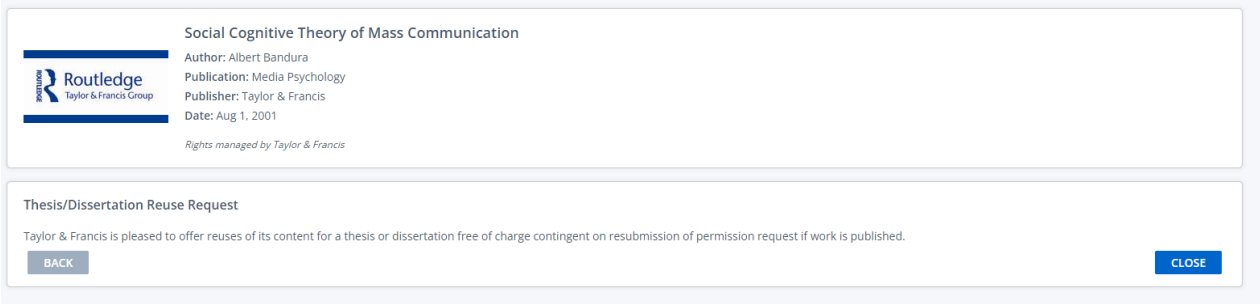
Appendix A: Interview Protocol

Questions	Four main sources of influence			
	Mastery experiences	Vicarious experiences	Social persuasion	Emotional states
How has your online PLN influenced your use of ICT in the classroom? New technologies?	X	X	X	X
What has been your biggest obstacle using ICT in the classroom? How has your online PLN influenced your ability to overcome obstacles for implementing ICT in the classroom? What conversations have you had with colleagues, in person or digital, regarding ICT obstacles?	X			
What experiences using ICT do you share with members of your online PLN? What experiences do you share using ICT? What kind of experiences using ICT do users within your online PLN share?	X	X		
Describe any experiences where members of your online PLN encouraged you to use ICT in the classroom.			X	
Describe any experiences of members of your online PLN promoting the development of skills for using ICT in the classroom.			X	X

Note. PLN = professional learning network; ICT = information communication technology.

Appendix B: Permission to Use Triadic Reciprocal Causation Diagram



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