THE RELATIONSHIP BETWEEN TECHNOLOGY READINESS AND ONLINE PROFESSIONAL DEVELOPMENT

by

Scott Ringkamp

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

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ABSTRACT

The purpose of this quantitative, correlational study is to determine if there is a relationship between technology readiness and grades, the number of attempts taken, or the time it took to complete an online professional development. Because of the pandemic, much educator professional development has shifted online. When this occurred, many teachers were unprepared to make this shift. To study the relationship, the researcher surveyed 73 staff members of an LEA in central Pennsylvania using the Technology Readiness Index 2.0 instrument. Then, the researcher computed a correlation coefficient between each participant's Technology Readiness Index score and their grades, number of attempts, and how long it took them to complete the online professional development. The results indicate no significant relationship between technology readiness and grades or the number of attempts. However, the correlation between technology readiness and days to completion yielded a small to moderate negative correlation. These findings support the use of online professional development and indicate that people will perform the same regardless of their technology readiness level. The only difference is that those with lower technology readiness might take longer to complete the online professional development. Expanding this study to include more variables regarding technology readiness and online professional development in the future would be beneficial.

Keywords: Professional development, readiness, online learning, technology readiness, COVID-19, correlation.

Acknowledgments

Receiving my doctorate, capped by the dissertation, has been an exercise of love and patience. I am reminded of the words of Paul in Philippians, where he says,

"I can do all things through him who strengthens me."

Philippians 4:13, ESV

Thank you, my God and Father, for giving me the strength and perseverance to get through this entire process. I could not have completed this dissertation and degree without help from many different directions. First, I must thank my family, who allowed me the time to take classes, work on papers, and spend countless nights over the last five years writing. With that, I must provide a special thanks to my wife, Amy Ringkamp, who has had to listen to me talk about statistics and research incessantly over that time. She has done a great job pretending to be interested, celebrating my successes, and encouraging me by being a steady presence at my side.

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List of Abbreviations

Institutional Review Board (IRB)

Local Education Agency (LEA)

National Aeronautics and Space Administration (NASA)

Student Online Learning Readiness (SOLR)

Technology Acceptance Model (TAM)

Technology Readiness Index (TRI)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this quantitative, correlational study was to determine if there is a relationship between technology readiness and grades, the number of attempts taken, or the time it took to complete an online professional development. Chapter 1 provides background information on technology readiness and online professional development. It starts by giving the historical context of the subject and then moves to an overview of the theoretical framework for this study. The problem statement follows this introduction, highlights technology readiness and online professional development use in recent literature, and defines the problem. Then Chapter 1 provides the purpose of this study, followed by the significance of the study. The final section introduces the research questions and pertinent definitions for the study.

Background

With the onset of the COVID-19 pandemic, most student and teacher learning moved to an online environment (Miller et al., 2020). Onyeaka et al. (2021) found that over 1.1 billion students across 143 counties suffered total school closures. These 1.1 billion students equate to about two thirds of students from primary, secondary, and tertiary education levels. Many of those schools shifted to learning online, while many schools closed and did not continue instruction due to a lack of internet connectivity. Schools that went online were predominantly from developed countries, such as schools in Southeast Asia, where over 80% of the population had an internet connection compared to many schools in Africa, where less than 40% had an internet connection.

Because of this shift to online learning, teachers found themselves working with challenging teaching and learning situations. They quickly found that they were not ready for these situations. Instead of thriving, they struggled to survive and meet their students' basic needs (Lockee, 2021). In essence, the teachers exhibited a lack of readiness for online learning, with a significant reason for this lack being technology readiness (Chung et al., 2020a). Slutzky and DeBruin-Parecki (2019) have identified readiness as an indicator of success across many disciplines.

For educators specifically, Wuryaningsih et al. (2019) identified this lack of readiness in a country-wide online teacher professional development study completed in Indonesia. The researchers suggest that a lack of readiness with technology might be causing teachers to be less successful than their peers. Because this was not the focus of the study, the researchers did not show causation. Nevertheless, they highlighted the need to understand how technology readiness affects teachers' ability to succeed with online professional development.

Historical Overview

The modern-day concept of readiness can be traced back to Jean-Jacques Rousseau's theory on teaching from 1911 that all lessons being taught should not exceed or fall short of the student's capacity (Iheoma, 1997). The concept of readiness is further defined and broadened to include all people, not just students. Gfrerer et al. (2021) define readiness as "the state of being fully prepared for something," where that something is to "move from a current state to a new desired state" (p. 25). Examples from the literature include but are not limited to student readiness, career readiness, online learning readiness, and technology readiness (Chung et al., 2020a; Paolini, 2020; Parasuraman & Colby, 2015; Slutzky & DeBruin-Parecki, 2019).

The National Aeronautics and Space Administration first introduced the concept of technology readiness in the 1970s as a model for helping develop the systems necessary for space travel (Olechowski et al., 2020). The concept was then clearly defined in the early 2000s. Parasuraman and Colby (2015) define it as "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (p. 60). The need for this clear definition arose with the broad adoption of the internet and the advent of Web 2.0 tools, which brought rapid changes in people's exposure to technology.

The most significant use of technology readiness has been in the corporate world, where new technology and software are constantly introduced. In one study, researchers found that technology readiness significantly affected peoples' willingness to adopt new banking software (Khadka & Kohsuwan, 2018). In another instance, researchers assessed the technology readiness of older people to determine their readiness to adopt mobile-based health services (Khan et al., 2021).

Another area where technology readiness has seen use is online learning. Hergüner et al. (2021) define online learning as education completed via a browser or other digital tools over the internet. Because technology is integral to successful online learning, multiple online learning readiness assessments include technology readiness as an indicator (Chung et al., 2020b; Hung et al., 2010). When building their assessment, Hung et al. (2010) found technology readiness to be an indicator of success, with a composite reliability score of .867.

Only recently has the concept of technology readiness been creeping into the regular education world, where much of the focus has been on teachers' readiness to teach with technology rather than their readiness to learn. The COVID-19 pandemic accelerated this need for technology readiness (Miller et al., 2020). Researchers have danced around the issue without

directly addressing it as it concerns teacher's professional development. The first mention of technology readiness in education was by Reeves and Li (2012), who studied teacher perceptions of online professional development. They found that teachers taking online courses generally considered themselves technologically ready for what they must do to complete the training. A limitation of this study is that all educators volunteered to complete the online professional development.

In another study, Wuryaningsih et al. (2019) found that teachers were more successful in online professional development than in in-person courses. These results contrast with other studies, which showed online professional development is less valuable (Fischer et al., 2020; Hurlbut, 2018; Schumaker et al., 2010). Wuryaningsih et al. (2019) believe that one reason for the different results in their study compared to other studies was that the teachers received training in technology before taking the online courses.

Society at Large

In the early 20th century, researchers identified the importance of technology readiness (Parasuraman, 2000). Since then, widely available technology has rapidly advanced. Studies have shown that technology readiness is critical for adopting new technology (Khadka & Kohsuwan, 2018; Khan et al., 2021). Onyeaka et al. (2021) noted that the effects of the COVID-19 pandemic will forever change the education sector because of the permanent advances and the increased spending in online learning. Spending on educational technology and digital learning tools is projected to be around 350 billion by 2025. Because of the forced adoption of online and digital learning due to the COVID-19 pandemic, school district administrators must understand how technology readiness affects educators' ability to succeed in online professional

development (Lockee, 2021; Onyeaka et al., 2021; Wuryaningsih et al., 2019). Understanding this might enable administrators to offer the necessary support for teachers to be successful.

Theoretical Background

Three main theories dominate the literature regarding technology readiness and educator professional development. The first is the technology acceptance model (TAM) developed by Fred Davis in 1985 (Davis, 1985). The second is andragogy, which Malcolm Knowles developed in the 1970s (Knowles, 1970). Finally, Steward Hase and Chris Kenyon extended andragogy through the theory of heutagogy in 2001 (Hase & Kenyon, 2001). The TAM and readiness go hand in hand, as seen in Simiyu and Kohsuwan's (2019) study on mobile banking adoption. In this study, the researchers used the TAM to identify how the perceived ease of use of technology affected the intention of a person to adopt new technology. The TAM focuses on the tool being used, whereas readiness focuses on the person using the technology. By combining the two, the researchers created a wide lens with which to view the adoption of mobile banking technology. While this present study does not deal with mobile banking software, it does deal with educators' use of technology to complete a task.

Andragogy, and by extension, heutagogy, address self-directed and self-determined learning. Andragogy, described by Malcolm Knowles (1970) as adult learning theory, tries to identify the science behind teaching adults. One of the pillars of the approach is adult learner readiness, which states that adults must be ready for learning. This readiness can refer to the learners' state of mind, or it can refer to their current level of ability. Once adult learners feel ready to participate, they can self-direct their learning. Heutagogy extends this theory by stating that not only can they self-direct their learning when they are ready, but they can also self-

determine what should be learned (Blaschke, 2012). These theories support and enable educator professional development (Yazdani, 2019).

According to Blaschke (2012), shifting to a heutagogical approach to education can be challenging but beneficial to learners, as it allows them to approach online learning confidently. In other words, increasing the technology readiness of learners provides them with the ability to complete a broader range of training. These last two, andragogy and heutagogy, are the theories this present study will use to frame the discussion around technology readiness and educator professional development.

Problem Statement

The COVID-19 pandemic stopped most face-to-face learning in the spring of 2020. Since then, schools have adopted online and hybrid learning models to meet student needs (Lockee, 2021; Onyeaka et al., 2021). Historically, most of the research around online learning has focused on K-12 and higher education students (Syauqi et al., 2020). Studies show that these students are successful in an online environment when they develop good time management, communication, and technology skills (Martin et al., 2020). Competent technology skills provided the learner with enough technology self-efficacy to successfully use online platforms for the courses (Christensen & Knezek, 2018). These technology skills are known as technology readiness.

Technology readiness is not just a tool used for measuring online learning success. It has also been used for years in the corporate world to estimate a population's readiness to adopt and use new technology (Khadka & Kohsuwan, 2018). This measure of readiness is very similar to how educators have approached the last two years of education, where they had to adopt many new technology tools to survive (Lockee, 2021). In one study, researchers using a pretest,

posttest design found that online professional development participants demonstrated a significantly higher mean-rank gain than their in-person counterparts when completing the same training (Wuryaningsih et al., 2019). Researchers administered the pre-and post-tests right before and after the training. The only difference between the groups was that one group took the training online, and the other group took the training in person. The researchers attributed some of that effect to the teachers' technology training.

Even though researchers have completed studies on online learning and the use of technology to teach students, most research has focused on the student experience and not the educator's experience as a learner (Kalkan, 2020). Likewise, studies have identified technology readiness as an important indicator of success across the corporate world and for product adoption (Khadka & Kohsuwan, 2018; Parasuraman, 2000). The problem is that more research is needed to determine if there is a relationship between technology readiness and grades, the number of attempts taken, or the time it took to complete online professional development (Christensen & Knezek, 2018; Sahin-Topalcengiz & Yildirim, 2020; Wuryaningsih et al., 2019).

Purpose Statement

The purpose of this quantitative, correlational study was to determine if there was a relationship between technology readiness and grades, the number of attempts taken, or the time it took to complete an online professional development. This study used a quantitative correlational research design with groups of educators at local educational agencies in north-central Pennsylvania. A local educational agency (LEA) is any public educational agency controlled by a board of directors that oversees the public education of a city, township, county, or school district (U.S. Department of Education, 2017). The participants were educators and

paraeducators working with prekindergarten through 12th-grade students. Most of them have bachelor's degrees, and many have completed graduate-level coursework.

The first variable used was the Technology Readiness Index (TRI) score. Participants completed a readiness assessment to measure their technology readiness. Parasuraman and Colby (2015) define technology readiness as "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (p. 60). A high score on this index demonstrates confidence and knowledge about learning and using technology, while a low score demonstrated hesitancy and a lack of technical expertise. For this study, the goal was completing an asynchronous online professional development.

The researcher used three other variables to understand how educators perform while completing an online professional development. First, the researcher examined educator scores from the training. Then, the researcher examined how many days it took them to complete the training. Finally, the researcher examined how many attempts each participant made on the assessments. These variables were then compared to each participant's technology readiness score. A positive or negative correlation demonstrated a relationship between technology readiness and the completion of online asynchronous professional development.

Significance of the Study

As stated earlier, Wuryaningsih et al. (2019) attributed some of the findings of their study to teacher training in technology. The main limitation of this study is that the researchers found "there were variables attributable to the effect that [were] not examined in this paper" (p. 140), one of which was the technology training provided to their educators. This limitation means they could not directly attribute the increase in performance to this technology training. This design limitation leaves room for this present study to address this gap directly. Similarly, Blaschke

(2021) has argued for the need to increase learners' capacity toward self-directed learning, especially in light of the pandemic (Onyeaka et al., 2021). Increasing educators' technology readiness will also increase their ability to engage in self-directed learning (Sahin-Topalcengiz & Yildirim, 2020). Sahin-Topalcengiz and Yildirim (2020) also concluded that more research was needed to investigate what other factors were inhibiting the adoption of new technology. This present study provides some more insight into whether technology readiness is a factor that inhibits the adoption of new technology.

Finally, education models are currently constantly changing between in-person, hybrid, and online learning. While many of these changes are temporary ones due to the pandemic, many will permanently remain. As Onyeaka et al. (2021) state, "educational delivery across the globe will significantly be altered in the coming years because of the COVID-19 pandemic" (p. 8). Consequently, teaching and learning in a self-directed manner is an essential skill for educators to learn so they can be successful with technology-driven professional development. In turn, technology-competent educators will help ensure student success in the post-COVID world of digital learning (Blaschke, 2021; Yazdani, 2019). This study provides administrators and decision-makers with important information about the needs of their teachers related to online professional development.

Research Questions

RQ1: Is there a relationship between local education agency (LEA) staff technology readiness scores and grades on an online professional development?

RQ2: Is there a relationship between LEA staff technology readiness scores and the number of attempts taken to complete an online professional development?

RQ3: Is there a relationship between LEA staff technology readiness scores and the time it took to complete an online professional development?

Definitions

1. *Distance Education* – Distance education is a method of education that utilizes technology to instruct and support students asynchronously or synchronously (Agostinelli, 2019).
2. *Career Readiness* – "Career readiness is the attainment and demonstration of requisite competencies that broadly prepare college graduates for a successful transition into the workplace" (Stebleton et al., 2020, p. 14).
3. *Local Educational Agency* – "Local educational agency or LEA means a public board of education or other public authority legally constituted within a State for either administrative control or direction of, or to perform a service function for, public elementary or secondary schools in a city, county, township, school district, or other political subdivision of a State, or for a combination of school districts or counties as are recognized in a State as an administrative agency for its public elementary schools or secondary schools" (U.S. Department of Education, 2017).
4. *Online Learning* – Online learning is a form of education that utilizes the internet to provide instruction and support (Hergüner et al., 2021).
5. *Professional Development* – Professional development is teacher learning to produce positive change in student learning outcomes (Basma & Savage, 2017).
6. *Readiness* – Readiness is the state of being prepared to move from the current state to a new state (Gfrerer et al., 2021). Readiness also refers to one of the principles of andragogy and heutagogy, which states that learners will not voluntarily enter the process

to move from the current state to a new state unless they are ready, based on their personal needs, for the move (Hase & Kenyon, 2001; Knowles, 1970).

7. *Self-determined Learning* – Self-determined learning is *"*An active and proactive process [where] learners [serve] as the major agent in their own learning, which occurs as a result of personal experiences" (Blaschke, 2012, p. 58).
8. *Self-directed Learning* – Self-directed learning is "A process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (Knowles, 1975, p. 18).
9. *Technology Readiness* – Technology readiness is people's willingness to embrace and use new technologies for accomplishing goals in the home, in life, or at work (Parasuraman, 2000). "Technology readiness represents a gestalt of mental motivators and inhibitors that collectively determine a person's predisposition to use new technologies" (Parasuraman & Colby, 2015, p. 60).
10. *Web 2.0* – Web 2.0 is the second generation of web tools that allow for online collaboration, instant two-way communication, and the creation and sharing of content (Jarrah & Alzubi, 2021).

CHAPTER TWO: LITERATURE REVIEW

Overview

A systematic review of the literature was conducted to explore how to ensure successful online professional development. This chapter examines the current literature related to this topic. The first section discusses the theories of andragogy and heutagogy, which are linked directly with adult education and online professional development. These theories are followed by a discussion about online learning and its specific application to online professional development. Finally, the chapter ends with an examination of the literature concerning readiness and how it relates to successful online professional development. This synthesis performed by the researcher identified a literature gap, confirming the need for the present study.

Theoretical Framework

Two closely related theoretical frameworks provide a lens with which to examine technology readiness regarding online professional development. The first, andragogy, forms the foundation of modern adult learning and provides the concepts behind self-directed learning (Parker, 2020). The second, heutagogy, builds on the foundation laid by andragogy and expands self-directed learning into self-determined learning (Hase & Kenyon, 2001). Using a combination of both provides a lens for examining LEA staff professional development in an online setting.

Theory of Andragogy

Any discussion of online professional development can be framed through the lens of andragogy, which is also known as adult learning theory. Alexander Kopp first used the term andragogy in Germany in 1833. The word andragogy, which translates to the teaching of adults, runs counter to pedagogy, which refers to teaching children. The early uses of the term referred

back to many of Plato's educational theories. It resurfaced again with Eugene Rosenstock-Huessy, also in Germany, in the 1920s. Rosenstock was an adult education theorist who thought that those teaching adults required unique strategies (Machynska & Boiko, 2020; Yazdani, 2019). Finally, Malcolm Knowles picked up the concept of andragogy in the 1970s. Knowles broadened the term and clarified the definition and purpose of andragogy (Knowles, 1970). His definition and corresponding theory became the backbone of modern adult learning theory (Machynska & Boiko, 2020).

The modern-day iteration of the theory of andragogy means the teaching of adults, and the theory is used to study the science behind adult learning (Machynska & Boiko, 2020). Andragogy posits that, because of the development of the brain, adults have different needs for learning than children (Knowles, 1970). Specifically, Knowles identifies five assumptions regarding adult learning. These assumptions are self-concept, experience, readiness, orientation to learning, and motivation. Knowles did not add the last one, motivation, until 1984 (Machynska & Boiko, 2020).

The assumption of self-concept refers to the idea that adults understand themselves and are not dependent on others to survive or succeed in a learning experience (Parker, 2020). The fact that adults understand themselves and lack dependence contrasts with children, who depend on a teacher to direct them in their learning. Self-concept is the basis for self-directed learning, which is where learners actively engage in deciding which direction to take their learning (Machynska & Boiko, 2020). This idea of self-directed learning is at the core of adult learning theory (Knowles, 1970; Livingston, 2020).

The assumption of experience means that adult learners have many life experiences that will affect how and why they learn (Knowles, 1970). Adults can draw on these experiences

during learning and actively apply what they are learning to events they have gone through (Livingston, 2020). The third assumption, readiness, means that adults choose to complete the learning experience when they need to know what is being taught (Parker, 2020). Adults tend to be more willing to learn when needed, whereas kids must be convinced to learn (Machynska & Boiko, 2020). Another way of stating this is that adults understand the need for learning. On the other hand, kids will willingly not learn even when presented with a need.

The fourth assumption is that adults have a specific orientation to learning. This assumption means that adults have a specific purpose for entering a learning experience. As Livingston (2020) says, adults shift their perspective from a "postponed application of knowledge to immediate application" (p. 176). Adult learning tends to focus more on problem-solving rather than content acquisition. For instance, if the drain is clogged, an adult learner might watch an online video to learn how to fix it.

Finally, andragogy assumes that adults have many intrinsic and extrinsic motivators for learning. Adults enter a learning experience not because the teacher tells them they have to learn (Knowles, 1970; Parker, 2020). Instead, they are motivated by the potential social, economic, or academic gain (Livingston, 2020). Some examples of these possible gains include a promotion at work or a graduate-level degree, among other things. Current research demonstrates that these motivators continue to drive participation in new experiences (Geng et al., 2019).

Along with these assumptions, Knowles developed four guiding principles for adult education. The first is that adults "need to be involved in the planning and evaluation of their instruction" (Machynska & Boiko, 2020, p. 30). Adults want to understand why they are doing what they are doing. This understanding plays out through an active learning environment that includes content created by the participants. This active learning environment also involves

participants creating assessment questions from the content and building self-evaluations (Livingston, 2020).

The second principle is that experiences are the foundation of adult learning activities. Adults can provide real-life problems as examples during learning experiences. Participants then tackle these real-life problems with real-life solutions developed from other adult learners engaged in the activity. The problems and the solutions originate from the learners' personal experiences (Knowles, 1970; Livingston, 2020). The third is that learning activities must be relevant to the current life situation of the participating adults. This principle is what drives learner engagement in adult learning. For example, if an adult learner attends training to learn a specific skill and that skill is left off the agenda, they will be discontent and might leave the training rather than stay to learn something they are not interested in (Livingston, 2020; Machynska & Boiko, 2020; Parker, 2020).

The last principle is that adult learning should focus on solving problems rather than sitting and receiving content. As with the other principles, these problems should be relevant, real-life problems that the adult learners are or were experiencing. Participating in solving problems involves the participants and allows them to self-direct their learning. The last thing most adult learners want to do is sit and listen to a lecture on content (Knowles, 1970; Machynska & Boiko, 2020; Parker, 2020).

Theory of Heutagogy

An extension of andragogy is the theory of heutagogy, which was developed by Hase and Kenyon (2001). With the advent of Web 2.0 tools and the incredible amount of information available via the internet, Steward Hase and Chris Kenyon proposed a new theory for adult

learning known as heutagogy. Whereas pedagogy translates to child learning and andragogy, to adult learning, heutagogy translates to self-learning (Yazdani, 2019).

Just like andragogy provided a counterpoint to pedagogy in the 1970s regarding adult learning, heutagogy provides a similar pivot with the advent of the internet and Web 2.0 tools. The theory presented by Steward Hase and Chris Kenyon is defined as self-determined learning and presented as a logical progression from previous theories on adult learning (Blaschke, 2012; Yazdani, 2019). Heutagogy eschews the traditional relationship between teachers and students, where teachers hold the keys to and provide the methodology for how knowledge and skills are taught to people. Instead, the theory of heutagogy posits that the learner should determine the content and pace of a learning experience and the method needed to teach that content (Hase & Kenyon, 2001).

The need to move the determination of learning from the teacher to the learner supports the idea of just-in-time learning, which is necessary due to information changing rapidly in many professions (Blaschke, 2021). By the time people take a course, the best practices have already changed. This rapid change of information means that the participant is learning old information.

Heutagogy balances this by allowing the student to choose what information they learn, decide how they learn it, and choose when to complete it. Allowing the learner this freedom ensures each student can learn about what they need to learn. This freedom also allows learners to ignore information that may not be relevant to their current job or life situation (Yazdani, 2019). Learning activities developed using this theory tend to be directed by the learner, follow a non-linear design, and strive to ensure students understand how they learn and learn the necessary concepts (Blaschke, 2012).

Learner-directed activities are more than the learner choosing from a menu of items, which is the case during personalized learning. Instead, the learner actively assists with the activity's design and then participates in it (Blaschke, 2012; Yazdani, 2019). This active participation leads to activities that are closely linked with the learner's experiences, needs, and interests. According to Lee et al. (2016), learner-directed activities allow participants to take control and be responsible for their learning. This control enables them to focus on what they feel is necessary, which leads to a non-linear design for adult learning activities.

With a non-linear design, participants do not follow a prescribed path through the learning activities. While a prescribed path works for students in a classroom, adult participants enter learning activities with varying levels of experience and knowledge (Blaschke, 2012). Because of adults' different levels of experience, their actual needs vary considerably, although each learner wishes to learn something about the topic (Schroeder, 2017). By allowing learners to determine their path through an activity, the learning experience can accommodate multiple ability levels and knowledge levels (Yazdani, 2019). These accommodations also enable the training to be more flexible and meet the ever-changing needs of the modern workplace (Schroeder, 2017). This flexibility also brings adult students into the learning process, which allows them to understand how and why they are learning what they are learning. Finally, involving them in the process motivates them to succeed (Blaschke, 2012).

Once adult learners understand how they learn, they can succeed with self-determined learning. Rather than choosing activities that might be good for others, they can focus on things they know will help them learn (Blaschke, 2012). This focus develops the learning capabilities of adult participants. In turn, this increases the effectiveness of future training and learning activities (Stoten, 2020).

One of the hallmarks of this theory is that it was developed alongside Web 2.0 with a specific bent toward online learning (Blaschke, 2012). Traditionally, distance learners have been adults who entered the experience willingly to learn about something that had interest or meaning in their lives. This willingness fits the general andragogical framework presented by Knowles (1970). That being said, because the learner has so much autonomy in distance learning, it moves past the self-directed learning presented by Knowles. With no teacher present to direct the learning experience, distance learning can quickly move into the realm of self-determined learning (Hase & Kenyon, 2001; Knowles, 1970).

Both andragogy and heutagogy provide a lens through which to examine adult learning. Knowles builds the foundation of adult learning theory through his assumptions and principles of andragogy (Knowles, 1970; Machynska & Boiko, 2020). These assumptions and principles demonstrate two things. First, they show how adults approach entering into learning differently than children. Second, these assumptions and principles show how adults learn differently than children. These distinctions set apart adult learning (andragogy) from child learning (pedagogy; Knowles, 1970).

Hase and Kenyon (2001) expanded upon andragogy to bring it into the 21st century with a theory that applies to the rapid change of information present in the world today (Blaschke, 2012). They used heutagogy to define this theory and separate it from andragogy. Hase and Kenyon define heutagogy as a move from self-directed learning to self-determined learning. All three theories—pedagogy, andragogy, and heutagogy—help display a spectrum of varying learning theories covering humanity's entire range of ages (Hase & Kenyon, 2001; Machynska & Boiko, 2020; Stoten, 2020).

Related Literature

There is a long history of providing professional development to teachers with the intent of bettering their professional practice (Yen, 2020). Most of this professional development was spent face to face in a classroom setting. Online professional development opportunities have been offered over the last 20 years as the internet has become more prevalent in homes and schools (Palvia et al., 2018). Even so, it has not flourished, with studies over the past 10 years showing the benefits of online professional development to be inconclusive at best (Fisher et al., 2010; Fishman et al., 2013; Webb et al., 2017; Wuryaningsih et al., 2019). With the recent COVID-19 pandemic, classroom and online professional development have meshed together, and almost all teachers, many of whom were not prepared, have been thrust into online professional development (Bragg et al., 2021). Bragg et al. (2021) even go as far as to state, "It is unquestionable that effective teacher professional development and learning that is offered exclusively online will be an integral part of this new global educational landscape" (p. 165).

Professional Development

Horace Mann pioneered the systematic training of teachers in the 1800s. His purpose was to train quality teachers to provide students with better education. He believed this better education would lead to a thriving economy for the United States. He set up a system of normal schools to provide teachers with professional development (Yen, 2020). Since then, multiple studies have shown that successful professional development leads to better student and teacher performance (Bragg et al., 2021). A meta-analysis conducted by Basma and Savage (2017) found that teacher professional development positively affected student reading ability, $g = 0.225$, $p < .05$. This analysis reviewed 17 studies, of which 14 showed a positive effect on student performance, and three showed a negative effect.

From the teacher's perspective, professional development is viewed as very important for being successful. Yenen and Yontem (2020) conducted a study examining the professional development needs of teachers. By studying a diverse group of 35 teachers, they found that most teachers felt they needed more professional development to succeed in the classroom. Some of the topics identified by the study included special education, research methods, and instructional technologies. Additionally, Weinhandl et al. (2020) determined that teachers' ability to address educational problems in the classroom is directly related to the knowledge and skills developed during teacher professional development.

Positive and Negative Factors

Teacher professional development activities that positively affect students share many of the same characteristics. Basma and Savage (2017) discuss how the quality of the professional development experience significantly impacts the experience's success. Brandisauskiene et al. (2020) completed a study of teachers from four different countries to measure which characteristics of professional development lead to success. Two factors stood out to them. First, collaboration is a consistent driver of successful professional development. Second, long-term teacher training trumps short one-off sessions.

Another significant factor for professional development success is an idea called communities of practice (Kin et al., 2019; Perry et al., 2021; Saifuddin & Strange, 2016). Teachers with considerable experience have a wealth of ideas and knowledge that should be shared to increase the competence of other teachers (Weinhandl et al., 2020). These communities allow teachers to communicate outside the scope of the course content and usually constitute an informal forum for teachers to share best practices. These information forums enable teachers to

take advantage of self-determined learning and seek more knowledge outside of a given professional development session (Blaschke, 2012).

Perry et al. (2021) identified that these communities are well-suited to the online learning environment. Current tools allow instant and asynchronous communication between community members, so even if a training is short, the community can be drawn upon well after the training is over. Even though these communities are enabled by online learning, Perry et al. (2021) further identified that participating teachers must sustain these communities. It is easier than ever for participants to sustain these communities with instant communication tools in mind. This sustainability is possible because of the advent of Web 2.0 tools, which have significantly increased the possibilities for collaboration during online learning (Jarrah & Alzubi, 2021).

By contrast, not all professional development activities lead to positive student outcomes. Perry et al. (2021) identified a significant problem with online professional development regarding communities of practice. That problem is that teacher professional development is usually short-term and does not allow for community-based sharing. Therefore, while the Web 2.0 tools are available, they are not being leveraged to extend learning possibilities via communities of practice, either because there is no time for implementation or because the participants do not feel comfortable utilizing them (Hamutoglu & Basarmak, 2020; Sahin-Topalcengiz & Yildirim, 2020).

Researchers have identified other potential shortfalls when it comes to professional development. A common denominator among these shortfalls is that they disregard common andragogical and heutalogical principles of self-directed and self-determined learning (Hase & Kenyon, 2001; Machynska & Boiko, 2020). One of these shortfalls is that professional development is too repetitive. Teachers are repeatedly learning the same thing without moving

on to higher-level instructional practices (Lane et al., 2019). Another shortfall is where only direct instruction is utilized and no space is given to discussion or learner participation. Finally, ineffective professional development is characterized by a one-size-fits-all approach where everyone in training is assumed to have the same level of competence and skill. This assumption leads to an experience that is not useful for most participants (Kraft & Blazar, 2018; Lane et al., 2019).

Online vs. Face to Face

Success factors have been well researched in face-to-face environments (Basma & Savage, 2017). Nevertheless, studies on the same factors in online environments are limited at best (Bragg et al., 2021). An exciting study conducted by Wasserman and Migdal (2019) examined teachers' attitudes toward online and face-to-face professional development. The authors found that those who chose to complete the course online were much more appreciative of the learning environment, even though the environment made collaboration more difficult. They also found that this group had a greater understanding of the technology needed to complete the training. Finally, the teachers who took the training online performed better than those in the classroom. By contrast, Perry et al. (2021) found that collaboration can increase in an online community of practice given the right circumstances.

Over the last decade, researchers conducted a set of studies that showed no increase in educator competency when completing online professional development (Fisher et al., 2010; Fishman et al., 2013; Wuryaningsih et al., 2019). A more recent study by Webb et al. (2017) concluded that in the field of computer science there were no adverse effects of completing professional development online. Interestingly, this study approached the topic from the angle that online professional development could be worse than face-to-face professional development.

The studies by Fisher et al. (2010), Fishman et al. (2013), and Webb et al. (2017) had small sample sizes, making it hard to use their data for generalizations and causal interpretations.

In response to these studies, Wuryaningsih et al. (2019) conducted a large-scale study to provide data that could be generalized across a broader population for decision-making purposes. They collected data from 427,189 teachers across Indonesia. The researchers conducted a mean-rank gain analysis on pretest and posttest data. They concluded that the training was more effective for those who completed it online than for those who completed it in person. By contrast, other recent large-scale studies have shown online courses to be slightly less effective (Fischer et al., 2020; Hurlbut, 2018).

Another example of the effects of online professional development includes a study by Yunjo An (2018), who examined how online professional development affected teachers' perceptions, attitudes, self-efficacy, and behavioral intentions toward game-based learning. This study employed a mixed-methods design to collect and triangulate data. The quantitative results displayed a significant effect of online professional development toward game-based learning. For example, the data from the study reflected a significant increase in the perception of games to foster real-world skills, $Z = -2.989$, $p = .003$, with a medium effect size of $r = -.46$. One limitation of this study is that no group took an in-person professional development training, which would have been a useful comparison group.

These studies related to the effectiveness of online learning are interesting in that they each examine the same types of questions and come to opposite conclusions. The researchers for the study based in Indonesia directly addressed one reason they believe there are divergent findings. They state, "This finding implies that digital constraint was not an obstacle for the teacher in Indonesia, where the policy innovation in teacher training is adequately implemented"

(Wuryaningsih et al., 2019, p. 139). While this study could not establish a causal relationship, the researchers believed that their teachers had received enough instruction on using the online learning tools and were not being held back by technology.

Constrained by Technology

The idea that people can be held back by technology is evident in many facets of life. It occurs with older adults while using smartphones and computers for communication and shopping tasks. Research has shown a correlation between age and the amount of time someone is willing to invest in learning how to use technology. Older people are less inclined to spend time learning new technology compared to younger people. This willingness leads to a scenario where older adults are generally less apt to succeed at a task requiring learning and using new technology (Sharit et al., 2021).

Constraint occurs in the workplace when newer technologies supplant old ones. One study by Schmidt et al. (2020) demonstrated that current accounting professionals resisted giving up Microsoft Excel and moving to new and better software programs for data analysis. Another study explored implementing a new records system at a hospital in Korea. Researchers found that nurses without confidence in learning a new system for keeping health records were resistant to switching systems. Those nurses then fell behind colleagues who desired to learn the new platform when completing tasks using the new system (Cho et al., 2021). A lack of technology skills leads to a resistance to change or trying something new in the workplace (Collins & Liang, 2015; Malhotra et al., 2021; Wuryaningsih et al., 2019).

Technology constraint also occurs with students. Students must have specific computer skills, such as typing, searching, and utilizing apps, to succeed in the modern classroom. Students without these skills tend to perform worse than their peers (Loveland, 2017). Likewise,

the technology-related skills students must learn to get a job are also considerable. According to Cummings and Janicki (2020), the skills needed are constantly changing as more technological advancements are made. Students who do not learn the necessary skills will not be as marketable in the job field and will not be as successful.

Measuring Professional Development

Over time, many variables have been used to measure successful professional development. Among those variables, scores from professional development assessments have been a traditional indicator of success for both students and staff with respect to any kind of learning. A systematic review of the literature identified participant scores as a significant predictor of success with any learning experience (Ifenthaler & Yau, 2020). Many of the studies referenced herein used scores as one of their variables to show participant improvement or regression (Fischer et al., 2020; Hurlbut, 2018; Wuryaningsih et al., 2019).

Another variable used to measure success is the relationship between the number of attempts on an assessment and success on that assessment. Bergner et al. (2019) studied the use of multiple attempts on assessments as a data point for determining student ability or knowledge acquisition on an assessment with open-ended questions. They completed in-depth analysis using psychometric models such as the graded response model or sequential item response framework. Attali et al. (2016) studied the use of multiple attempts on assessments for multiple-choice responses. According to these studies, after students answer a problem incorrectly, they "may feel more certain…less certain…stimulated to try again, or perhaps completely frustrated" (Bergner et al., 2019, p. 415). In general, research has shown that multiple attempts yield higher student scores and evidence of authentic learning and improvement (McManus & Ludka, 2012; Temen et al., 2020).

A third variable used to measure success is the relationship between the length of time it took participants to complete a learning experience and successful completion of the learning experience. Hong et al. (2021) defines this period as academic procrastination. The researchers found participant levels of academic procrastination to be a significant predictor of failure or success with any activity that requires self-regulated learning. Participants who delayed completing the studied activities fared worse in general than those who completed them right away. The related literature supports the finding that academic procrastination negatively affects learner success (Li et al., 2020; Lim, 2016; Soffer & Cohen, 2018). Additionally, research shows pressures and stress to finish a course or assignment before the due date negatively affect learners (Alghamdi et al., 2020). All three variables have been applied to in-person learning and online learning but not specifically to learner technology readiness or online professional development.

Online Learning

Korkmaz and Toraman (2020) state that "Digital transformation…has been accelerated…due to COVID-19, and many educational institutions have started using different distance education systems and tools" (p. 293). Many school districts have used these tools to implement online learning programs. Online learning, defined as an online teaching method using digital technology, is also known as e-learning or distance learning (Hergüner et al., 2021). While online learning is synonymous with distance learning, that was not always the case (Korkmaz & Toraman, 2020; Li, 2018; Palvia et al., 2018).

History

According to Michael Agostinelli (2019), distance education has three iterations. From 1852 to 1939, correspondence courses allowed rural Americans access to programs of study

previously unattainable due to travel and location. These courses' learning materials were sent and responded to via the postal system (Agostinelli, 2019; Li, 2018; Palvia et al., 2018). In 1870, Anna Ticknor created the first school centered around correspondence learning. Correspondence courses flourished throughout the early 1900s as more organizations started offering them. This method thrived due to the availability of printed materials and the introduction of the ballpoint pen, which made completing worksheets very easy (Agostinelli, 2019).

The most significant limitation of this form of distance education was the lack of real-time communication and collaboration between the instructor and the student. Students had to wait for their materials in the mail, and if they had questions about an assignment, there was no way to receive immediate assistance (Agostinelli, 2019). Lee et al. (2016) mentions that communication only went in one direction. These communication challenges also led to an isolating experience in which students worked by themselves with no collaboration (Agostinelli, 2019).

The second iteration lasted from 1940 to 1999 and rose in tandem with the widespread availability of radio and television (Agostinelli, 2019). These new technologies allowed learners to see and hear the course's instructor. Rather than displace correspondence courses, these technologies supplemented and improved the experience (Li, 2018). The end of this period saw the first attempts at online courses with the rise of the world wide web in 1991. These early adopters did not succeed due to the same limitations that hounded early correspondence courses (Palvia et al., 2018).

Even with the advent of television, radio, and the world wide web, the same limitations from early correspondence courses marked this period. Communication was still one-sided, with the participant not interacting with the instructor presenting the content. Any communication

would require a phone call outside of instructional time or a postal mail message (Agostinelli, 2019; Li, 2018). The early internet-based courses also ran into this issue, as web-based communication tools were unavailable until Web 2.0 in the early 2000s (Palvia et al., 2018). Instead, instructors presented static content on a website, which was virtually the same as receiving a packet in the mail.

The third and current iteration began in 2000 with the widespread availability of the internet and the saturation of personal computers in the home environment (Agostinelli, 2019). This period was also marked by the rise of collaboration and instant online communication tools (Jarrah & Alzubi, 2021; Palvia et al., 2018). No longer were students and teachers relegated to interacting in slow forms, such as written correspondence, or via one-way communication with the television. The immediate communication and feedback tools provided by Web 2.0 created the perfect environment for distance learning to transform into online learning (Li, 2018). As Agostinelli (2019) says, “The internet has been so impactful on distance education that the term used for learning from a distance has changed to be commonly known as online learning” (p. 6).

Web 2.0

During the current iteration of distance education, there have been many rapid advances in how the internet has affected educational models. One name for these rapid advances is Web 2.0, defined as “the second generation of web-based services emphasizing online collaboration, creating, and sharing” (Jarrah & Alzubi, 2021, p. 674). These tools allow people with no technical background to create and share content on the internet. Ease of creation and sharing were key features, as previous tools required advanced technical skills make changes or create new content. Examples of these complicated tools include social media sites, blogs, podcasts, and photo editing sites (Jarrah & Alzubi, 2021).

Before Web 2.0, the internet consisted of Web 1.0 tools that were static (Chitanana, 2021). These tools included basic web pages that were hard to update and lacked advanced communication features. Making any changes required advanced knowledge of webpage design and computer coding. Furthermore, web applications did not exist, which meant that people had to download programs to their computers before using them (Jarrah & Alzubi, 2021). Agostinelli (2019) discusses these tools as part of his second iteration of distance learning and notes that these limitations led to the limited success of online learning before the introduction of Web 2.0 tools.

Web 2.0, which includes interactive tools such as learning management systems and instructional technology tools, allowed for high-quality synchronous and asynchronous educational experiences in an online environment (Jarrah & Alzubi, 2021; Palvia et al., 2018; Sahin-Topalcengiz & Yildirim, 2020). These tools were developed and aligned with Agostinelli's (2019) third iteration of distance education around 2000 and aligned with heutagogical principles surrounding self-determined learning (Blaschke, 2021; Yazdani, 2019).

These essential tools provided the foundation allowing modern online learning to take shape (Palvia et al., 2018). One of the most crucial Web 2.0 tools is the learning management system. This system provides a way to systematically and comprehensively present the content for a topic of study. Learning management systems allow teachers to communicate with students instantly and offer an online environment ripe for collaboration. Unlike posting static content to a website, instructors can now post and interact with their students instantly (Palvia et al., 2018; Sahin-Topalcengiz & Yildirim, 2020).

Even though these tools have existed for many years, their adoption by teachers has been sporadic at best (Sahin-Topalcengiz & Yildirim, 2020). Teachers have spurned their use and held

on to traditional tools. Some of the identified reasons for this are a lack of training, resistance to change, and teachers' lack of self-belief that they can use new technologies. One final identified barrier is a perceived or actual lack of self-efficacy in using Web 2.0 tools (Hamutoglu & Basarmak, 2020). These factors are closely linked to the success factors identified for online professional development and highlight the need for teachers to receive adequate training regarding the tools they will use (Sahin-Topalcengiz & Yildirim, 2020; Wuryaningsih et al., 2019). This need for teacher training became even more evident with the advent of the COVID-19 pandemic.

COVID-19

In March 2020, schools across the globe closed to in-person learning due to the COVID-19 pandemic. Over 1.1 billion students from 143 counties had their schools closed. These students equated to about two thirds of primary through tertiary education students (Onyeaka et al., 2021). These school closings thrust millions of students and teachers into the world of online learning (Lockee, 2021; Syauqi et al., 2020). Those who shifted to online education came primarily from the developed world, where most students had internet connectivity. Over 80% of students in developed nations had a connection, whereas less than 50% of students had an internet connection in developing nations. Schools without reliable internet at either the school or students' homes tended to close and stay closed (Onyeaka et al., 2021).

This shift to online education required rapid advances in the world of education. Whereas before, the adoption of Web 2.0 tools was partial at best (Sahin-Topalcengiz & Yildirim, 2020), all teachers and students were now faced with the necessity of learning how to use them to continue the education process. Teachers who had no previous experience teaching online had to

do so, and students with no desire to learn online had no choice (Miller et al., 2020; Syauqi et al., 2020).

Much of the focus on learning during the pandemic was on how it affected the students (Syauqi et al., 2020). Starting in March of 2020, all students worked from home. Furthermore, this transition was disorganized for many people (Tremmel et al., 2020). Schools, especially rural schools, did not have enough resources, and many stopped teaching altogether in the spring. Online learning became the solution for many students, but many districts had to reach those not connected via other means, such as printed materials and phone conversations (Miller et al., 2020).

Besides student learning, teacher professional development also shifted online because of the global pandemic (Lockee, 2021). Professional development plans did not go away, and teachers had to continue learning virtually (Miller et al., 2020). Because of the sudden shift, teachers found themselves in a teaching and learning situation that they were not ready for and was challenging. Instead of flourishing in this environment, they struggled just to survive and meet the basic needs of themselves and their students (Lockee, 2021).

Readiness

One of the areas that teachers lacked preparation for was technology. Another way of defining this was a lack of readiness to use technology. The modern-day iteration of readiness has its origins in the educational theory of Jean-Jacques Rousseau. Iheoma (1997) contends that Rousseau's educational theory "is like a readiness technique which…ensure(s) that any new lesson is within the emotional and intellectual capacity of his or her pupils" (p. 71). Since then, the concept of readiness has been expanded and generalized to include people of all ages, not just students. At its base, readiness refers to people's preparedness to do something that will move

them from their current state to a new, more desirable one (Gfrerer et al., 2021). Hergüner et al. (2021) relate the concept of readiness to having the necessary prior knowledge and attitudes to be successful at a given task.

The concept of readiness has been used for years to determine when people have reached specific thresholds needed to succeed. For example, kindergarten readiness is measured by examining a child's attributes and environmental conditions. Teachers then use that data to decide when students should begin formal learning (Slutzky & DeBruin-Parecki, 2019). Another example is career readiness, which looks at whether a student has the necessary skills for obtaining a job in their chosen career. Guidance counselors might use the data gathered to direct students to a profession they will succeed in (Paolini, 2020). One last example is online learning readiness, which predicts a learner's success in online learning in an online learning environment. Parents might use this data to decide if their students would succeed in an online cyber-school environment (Chung et al., 2020a).

Readiness in Education

Readiness has always been important in the education process (Akhtar & Bilal, 2018; Hergüner et al., 2021). From Rousseau to the present day, educators have recognized the importance of ensuring students are ready before attempting to teach them certain concepts (Akhtar & Bilal, 2018; Iheoma, 1997). Common attributes include literary ability, cognitive ability, and social-emotional and physical development. These attributes can be affected by factors such as socioeconomic status and parenting, among other factors (Akhtar & Bilal, 2018). Readiness is often applied to students about to enter kindergarten. After that, it is used throughout children's educational experience to ensure they meet specific educational and developmental milestones (Akhtar & Bilal, 2018; Slutzky & DeBruin-Parecki, 2019).

Akhtar and Bilal (2018) conducted a phenomenological study exploring school readiness. The researchers interviewed parents, teachers, and principals about school readiness. Common themes from the study indicated that successful children must demonstrate the capacity to control their emotions and demonstrate age-appropriate behavior. Physical development such as successful potty training is also an essential indicator of school readiness. These themes help determine important readiness milestones for school. For preschool age students, these milestones are developmental rather than things that must be taught.

In another study, Ricciardi and Winsler (2021) found that school readiness indicator scores on a standardized school readiness assessment could predict whether students would enroll in advanced courses. The assessment tested cognitive, language, and fine and gross motor skills. Using bivariate analysis, the researchers compared the mean scores of students who enrolled or did not enroll in advanced courses. They found each indicator to be a statistically significant predictor of advanced course enrollment, with cognitive, language, and fine motor indicators all displaying medium effect sizes, as measured by a Cohen's $d > .50$.

Career Readiness

The concept of career readiness is similar but different from educational or school readiness. Stebleton et al. (2020) define career readiness as "the attainment and demonstration of requisite competencies that prepare [people] for a successful transition into the workplace" (p. 14). Like school readiness, career readiness involves the preparation to move from the state of being in school to the state of having a career or job. Career readiness diverges from school readiness because the "requisite competencies" are developmental milestones that are usually not taught like those of school readiness. Instead, some career readiness indicators are learned competencies (Akhtar & Bilal, 2018). This divergence between school and career readiness

demonstrates one of the hallmarks of readiness in andragogy and entails a logical separation between child and adult readiness (Knowles, 1970).

Williams et al. (2018) identified four career readiness indicators: knowledge, character, academic competency, and goal setting. Of these indicators, knowledge, academic competency, and goal setting are learned competencies, while the remaining indicator of character is the only one that might be considered developmental. These skill-based indicators are areas where training can affect students' career readiness (Troisi, 2021). Increasing students' readiness increases the chance of them successfully transitioning to the workplace (Stebleton et al., 2020).

Troisi (2021) conducted a study using a pretest posttest design with test and control groups to demonstrate that instruction in career readiness can be successfully done. Participants in both groups were taking a college course in psychology. In the test group, participants were offered embedded career readiness training throughout the course. Troisi found that the test group's career readiness increased significantly over the control group, (*Nskills* = 8, *Ncomparison* = 23) $U = 39.000$, $z = -2.396$, $p = .016$ (two-tailed), $\eta 2 = .191$.

Researchers found that career readiness indicators include external factors not generally associated with the career readiness instruction explored in other studies. Two of these external factors included leadership style and mathematics (Cogan et al., 2019; Villarreal et al., 2018). Villarreal et al. (2018) found that students with the personality type to be a leader, considered a developmental character indicator, scored higher on career readiness assessments (Williams et al., 2018). Similarly, Cogan et al. (2019) found that students who were successful at mathematics, which would fall under the academic competency indicator outlined by Williams et al. (2018), also scored higher on career readiness assessments.

Finally, technology readiness has emerged over the past few years as an indicator of career readiness (Buzzetto-Hollywood & Alade, 2018; Quinn & Buzzetto-Hollywood, 2019). According to Quinn and Buzzetto-Hollywood (2019), "The increasing complexity and technological dependency of the diverse hospitality and tourism sector raises the skill requirements needed, and expected, of new hires making education and competency development a strategic priority" (p. 21). Not only is technology readiness a requirement of many jobs, such as cybersecurity and computer coding; it is also desirable to current students in higher education. Studies have shown that students want to be more familiar with the technology to succeed in the rapidly evolving technology-dominated workplace (Buzzetto-Hollywood & Alade, 2018).

Readiness in Online Learning

Readiness is also used to measure people's ability to succeed with online learning (Chung et al., 2020a; Chung et al., 2020b; Hergüner et al., 2021). This readiness for online learning generally uses an instrument that measures multiple variables, such as time management, communication ability, student attributes, and technology (Martin et al., 2020). One last variable noted is the need for the right attitude and motivation. The right attitude and motivation mean the participant must have a positive outlook on the online learning experience (Hergüner et al., 2021).

According to Martin et al. (2020), time management refers to the self-discipline to complete everything in the allotted time provided. Communication refers to the willingness to interact via discussion board and other computer-related communications with classmates and the instructor. Student attributes include self-motivation and self-directed learning (Knowles,

1970). Finally, technology refers to self-efficacy with a computer, internet, and search skills (Blaschke, 2012; Martin et al., 2020).

Multiple studies have shown that students who score high on online learning readiness indicators tend to succeed. For example, Al-Adwan and Khdour (2020) completed a study concerning the acceptance of massive online open courses and found that students who demonstrated high scores on the Student Online Learning Readiness (SOLR) assessment were the most likely ones to take one of these courses. In another instance, researchers investigated readiness for online learning among secondary, graduate, and post-graduate students. The researchers found that online learning readiness increases as students move toward the post-graduate level of education (Tang et al., 2021). Post-graduate education generally fits into the andragogy model, as these students have some need in their lives and are ready to move from one state to another via an advanced degree (Gfrerer et al., 2021; Knowles, 1970).

Al-Adwan and Khdour (2020) used SOLR to measure the online learning readiness of students. Three competencies make up the SOLR assessment: social competency, communication competency, and technical competency (Yu, 2018). The technical competency in the SOLR assessment is synonymous with technology readiness (Al-Adwan & Khdour, 2020). Studies have shown that technology readiness is one of the most significant factors in online learning success (Khalid & Zainuddin, 2020; Wei & Chou, 2020).

In the case of Khalid and Zainuddin (2020), a high technology readiness score, $M = 3.30$ out of 4, correlates with a medium effect regarding the motivation to complete online learning activities, $r = .58$, $p < .05$. The researchers found that students with a high score in this dimension desired to participate more in the online activities. Likewise, Wei and Chou (2020) utilized a structural equation modeling analysis and confirmatory factor analysis to study the

effects of technology readiness on participants' discussion scores and course satisfaction. The researchers found that technology readiness exerts "a direct, positive effect on [students'] online discussion score and course satisfaction [as well as] a mediated effect (p. 48)" on the perceptions of their online discussion score and course satisfaction, $B = .545$, $SE = .119$, $p < .001$ and $B = .318$, $SE = .130$, $p < .05$, respectively.

Much of the research behind online learning readiness, including the research mentioned in this section, focuses on full-time adult learners such as college students (Chung et al., 2020b; Kalkan, 2020; Martin et al., 2020). Multiple tools are available to measure online learning readiness (Chung et al., 2020a; Yu, 2018). One of the common elements of all these tools is using technology readiness as an indicator and sub-scale for online learning readiness. In the studies these tools are used in, technology readiness is a significant indicator of online learning readiness, leading to successful online learning experiences (Al-Adwan & Khdour, 2020; Khalid & Zainuddin, 2020; Wei & Chou, 2020).

Readiness with Technology

One common theme running through career readiness and online learning readiness is the importance of technology readiness (Buzzetto-Hollywood & Alade, 2018; Chung et al., 2020a; Chung et al., 2020b; Hergüner et al., 2021; Martin et al., 2020; Quinn & Buzzetto-Hollywood, 2019). Parasuraman and Colby (2015) define technology readiness as "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (p. 60). Parasuraman's definition clarifies a term first introduced by the National Aeronautics and Space Administration (NASA) in the 1970s. At the time, NASA was working on space travel, and administrators needed a way to ensure new technologies were ready (Olechowski et al., 2020). Simultaneously, researchers in telecommunications were beginning to study the effects of the

adoption of new technology on society. This research focused on the social aspect of using a phone in a private household (Parasuraman, 2000).

These new ideas coalesced in the early 2000s as households gained broad access to the internet and Web 2.0 came into existence (Palvia et al., 2018). Over the past 20 years, the adoption rate for new technology has exploded. For example, it took 60 years for the telephone to reach an 80% adoption rate in the United States, but it only took 10 years for the cellphone to reach the same saturation (McGrath, 2019; Palvia et al., 2018). This rapid growth of technology meant that people were constantly being exposed to new tools, and they had to decide whether or not they wanted to invest the time to learn and use these new tools (Hamutoglu & Basarmak, 2020). Technology readiness measures this propensity to overcome barriers in adopting new technologies (Parasuraman, 2000).

Corporate Technology Readiness. The most significant research around technology readiness focuses on the corporate world, where businesses attempt to have consumers adopt their technology or products. In a study regarding new banking software, researchers conducted a study using structural equation modeling to assess the influence of technology readiness on participants' willingness to adopt mobile banking software. They found that those with high technology readiness scores were more willing to adopt new software (Khadka & Kohsuwan, 2018).

In another instance, this time in the health services industry, researchers focused on older participants to determine if they were ready to adopt mobile-based health services. The researchers used a structural equation model to examine factors influencing participants' willingness to use mobile health services. They found that participants would be willing to adopt the new technology if its benefit was easy to perceive and it was easy and intuitive to use, among

other factors. These insights show that technology adoption is possible among groups that are hesitant to use new technologies so long as the risk-benefit ratio is low (Khan et al., 2021). The study by Khan et al. (2021) and the study by Sharit et al. (2021) show that the older people are a frequent target of technology readiness research. They are a common target for research because they lack experience with advanced technology (Khan et al., 2021).

These studies also demonstrate that much of the research regarding technology readiness occurs in the financial and health industries. These focus areas have continued to be studied recently (Alexandrino Caldeira et al., 2021; Jagde et al., 2021; Oo et al., 2021). Transportation, housing, communication, recreation, and work make up the other primary areas in which businesses try to entice consumers to use their technology (Khan et al., 2021).

Education Technology Readiness. The link between technology readiness and various aspects of education is well documented. As seen earlier, technology readiness is one of the most critical indicators of online learning readiness (Hergüner et al., 2021). That being said, technology readiness is tied to other areas of education. In the corporate world, technology usage has exploded over the past few years in the areas of virtual reality, cloud computing, learning management systems, and interactive Web 2.0 tools such as discussion boards and video creation sites. These tools are used in the classroom, in blended learning, and in online learning (Cho et al., 2021).

Geng et al. (2019) state that "Students with higher levels of technology readiness hold a positive attitude toward technological learning media and innovative platforms for communication" (p. 9). Likewise, the researchers say that students who are uncomfortable with technology may take longer to acclimate and use technology effectively. They found that technology readiness had a significant positive correlation with learning motivation and teaching

presence for students learning face to face and in a blended learning environment. Teaching presence refers to the processes that go into the course design, facilitation, and direction of the learning experience (Geng et al., 2019).

Technology readiness also applies to the teacher in the classroom. According to Istenic et al. (2021), "Teacher's readiness for technology integration also depends on their beliefs about the contribution of technology to teaching and learning, which influences their motivation for its adoption" (p. 2340). Istenic et al. (2021) also say that students tend to pick up new technology quicker than teachers because they are not worried about how it will affect the classroom. Because students can pick up technology faster, they are usually less wary, more engaged, and less burdened as new tools are introduced.

Most research around teachers and technology readiness refers to teachers' willingness and training related to implementing a given technology in the classroom. For instance, Istenic et al. (2021) examined whether teachers were ready to implement life-like robots in the classroom. Likewise, Vladimirovna (2020) looked at implementing innovative technologies for speech in the preschool classroom. The researcher's study focused on the training teachers received in the classroom to implement these identified innovative technologies. As noted by Vladimirovna, the study's purpose was to target the competence of the teachers' readiness to introduce innovative technology into the educational process.

Finally, Christensen and Knezek (2018) examined teachers' technology readiness to implement mobile learning in the classroom. They identified multiple barriers to implementing mobile learning. These barriers included a lack of teacher self-efficacy and negative attitudes toward technology. Both of these barriers deal with teacher technology readiness (Parasuraman & Colby, 2015). One common thread ties all these studies on teacher technology readiness

together. They all identified the need for high-quality professional development to support mobile learning implementation in the classroom (Christensen & Knezek, 2018; Istenic et al., 2021; Vladimirovna, 2020).

Technology Readiness and Online Professional Development

Whether for school or careers, readiness is an essential indicator of student success (Slutzky & DeBruin-Parecki, 2019). Technology readiness is an indicator of success for online learning (Chung et al., 2020b). However, there is a lack of research on teacher technology readiness regarding online professional development. Most of the current research on technology readiness focuses on how school districts can provide technology readiness support to teachers and students in the classroom. This support includes how students use current technology and how teachers implement new technology (Christensen & Knezek, 2018; Istenic et al., 2021; Kalkan, 2020).

Hung et al. (2010) first addressed technology readiness by including technology as an indicator in their online learning readiness scale. This scale was a general instrument and not developed to target teachers specifically. Reeves and Li (2012) identified that low technology readiness might be a barrier for teachers to succeed in online professional development. The researchers studied teachers' beliefs and attitudes toward online professional development and correlated them to their perceived readiness. They found that teachers believed that online professional development was valuable. This perception only increased after the teachers participated in an online professional development workshop ($F(1,11194) = 3{,}016.00$, $p < .001$, partial $n^2 = .22$). What was missing from this study was any comparison of technology readiness and teacher performance. Finally, Wuryaningsih et al. (2019) identified that the relative success of teachers in online professional development might be due to the removal of the technology

barrier. This observation of Wuryaningsih et al. was notably only an observation alongside their actual research study.

Summary

In the spring of 2020, the COVID-19 pandemic drove schools worldwide to close to in-person learning. While the shift to student learning online took the spotlight and the nations' concerns, all teacher professional development also shifted to an online format. With this in mind, schools must approach the development and planning of online professional development using appropriate andragogical and heutalogical principles. A review of the related literature shows that online learning has been around for a long time and has developed from correspondence courses to today's e-learning. Until the pandemic, most teacher professional development was held in person. The success factors and program design criteria have been well researched for in person professional development. However, there are very few systematic studies examining the effectiveness of online teacher professional development. Most of those that exist are general and do not delve into what factors determine the effectiveness of online professional development.

Online teacher development was new for many teachers with the advent of COVID-19. To succeed, many teachers had to participate before reaching the necessary technology readiness level. The concept of readiness has been studied widely across various learning domains, including kindergarten, careers, and technology. The theories of andragogy and heutagogy recognize readiness as a significant assumption and essential precursor to successful learning experiences. However, very little attention has been paid to technology readiness and its relationship with the effectiveness of online professional development. A gap exists in the literature about how technology readiness relates to the effectiveness of online professional

development. By understanding this relationship, administrators and program designers can provide necessary support and remove existing barriers. Administrators who remove existing barriers and provide support can ensure that all teachers have the same chance to succeed in their online professional development.

CHAPTER THREE: METHODS

Overview

The purpose of this quantitative, correlational study was to determine if there is a relationship between technology readiness and grades, the number of attempts taken, or the time it took to complete an online professional development. Chapter 3 begins with an overview of the research design and definitions of the variables used in the study. Then, the research questions and null hypotheses are stated. The questions and hypotheses are followed by describing the participants, setting, instrumentation, and procedure used. Finally, the chapter concludes with an outline of the data analysis plan.

Design

This study used a quantitative, correlational design. A correlational design is a non-experimental research design that investigates the relationship between two variables (Price et al., 2015). Researchers use correlational designs to "describe and measure the degree of association (or relationship) between two or more variables or sets of scores" (Creswell & Guetterman, 2019, p. 343). According to Gall et al. (2007), the purpose of correlation research is to "discover relationships between variables through the use of correlational statistics" (p. 332). Gall et al. also state that correlation results can be positive, negative, or nonlinear, or there can be no correlation. One advantage of correlational research is that it allows for the study of many variables simultaneously. Correlation research of a topic that identifies strong relationships can lead to more in-depth investigation of a topic using quasi-experimental or experimental designs.

Correlation designs are composed of two different branches of research. The first is a non-predictive relationship design. This branch seeks to examine the degree and the direction of relationships between particular variables. For example, a non-predictive correlation design for

this study could be used to examine the relationship between technology readiness and online professional development scores. In this case, researchers would expect participant scores to increase as participant technology readiness scores increase, demonstrating a positive correlation. Visually, this would be represented using a scatterplot containing a positively sloped line of best fit (Gall et al., 2007).

The second branch that Gall et al. (2007) identify is a predictive research design. Predictive studies seek to measure the ability of scores on one variable to predict scores on another variable. For example, the researcher might ask whether technology readiness scores can predict scores on online professional development rather than just explore the relationship. Gall et al. identified that these types of studies are often used in education to predict future student success in the workplace or placement in advanced-level courses.

A correlation research design is appropriate for this study because it seeks "to relate two or more variables to see if they are associated with each other" (Creswell & Guetterman, 2019, p. 343). In the study, the researcher wants to see if technology readiness can be related to online professional development scores, the number of attempts, or how much time it took participants to complete it. A correlation research design allows the researcher to discover possible relationships and determine the strength and the direction of relationships discovered (Gall et al., 2007).

A correlation is also appropriate for this study because each variable is quantitative and measurable. Each variable is also measured using a suitable instrument. The independent variable, technology readiness, which represents "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (Parasuraman & Colby, 2015, p. 60), was measured using the Technology Readiness Index 2.0 survey instrument. The first

dependent variable, participants' scores on an online professional development, came from test data. The researcher observed the second dependent variable, the number of attempts. Then, the researcher observed the third dependent variable, the time taken to complete the online professional development. Using a correlation is appropriate because a correlation allows the researcher to study four variables across three relationships simultaneously rather than needing to conduct a separate study to examine each variable and set of relationships (Gall et al., 2007).

Finally, a correlative study is appropriate because of the timeline of the study. The dependent variables come from a professional development provided in the fall of 2021, whereas the TRI data comes from the survey administered in the spring/summer/fall of 2022 to LEA staff. Gall et al. (2007) supports the use of a correlative study by stating that "In causal [correlational] research, the variables can be measured at one point in time or at different points in time" (p. 337). For example, correlation research done in the 1980s used questionnaire data from the 1940s to explore how the tone of those responses correlated to their current health status. They found that optimistic responses in the 1940s correlated to better health in the 1980s (Peterson et al., 1988).

For both data series, the researcher was not interested in manipulating the variables or trying to control for the effects of external or extraneous variables. In fact, using the terms dependent and independent variables for this study might be misleading to readers, as no variables are being acted upon (Creswell & Guetterman, 2019; Price et al., 2015; Warner, 2013). This disinterest in controlling for extraneous effects allows a correlation design to be valid regardless of the span of time between data collection points, as the researcher was only interested in the relationship between the measured variables (Creswell & Guetterman, 2019; Gall et al., 2007; Price et al., 2015; Warner, 2013). Furthermore, individual technology readiness

is a stable construct that does not vary widely over time or due to extraneous variables (Parasuraman & Colby, 2015; The Technology Readiness Index Primer, n.d.). Consequently, participants' scores were not expected to vary significantly over the course of 6 to 12 months. The research conducted while validating the TRI supports the lack of variability of participants' scores (Parasuraman & Colby, 2015).

Research Questions

RQ1: Is there a relationship between LEA staff technology readiness scores and grades on an online professional development?

RQ2: Is there a relationship between LEA staff technology readiness scores and the number of attempts taken to complete an online professional development?

RQ3: Is there a relationship between LEA staff technology readiness scores and the time it took to complete an online professional development?

Hypotheses

The null hypotheses for this study are as follows:

$H_0$1: There is no significant relationship between LEA staff technology readiness scores as measured by the Technology Readiness Index 2.0 and scores on an online professional development.

$H_0$2: There is no significant relationship between LEA staff technology readiness scores as measured by the Technology Readiness Index 2.0 and the number of attempts taken to complete an online professional development.

$H_0$3: There is no significant relationship between LEA staff technology readiness scores as measured by the Technology Readiness Index 2.0 and the time it took to complete an online professional development.

Participants and Setting

This section opens with an overview of the population studied. It then narrows its focus to describe the characteristics of the study participants. Included in this description are the sampling technique and sample size. Finally, this section concludes with a description of the study setting.

Population

Participants for this study came from a convenience sample of staff from a local education agency in north-central Pennsylvania during the 2021-2022 school year. The researcher invited all the staff of the LEA to participate in the study voluntarily. This population was appropriate for the study, as all employees were required to complete the same online professional development using the Infinitec Online Classroom during the same time period at the beginning of the 2021 school year. This professional development encompassed subjects such as trauma, harassment, privacy laws, and classroom procedures. Restricting the study to a population completing the same professional development was ideal, as this made the dependent variables easy to compare.

The LEA serves students who fall into primarily middle- and lower-income brackets. These students live in urban, suburban, and rural areas. There is a large proportion of students with disabilities in many LEA programs. The LEA employs about 300 staff across all departments. About 150 of those staff are teachers. About 80 are paraprofessional staff. The rest of the staff of about 70 people hold titles such as specialist, support staff, technology specialist, and supervisor or administrator. Staff from the LEA are primarily female. Since most are teachers, most also hold a bachelor's degree, with a smaller percentage holding a graduate degree. The LEA has teachers working with and in all local school districts across a multi-county

area. It also has teachers working in its school programs at independent sites.

Participants

For this study, 72 participants were sampled, which is more than the minimum number of participants required for a medium effect size. For a Pearson product-moment correlation coefficient, this number is 66 participants when assuming a medium effect size with a statistical power of .7 and an alpha of .05 (Gall et al., 2007). Participants were sampled across the entire population by allowing them to opt into the study. All full-time employees of the LEA were emailed the Technology Readiness Index survey link and provided with a description of the study. Those who chose to complete the index comprised the sample for the study.

The sample consisted of 16 males and 56 females from the LEA. Forty-one hold a graduate degree of some type, 19 hold a bachelor's degree, two hold an associate's degree, five have a high school diploma, and five listed their education as other. The most identified roles were teachers with 21 participants followed by specialists and administrators with 10 participants. Other identified roles included technology with nine participants, support staff with seven participants, and paraprofessionals with four participants. Eleven others listed their position within the organization as other.

Setting

The setting for this study was entirely in an online asynchronous environment. The data for the professional development variables came from trainings completed at the beginning of the 2021-2022 school year. Participants completed the online professional development via the Infinitec Online Classroom learning management system (LMS) at their own pace and time during a specific window of availability that began on August 7th, 2021 and extended through September 30th, 2021. All participants were required by the LEA to finish the assigned online

professional development by September 30th but could complete it any time during the given period.

All participants were assigned the same professional development learning path, which consisted of four modules that covered the topics of childhood trauma, bloodborne pathogens, workplace harassment, and privacy in education. Each of these modules included a recorded webinar, video, or presentation with embedded practice activities. Each module ended with a check for understanding consisting of 10 to 15 multiple-choice questions.

For each module, participants had to score at least 80% on the check for understanding quiz to move on. Participants who failed were asked to review the training material and then retake the check for understanding. Participants could retake the check for understanding until they reached a passing score of 80%. The scores for each module were automatically graded by the LMS and returned to the participant.

The researcher gathered the technology readiness data during the spring of the same school year using the Technology Readiness Index (TRI) 2.0 instrument. This gap in time, while not ideal, was not a serious issue due to the nature of technology readiness. The developers of the TRI 2.0 instrument have demonstrated that technology readiness is a mindset that is stable and resistant to change for each individual over time (Parasuraman & Colby, 2015; The Technology Readiness Index Primer, n.d.). The researcher used an email to communicate with participants about the study. This email included information and was used to obtain consent. Once consent was gathered, participants filled out the Technology Readiness Index instrument via an online Google form. By completing the form, participants ended their active participation in the study. The researcher was available via email to answer participant questions throughout the process. Additional communication via phone was also available if necessary.

Instrumentation

This study used the Technology Readiness Index 2.0 to measure the technology readiness of participants. The initial purpose of this instrument was to "measure people's propensity to embrace and use cutting-edge technologies" (Parasuraman & Colby, 2015, p. 59). Researchers have since used the tool to measure the technology readiness of participants across a wide range of contexts, from cutting-edge telemedicine to measuring the technology readiness of up-and-coming business people (Parasuraman & Colby, 2015; Penz et al., 2017). The researchers who developed the index see technology readiness as more of a mindset than knowledge or a skill. It is consequently resistant to change within an individual over time and regardless of external stimulus (Parasuraman & Colby, 2015; The Technology Readiness Index Primer, n.d.). Appendix A provides more details about the Technology Readiness Index, including scoring instruction.

Parasuraman and Colby (2015) created the Technology Readiness Index 2.0 by revising the Technology Readiness Index 1.0, an accurate but outdated instrument for measuring technology readiness. The need for the TRI 2.0 grew out of research conducted by Mick and Fournier (1998) that demonstrated four positive and four corresponding adverse reactions to technology. This research demonstrated a need for a more accurate indicator of technology readiness. The authors therefore created the TRI 2.0 to provide a robust indicator of technology readiness appropriate for the technological advancements present in today's society. Multiple researchers have used the revised TRI 2.0 (Crundall-Goode et al., 2017; Humbani & Wiese, 2018; Penz et al., 2017).

Parasuraman and Colby designed the TRI 2.0 to assess overall technology readiness and measure specific readiness across four distinct dimensions. The first dimension is optimism,

which refers to the belief that technology enables people to have more control, flexibility, and efficiency. The second dimension is innovativeness, which refers to people who are early adopters of technology. The third dimension is discomfort, which refers to being overwhelmed by and experiencing a lack of control with technology. The fourth dimension is insecurity, which refers to distrusting technology to work correctly and not cause harm. These four domains were then combined to compute an overall technology readiness score that demonstrates the participant's willingness to use or adopt new technology (Parasuraman & Colby, 2015).

Parasuraman and Colby established the TRI 2.0's validity by comparing the TRI 2.0 scale with the TRI 1.0 scale. They conducted a linear regression analysis using the overall score of the 1.0 and 2.0 scale as the independent variable and three measures of technology behavior as the dependent variables. This research demonstrate that both the TRI 1.0 and the TRI 2.0 scale demonstrated statistical significance at the .001 level that technology readiness could predict the reported technology behavior. The authors also compared all 23 technology behaviors captured in the survey with participants' technology readiness scores and found technology readiness to be associated with an increase in each behavior at the .001 significance level for all but one behavior (Parasuraman & Colby, 2015).

Parasuraman and Colby established the TRI 2.0's reliability by determining the Cronbach's alpha of each dimension. Each met or exceeded the accepted reliability threshold level of .7 (Parasuraman & Colby, 2015). The lowest corresponded to the domain of discomfort, at .70, which was followed by insecurity, at .71; optimism, at .80; and innovativeness, at .83. To further demonstrate the reliability of the constructs, Parasuraman and Colby performed a confirmatory factor analysis, which returned a goodness-of-fit index at .953, a nonnormed fit index of .920, a comparative fit index of .942, and a root mean square residual of .065

(Parasuraman & Colby, 2015). These reported values from the confirmatory factor analysis demonstrate the satisfactory fit of the constructs (Shek & Yu, 2014).

The TRI 2.0 instrument has 16 questions evenly split across the four dimensions. Questions for the dimensions of optimism and innovativeness regard positive themes. Questions for the dimensions of insecurity and discomfort regard negative themes and require reversal upon scoring the instrument. The instrument uses a 5-point Likert scale with values from Strongly Agree to Strongly Disagree. Responses correspond to numbers as follows: Strongly Agree = 5; Somewhat Agree = 4; Neutral = 3; Somewhat Disagree = 2; Strongly and Disagree = 1. The dimensions are scored by computing the averages for each of the four dimensions (Parasuraman & Colby, 2015).

A total technology readiness score is calculated by reversing the averages for the domains of insecurity and discomfort and then adding the averages for the four domains together and dividing them by four. The combined possible scores for this instrument range from 1.0 to 5.0. A score of 1.0 is the lowest possible score and indicates a low level of technology readiness. A score of 5.0 is the highest possible score and indicates a high level of technology readiness. Appendix A provides detailed scoring information (Parasuraman & Colby, 2015).

The TRI 2.0 instrument can be administered via phone, in person, or asynchronously online using a form or survey application. If administered online, detailed instructions should be included to ensure the participant understands how to complete the survey instrument. The instrument takes approximately 10 minutes to complete. Appendix A provides detailed administration instructions. Once all participants completed the instrument, the researcher scored it for this study using the instructions in Appendix A. Finally, Rockbridge Associates granted permission to use this instrument for academic research purposes. Appendix B provides the

permission letter to use this instrument from Rockbridge Associates.

Procedures

This present study began with the submission of the research plan and proposal to the researcher's dissertation committee. The researcher simultaneously gained consent from the participating organizations to conduct the research study using their data and staff. Appendix C provides the signed organizational consent forms. After this, the researcher defended the proposal before the dissertation committee. Then the researcher submitted the study to Liberty University's Institutional Review Board (IRB) for approval to conduct research with human subjects. Appendix D provides the complete IRB approval.

With IRB approval in hand, the researcher finalized the study procedure with the dissertation committee. The instrument was finalized as part of this process by combining the TRI 2.0 instrument and the demographic questions into one online survey. Appendix E gives a detailed description of the included demographic questions. This process also included drafting the email used to recruit participants. This email explained the study's purpose, provided directions on how to consent and participate, and provided a link to the survey. Appendix F provides the participant consent form. The researcher then reviewed this email and the step-by-step procedure with the executive director of the participating organization. Appendix G provides the recruitment email and instructions.

Once the researcher gained approval from the dissertation committee and the executive director, the researcher sent out the email to the potential participants. This email included information on the study, instructions on how to complete the study, and the survey link. Because the LEA uses Google for Education on a regular basis, the researcher delivered the survey via Google forms, which was a familiar tool for the staff of the LEA. The survey

remained open for four weeks for participants to complete. Two reminder emails encouraging voluntary participation were sent out to the population two weeks and one week before the survey closed. Appendix G provides examples of the reminder email.

When the survey window closed, the researcher exported the data from the survey site into a spreadsheet. Then, the researcher calculated the technology readiness score for each participant using the provided instructions for the TRI 2.0 instrument and entered it into the spreadsheet. The researcher then exported each participant's online professional development data into a separate spreadsheet from the organization's learning management system. These two spreadsheets were combined into one, and then, this integrated spreadsheet was de-identified by substituting a code for each participant.

This de-identified spreadsheet was then converted into an SPSS data file to conduct the statistical analysis. Using SPSS, the researcher conducted assumption testing and calculated a correlation coefficient for each hypothesis to determine if a relationship existed between technology readiness and the participants' grades on the online professional development, the completion time, or the number of attempts on each assessment for the online professional development. The researcher then reported the findings of the study in Chapter 4.

Because the researcher collected personally identifiable information during the study, the researcher implemented a data protection plan. First, the researcher stored all data for the study in a personal Google Drive account that was secured with two-factor authentication at all times. No other individuals or organizations had access to this account at any time. Then, the researcher de-identified the dataset by replacing names with codes and removed any additional personally identifiable information, such as emails. This de-identified data was the only set of data shared with anyone, including the dissertation committee.

Finally, the researcher secured the data for long-term storage after the study. To do so, the researcher first removed all data from the site used to present the survey. Then, he downloaded all other study data to an external, offline hard drive to be stored in a safe. He lastly removed the data from the Google Drive account. The researcher will retain the data for five years after the study's conclusion.

Data Analysis

The statistical analysis used in this study consisted of three separate Pearson product-moment correlation coefficient analyses (Gall et al., 2007). Correlation coefficients were calculated to show the degree and direction of a possible relationship between two variables (Warner, 2013). This type of study was consistent with the presented research questions. Those questions were used to explore the potential relationship between technology readiness and three other variables. Correlations come in two forms, predictive and causal. The researcher considered using bivariate linear regressions and a predictive research design with predictor and criterion variables but rejected this idea because the possible predictor variable was unable to be collected before the other variables in the study (Gall et al., 2007).

Instead, the researcher used a causal relationship research design and calculated Pearson's *r* for each correlation. Gall et al. (2007) support this analysis by stating, "causal relationship studies [are used] to identify the causes and effects of important educational phenomena" (p 337). Pearson's *r* holds one distinct advantage for this study over a linear regression: Pearson's *r* is symmetrical, which means "the correlation of X with Y is identical to the correlation of Y with X" (Warner, 2013, p. 348).

This advantage is significant because it allows the study results to be applied more broadly across different educational scenarios. For instance, decision-makers can use a positive

correlation between technology readiness and the time it took to the complete the online professional development to identify teachers who need support. These teachers might have a low level of technology readiness based on the time it took them to complete the online professional development. Understanding this relationship is essential because most administrators do not know the technology readiness level of their staff.

The data were analyzed by comparing the technology readiness scores with each of the other variables to determine if a causal relationship might exist between technology readiness and the other variables. It is important to note that a correlation design alone cannot show causation because of unknown or uncontrolled factors (Gall et al., 2007). The resulting statistic, the product-moment correlation coefficient, or Pearson's *r*, demonstrated the variables' linear positive or negative relationship (Warner, 2013).

The analysis began with data screening by visually inspecting the data for missing or inaccurate entries. The researcher then tested the assumptions by building a scatter plot for each of the three hypotheses with technology readiness on the *x*-axis and each of the other variables on the *y*-axis. A Pearson correlation requires that assumptions concerning bivariate outliers, linearity, and bivariate normal distribution must be met (Warner, 2013).

Before conducting the assumption testing, the research decided how to handle potential problems with the data, such as extreme outliers and data points that might fall outside of the line of best fit. The assumption of bivariate outliers was assessed by examining the scatter plot for extreme outliers. The assumption of linearity was assessed by examining the line of best fit to ensure all data points fell along the line. Finally, the assumption of normal distribution was assessed by looking for the classic cigar-shape structure of the data points on the scatter plot (Warner, 2013).

After assumption testing, the researcher calculated the product-moment correlation coefficient (Pearson's *r*) for each null hypothesis. For each correlation, the researcher used an alpha of .05 (Gall et al., 2007). Because the researcher was not testing an overall null hypothesis that required all tests to be significant and was not initiating a large number of tests with no specific or preplanned hypothesis, the researcher decided not to apply a Bonferroni adjustment (Armstrong, 2014; Perneger, 1998; Warner, 2013). A Pearson product-moment correlation coefficient serves as an effect size, so no additional effect size was reported (Gall et al., 2007). Chapter 4 reports the findings of this statistical analysis.

CHAPTER FOUR: FINDINGS

Overview

Chapter 4 begins by restating the research questions and null hypotheses. Then, it presents the results of this study, starting with descriptive statistics. Following the presentation of the descriptive statistics, the researcher discusses the data screening and assumption testing performed before the completion of the statistical analysis. Finally, the statistical analysis results are presented, with each research question presented in its own section.

Research Questions

RQ1: Is there a relationship between LEA staff technology readiness scores and grades on an online professional development?

RQ2: Is there a relationship between LEA staff technology readiness scores and the number of attempts taken to complete an online professional development?

RQ3: Is there a relationship between LEA staff technology readiness scores and the time it took to complete an online professional development?

Null Hypotheses

The null hypotheses for this study are as follows:

$H_0$1: There is no significant relationship between LEA staff technology readiness scores as measured by the Technology Readiness Index 2.0 and scores on an online professional development.

$H_0$2: There is no significant relationship between LEA staff technology readiness scores as measured by the Technology Readiness Index 2.0 and the number of attempts taken to complete an online professional development.

$H_0$3: There is no significant relationship between LEA staff technology readiness scores as measured by the Technology Readiness Index 2.0 and the time it took to complete an online professional development.

Descriptive Statistics

The researcher solicited participants for the study from an LEA in Pennsylvania. The researcher collected data for the Technology Readiness Index using a 16-question survey. Each question on the survey could be answered using a 5-point scale. The highest score was 4.50 indicating a high level of technology readiness, and the lowest was 1.81, indicating a lower level of technology readiness.

The researcher collected the data for the three other variables from the LEA's learning management system. Scores could be between 0 and 100. The lowest score was 59.41, and the highest score was 97.50. The variable for the number of attempts had to be at least four. The most common value for this variable was four, which occurred 22 times. Days to completion could fall between 1 and 54 days. The shortest time to completion was one day, and the highest was 53 days. The mean and standard deviation for each of these variables are reported in Table 1.

Table 1

Descriptive Statistics

Variables	*M*	*SD*	*N*
Technology Readiness Index	3.11	.59	72
Scores	79.14	8.88	72
Number of Attempts	6.54	2.92	72
Days to Completion	9.03	12.54	71

Results

Data Screening

The researcher screened the data to look for inconsistencies and missing data. The researcher identified one case that was missing data for the variable days to completion. This case was excluded from the study. No other issues were discovered during data screening.

Assumption Tests

The researcher used a Pearson product-moment correlation coefficient to test each null hypothesis. A Pearson correlation must meet assumptions regarding bivariate outliers, linearity, and bivariate normal distribution (Warner, 2013). The researcher used scatterplots to look for bivariate outliers between the TRI and grades (Figure 1), the number of attempts (Figure 2), and days to completion (Figure 3). No extreme bivariate outliers were identified between the TRI and grades or the number of attempts. The scatterplot between the TRI and days to completion in Figure 3 indicates some possible outliers. After reexamining the data, the researcher determined that one of the cases represented an extreme bivariate outlier. This outlier is the data point toward the upper right section of the scatterplot in Figure 3. The researcher removed that case when running the correlation coefficient between the TRI and the time to complete the online professional development.

Figure 1

Scatterplot Between the TRI and Grades

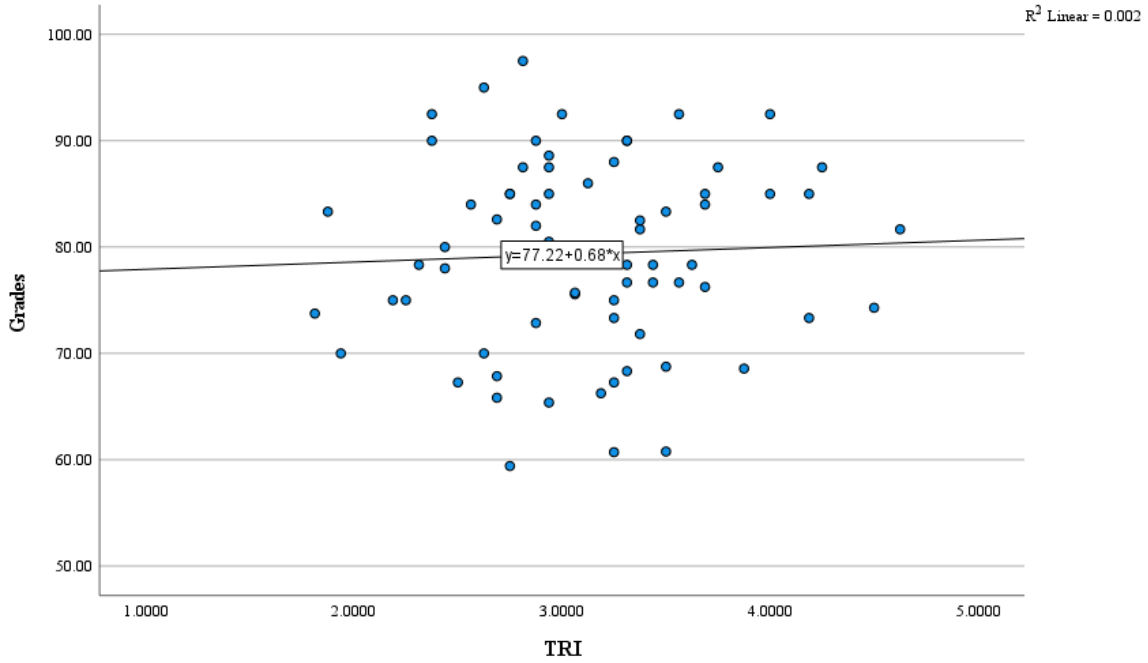


Figure 2

Scatterplot Between the TRI and Number of Attempts

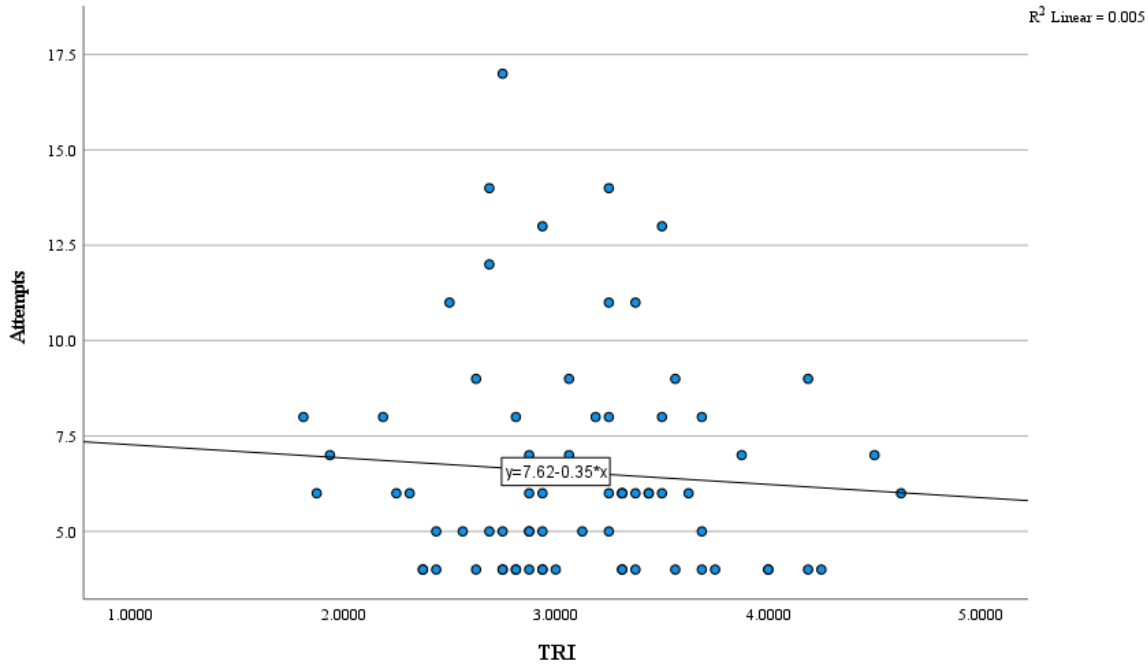
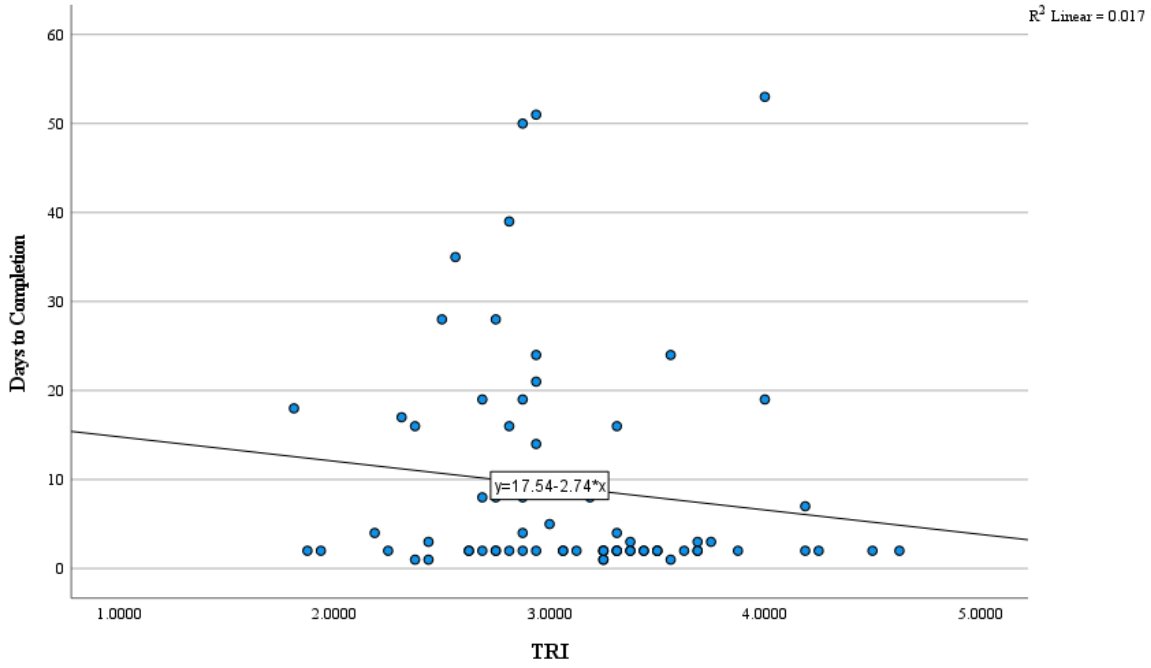


Figure 3

Scatterplot Between the TRI and Days to Completion



To check the assumption of linearity, the researcher applied a line of best fit to each scatterplot. No violations were noted, as each scatterplot indicates a linear rather than a curvilinear or monotonic relationship. Finally, the researcher tested the assumption of bivariate normal distribution using the same scatterplots. This initial testing indicated a normal distribution between the TRI and grades but a skewed distribution when examining the relationship between the TRI and the number of attempts and the TRI and days to completion.

Further exploration indicated a positive skewness for attempts, skewness = 1.53, and days to completion, skewness = 2.08. This violation led the researcher to transform the data before running any correlations. The research applied a natural log transformation to the number of attempts and days to completion. This transformation brought the skewness of attempts, skewness = .75, and days to completion, skewness = .82, under 1. These skewness scores

indicate that each variable is close enough to a normal distribution to use a general linear model such as a correlation model for statistical analysis (Warner, 2013).

Hypothesis 1 Results

The researcher used a Pearson product-moment coefficient with an alpha of .05 to test the null hypothesis that looked at the relationship between LEA staff technology readiness scores, as measured by the Technology Readiness Index 2.0, and scores on the online professional development. The results of the Pearson correlation, $r(72) = .046$, $p < .700$, indicate no significant relationship between TRI scores and grades on an online professional development. An $r = .046$ is considered a minimal effect resulting from random results rather than a relationship between the two variables. Because the correlation results were insignificant, the researcher could not reject the null hypothesis. In conclusion, there was no significant relationship between TRI scores and scores on an online professional development.

Hypothesis 2 Results

The research used a Pearson product-moment coefficient with an alpha of .05 to test the null hypothesis that looked at the relationship between LEA staff technology readiness scores, as measured by the Technology Readiness Index 2.0, and the number of attempts on an online professional development. Because the data for attempts was skewed, the researcher transformed it by applying a natural log transformation and used the transformed data to perform the correlation. The results of the Pearson correlation, $r(72) = -.066$, $p < .581$, indicate no significant relationship between TRI scores and scores on an online professional development. An $r = -.066$ is considered a minimal effect resulting from random results rather than a relationship between the two variables. Because the correlation results were insignificant, the researcher could not

reject the null hypothesis. In conclusion, there was no significant relationship between TRI scores and the number of attempts on an online professional development.

Hypothesis 3 Results

The research used a Pearson product-moment coefficient with an alpha of .05 to test the null hypothesis that looked at the relationship between LEA staff technology readiness scores, as measured by the Technology Readiness Index 2.0, and the time it took to complete an online professional development. Because the data for the time measured in days to completion was skewed, the researcher transformed it by applying a natural log transformation and used the transformed data to perform the correlation. The results of the Pearson correlation, $r(71) = -.242$, $p < .038$, indicate a significant relationship between the TRI and the time it took to complete the online professional development. The r of -.242 indicates a moderate negative correlation and suggested that the TRI score affected about 6% of the time it took to complete online professional development. The results generally indicate that staff with higher TRI scores finish online professional development faster than those with lower TRI scores. Because the correlation results demonstrated a moderate negative relationship, the researcher safely rejected the null hypothesis. In conclusion, there was a significant correlation between TRI scores and the time taken to complete an online professional development.

CHAPTER FIVE: CONCLUSIONS

Overview

Chapter 5 begins with an overview of the entire study. Then, the results presented in Chapter 4 are discussed. Each research question is discussed separately. After that discussion, the researcher delves into the study's implications for society. This section on implications is followed by an exploration of the study's limitations. Finally, the researcher presents recommendations for future research.

Discussion

This quantitative, correlational study aimed to determine if there is a relationship between technology readiness and grades, the number of attempts taken, or the time it took to complete an online professional development. As a reminder, online professional development is a relatively new practice in the history of distance learning. Its current iteration only came into being with the advent of Web 2.0 at the turn of the century (Agostinelli, 2019). Since then, researchers have published multiple conflicting studies about the effectiveness of online professional development, with some demonstrating no difference between online and face-to-face learning, some demonstrating face-to-face learning as superior, and some demonstrating online learning to be more effective (Fisher et al., 2010; Fishman et al., 2013; Webb et al., 2017; Wuryaningsih et al., 2019). Rather than complete another study about the effectiveness of online professional development, the researcher focused on a possible variable, technology readiness, to see if it might affect the online professional development outcomes.

The researcher gathered the technology readiness data through a 16-question validated survey instrument called the Technology Readiness Index 2.0. The scores from this instrument were then correlated with each of the three variables regarding performance on an online

professional development. The only significant relationship was between technology readiness and the time it took to complete the online professional development. Each question is discussed in more detail in the following sections.

Research Question 1

Research question 1 is, “Is there a relationship between LEA staff technology readiness scores and grades on an online professional development?” The findings indicate that there seem to be no significant relationship between the two. According to Ifenthaler and Yau (2020), scores are one of the most common and vital indicators of success for any training exercise. The fact that technology readiness does not seem to skew the results of participants is essential in the context of andragogy and heutagogy.

From an andragogical perspective, one way adult learners remain engaged in learning is to feel their learning is successful (Knowles, 1970). Because there seems to be no relationship between the TRI and their grades on an online professional development, these grades will accurately represent how well they are performing. From a heutagogical perspective, where learners are choosing their paths, any barrier or misrepresented score because of confounding factors such as technology readiness could make them more hesitant to seek out additional online professional development in the future (Hase & Kenyon, 2001). They might lose the benefits of online professional development, such as no need to travel, instant access, and more (Agostinelli, 2019; Li, 2018).

Because of these benefits of online professional development, school districts will probably never return to how they were before the pandemic, when almost all professional development was in person. Instead, they will continue to leverage online professional development to provide more opportunities for their teachers (Onyeaka et al., 2021). The fact that scores do not seem to

be affected by technology readiness will only continue this trend. Administrators will continue to see positive results even for those educators who might not feel as comfortable with technology.

The results for research question 1 about the TRI and grades also contrasts with the observations made by Wuryaningsih et al. (2019). The researchers attributed the participants' performance on the online professional development partially to their technology readiness and technology training before completing the online professional development. While this study on the TRI and grades does not examine in-person and online participants, the lack of a relationship between participant grades and the TRI indicates that they would have scored the same regardless of additional training or technology readiness preparation. Indeed, the scatter plot displayed in Figure 1 and the Pearson coefficient of $r(72) = .046$, $p < .700$, demonstrate this well.

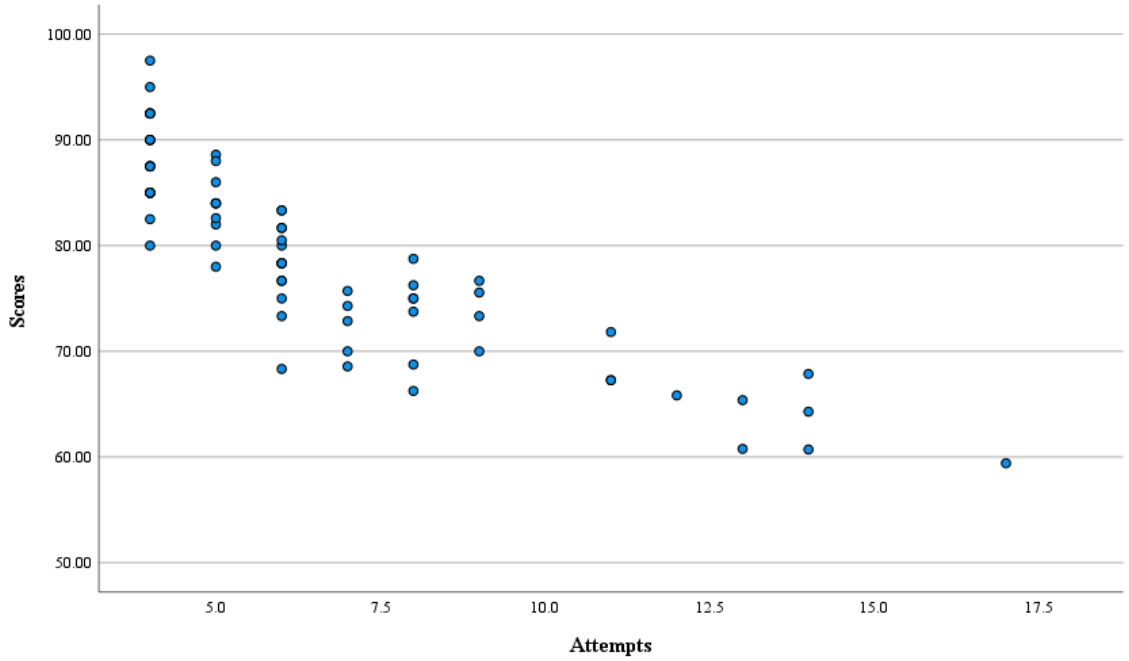
Research Question 2

Research question 2 is, "Is there a relationship between LEA staff technology readiness scores and the number of attempts taken to complete an online professional development?" The finding indicates that, while the relationship was more substantial than between the TRI and grades, there was no significant relationship between the TRI and the number of attempts. According to the research, the number of attempts can be used as an indicator of online learning success, and learners generally score higher when taking multiple attempts (Bergner et al., 2019; Temen et al., 2020).

This lack of a significant relationship makes sense when examining the relationship between the number of attempts and grades. Though it was not part of this study and no inferential statistics were calculated, the number of attempts and grades display a linear relationship, as shown by the scatterplot in Figure 4. This scatterplot shows that those who complete the online professional development on the first attempt tend to score higher.

Figure 4

Scatterplot Between the Number of Attempts and Scores



The lack of a significant relationship between the TRI and the number of attempts fits with the theories of andragogy and heutagogy. Because there seems to be no relationship between the two, providing extra attempts can be a way to provide learners with more choice. Allowing additional attempts is an example of self-directed learning, a pillar of andragogy (Machynska & Boiko, 2020). It also allows them to choose to improve on their own. Even once a participant has obtained a passing score, they can retake the assessments. Having the freedom to redo assignments creates an environment where participants can choose to continue their learning if they feel the need to, which is an example of heutagogy (Hase & Kenyon, 2001). This strategy can lead to increased learning from online professional development assessments (Temen et al., 2020).

Research Question 3

Research question 3 is, “Is there a relationship between LEA staff technology readiness scores and the time it took to complete an online professional development?” Unlike the first two research questions, the finding here indicates a small to moderate relationship between the TRI and the time it took to complete the online professional development.

This data on time to completion fits nicely with the theories of both andragogy and heutagogy. From an andragogical perspective, giving learners a broader range of time allows them to self-direct their learning. They can stop and start and choose not to complete everything in one sitting. This ability to stop and start makes learners feel like they are in control of the learning process (Knowles, 1970; Machynska & Boiko, 2020). According to the heutagogical perspective, adult learners like to control the learning environment (Hase & Kenyon, 2001). For staff taking asynchronous online learning, when they choose to complete the experience is one of the only things they can control. The relationship between the TRI and time to completion demonstrates that, while those with a lower TRI score take longer to complete the training, they do complete it.

This last point is essential from an andragogical perspective. Adults tend to overcome obstacles if they need to learn, but children tend to stop learning when encountering obstacles (Machynska & Boiko, 2020). The data from this study support this theory, as the relationship between the TRI and grades and the number of attempts was not significant. Only the relationship between the TRI and time to completion was significant, which does not measure how much learning occurred.

This significant relationship between the TRI and time to completion supports the notion of technological constraint. Multiple studies have shown that people with a lower TRI tend to take

longer to adopt new technologies (Schmidt et al., 2020; Sharit et al., 2021). The same holds in this study: those with a lower TRI tended to complete the online professional development more slowly. The exciting part of the comparison between the TRI and time to complete online professional development is that most previous studies indicate that the slowdown was not because of technical ability or the ability to navigate the platforms or courses but because of users' lack of confidence in their ability to complete the tasks (Cho et al., 2021; Malhotra et al., 2021). This lack of confidence holds for other integrations of technology tools in the classroom (Hamutoglu & Basarmak, 2020). The only setting in previous research where learners were held back by a lack of skill was in the K-12 classroom, where an inability to use technology led to students obtaining lower grades (Loveland, 2017).

Finally, Hong et al. (2021) identified academic procrastination as an indicator of online learning success. Studies showed that those who take longer to complete tasks experience more negative effects than learners who complete them quickly. Those negative effects were predominantly expressed as self-applied stress and pressure to finish the activities (Lee et al., 2020; Soffer & Cohen, 2018). A significant relationship between the TRI and time to completion supports this idea, especially in light of the research that shows those with a lower TRI score are more hesitant to tackle tasks with new technology (Cho et al., 2021). This hesitancy leads to procrastination, which consequently leads to more stress. This stress can affect the learners' performance on the given task.

Additional Discussion

One of the problems identified in the literature concerning technology readiness is that people can be held back by their views on technology. Being held back by technology generally means those with a lower Technology Readiness Index score are less likely to adopt or try new

technology than those with a higher score (Parasuraman & Colby, 2015). The literature supports two views here. The first is that a lack of technology-related skills makes people perform worse on technology tasks (Loveland, 2017). The second view is that people perceive that they will perform worse on technology tasks, when, in fact, they will perform the same as their peers who are more technology literate (Hamutoglu & Basarmak, 2020).

The present study supports the second view. Because of the lack of a significant relationship between the TRI and grades or attempts, the technology is not negatively affecting people's ability to succeed in online professional development. The significant relationship between the TRI and time to completion shows that it might take those with lower TRI scores a bit longer to complete the online professional development. This conclusion about the length of time needed to complete the online professional development is in line with Cho et al. (2021), who found that nurses lacking confidence in their ability to complete technology tasks fell behind those that did have confidence.

Implications

The results of this study provide a few implications regarding the relationship between technology readiness and grades, the number of attempts, and the time to complete the online professional development. Technology readiness means "People's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (Parasuraman & Colby, 2015, p. 60). Because the study looked specifically at public education staff, the first implication concerns those who completed the online professional development. The lack of a significant relationship between the TRI and grades or the number of attempts demonstrates that learners do not need to worry about whether their technological ability will affect their performance on an

online professional development. This lack of a significant relationship is also helpful for administrators seeking to provide online professional development opportunities to their staff.

These findings regarding the relationship between the TRI and grades and the number of attempts also hint at a broader implication for online learning. Because no relationship was found between these variables, schools can continue to roll out online professional development opportunities to their staff without having to differentiate them based on technology readiness levels. Schools and districts also do not have to devote many extra resources to ensuring staff are comfortable with the online professional development. One word of caution regarding this implication is that the results of this study only include staff taking the online professional development and not teachers using or implementing technology in the classroom. Other studies have shown the need for additional training and support to make staff feel comfortable and use those tools well in the classroom (Lockee, 2021; Onyeaka et al., 2021).

The next implication regards the only significant relationship in this study, which is the relationship between the TRI and the time to complete the online professional development. The results suggest that those with lower TRI scores need more time to complete these online experiences. The implication for administrators is that they might need to allow for more time when scheduling online professional development trainings. The participants in this study had up to 54 days to complete the trainings, which allowed for flexibility and choice. If the time window was shorter, this might have affected performance.

Finally, this study adds to the existing body of knowledge by addressing the gap in the literature concerning the relationship between the TRI and grades, the number of attempts, and the time to complete online professional development. Most research up to this point regarding technology readiness only addresses the adoption of new technologies. Similarly, most research

regarding online professional development only examines if it is better or worse than face-to-face professional development. No current studies address the underlying reasons why teachers and school staff might be more or less successful partaking in online professional development. The fact that at least one relationship exists between technology readiness and online professional development means there could be others.

Limitations

The researcher identified some of the limitations of this study and organized them into threats to the study's internal and external validity. The first threat to internal validity was the time lapse between collecting the Infinitec testing data and having the staff complete the TRI. Some of the answers on the TRI might have been different if the survey were taken around the time participants completed the online professional development. The researcher addressed this by using a correlational design, which addresses the relationship as a snapshot in time, and the TRI, which is an indicator that is resistant to change over time.

The second threat to internal validity was the skewed nature of the data for two of the variables. Attempts and completion time both had a positive skew with a long tail. This positive skewness led to a non-normal distribution, which can lead to a correlation coefficient that might not explain the entire relationship. To address this issue, the researcher transformed the data for attempts and time to completion using the natural log calculation. This transformation brought both variables closer to a normal distribution and helped eliminate the long tail.

The last threat to internal validity was the sample size. An *n*-count of 72 is a decent sample size for a correlation, but it is not big enough to eliminate the effects of outliers and skewed or non-normal data. A correlation becomes increasingly robust as the sample size

increases due to the central limit theorem (Warner, 2013). Due to the nature of the study population, it was hard for the researcher to increase the sample size to address this limitation.

The greatest threat to external validity was that the study was completed in one school district in central Pennsylvania. This limits the extent to which the results can be generalized across a larger population. The researcher tried to address this issue by ensuring the sample was diverse. By including other people in addition to teachers, the sample was larger and included a better spread of positions and education levels.

Recommendations for Future Research

Several gaps in the literature regarding technology readiness and online professional development have come to light as a part of this study. The researcher recommends the following areas for further research on technology readiness and online professional development.

1. It would be beneficial to conduct additional research exploring the relationship between other variables concerning online professional development. Researchers could run correlations between scores, attempts, the time needed to complete an assessment, level of education, job title, and more. The data for these comparisons is available but was not included in this study.
2. It would be beneficial to complete the study again using a different learning management system. It might even be beneficial to use multiple learning management systems and compare the results of each.
3. Most research around the TRI involves the adoption of new technology. It would be helpful to complete more research in the field of education. Areas such as the adoption of technology in the classroom or the effects of the TRI on in-person professional development would be areas to explore.

4. Because of the significant relationship between the TRI and time to completion, it would be helpful to complete the study again to verify those findings.
5. This study only encompassed one LEA in central Pennsylvania. It would be beneficial to duplicate the study with different populations, such as urban school districts or school districts in other countries.
6. Completing this study with a much larger sample size would also be beneficial.

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APPENDIX A

TECHNOLOGY READINESS INDEX 2.0: INSTRUCTIONS FOR USE IN A SURVEY

July 24, 2014

BACKGROUND

The Technology Readiness Index 2.0 (TRI 2.0) is a survey research scale that measures and classifies individuals by their propensity to adopt and embrace technology at home and work. The scale can be used with any population (consumer, business, employee) and in any type of survey (telephone, mail, web, mobile, self-administered).

Instructions were removed to comply with copyright.

Parasuraman, A. & Rockbridge Associates, Inc. (2014). *Technology Readiness Index 2.0.* https://rockresearch.com/techqual/

APPENDIX B

RE: [External] RE: TRI 2.0

Charles Colby [redacted]
Thu 5/6/2021 6:04 PM
To: Ringkamp, Scott [redacted]

1 attachments (24 KB)
TR Index 2.0 List for Academic Subscribers.docx;

Hi Scott, you have a license now to use the TRI 2.0 for your academic study. As a resource for you, I am attaching a list of scale items and recommendations on administering the scale.

Let me know if you have questions.

Regards,

ROCKBRIDGE

Charles L. Colby
Principal, Chief Methodologist and Founder
Office: [redacted]
[redacted]

AMERICAN INNOVATION INDEX™

From: Ringkamp, Scott [redacted]
Sent: Thursday, May 6, 2021 12:51 PM
To: Charles Colby [redacted]
Subject: Re: [External] RE: TRI 2.0

Good afternoon,

I wanted to follow up and see if you had received my completed form for using the TRI 2.0 tool.

Thanks,

Scott

--

Scott Ringkamp

Liberty University

From: Ringkamp, Scott [redacted]
Sent: Tuesday, April 27, 2021 10:02 AM
To: Charles Colby [redacted]
Subject: Re: [External] RE: TRI 2.0

Good morning,

Thanks for the information and for allowing the use of your instrument. I have attached the completed form! I am looking specifically at how technology readiness affects the performance of teachers in online asynchronous professional development. I am currently working on my dissertation proposal with a hopeful defense and graduation by next May. I will gladly share results and data from the study.
Best regards,

Scott

--

Scott Ringkamp

Liberty University

From: Charles Colby [redacted]
Sent: Monday, April 19, 2021 7:46 PM
To: Ringkamp, Scott [redacted]
Subject: [External] RE: TRI 2.0

[EXTERNAL EMAIL: Do not click any links or open attachments unless you know the sender and trust the content.]

Hi Scott, since this is an academic study, you may license the TRI 2.0 for free. To obtain a license, please complete and return the attached agreement. I will follow up by authorizing your license and providing more information on the scale.

Regards,

Charles L. Colby
Principal, Chief Methodologist and Founder
Office: [redacted]

From: Ringkamp, Scot[redacted]
Sent: Monday, April 19, 2021 7:23 PM
To: [redacted]
Subject: TRI 2.0

Good afternoon,

I am a doctoral student with Liberty University. I am working on my dissertation with a focus on how teacher readiness affects teacher success when completing online professional development.

I wanted to see what options I have to use or license your technology readiness index 2.0 instrument for use in my dissertation research.

Thanks,

Scott

APPENDIX C

[redacted]

3/21/2022

Scott Ringkamp
Liberty University Doctoral Candidate
Liberty University

Dear Scott Ringkamp:

After careful review of your research proposal entitled The Relationship Between Technology Readiness and Online Professional Development, we have decided to grant you permission to contact our staff and invite them to participate in your study.

☒ We grant permission for Scott Ringkamp to contact the staff of [redacted] to invite them to participate in his research study.

☒ We are requesting a copy of the results upon study completion.

Sincerely,

[redacted]

[redacted]

3/21/2022

Scott Ringkamp
Liberty University Doctoral Candidate
Liberty University

Dear Scott Ringkamp:

After careful review of your research proposal entitled The Relationship Between Technology Readiness and Online Professional Development, we have decided to grant you permission to contact our staff and invite them to participate in your study and receive and utilize staff training data from the Infinitec learning platform for your research study.

☑ We grant permission for Scott Ringkamp to contact the staff of [redacted] to invite them to participate in his research study.

☑ We grant permission for Scott Ringkamp to use the requested data. The requested data WILL NOT BE STRIPPED of identifying information before it is provided to the researcher.

☑ We are requesting a copy of the results upon study completion.

Sincerely,

[redacted]

Executive Director

[redacted]

[redacted]

APPENDIX D

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

April 20, 2022

Scott Ringkamp
Kevin Struble

Re: IRB Exemption - IRB-FY21-22-877 The Relationship Between Technology Readiness and Online Professional Development

Dear Scott Ringkamp, Kevin Struble,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:104(d):

Category 2.(iii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by §46.111(a)(7).

Your stamped consent form(s) and final versions of your study documents can be found under the Attachments tab within the Submission Details section of your study on Cayuse IRB. Your stamped consent form(s) should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document(s) should be made available without alteration.

Please note that this exemption only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at [redacted]

Sincerely,
G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office

APPENDIX E

1. First Name
2. Last Name
3. Email Address
4. Job Title
5. Highest Level of Education

APPENDIX F

Consent

Title of the Project: The Relationship Between Technology Readiness and Online Professional Development

Principal Investigator: Scott Ringkamp, Doctoral Candidate, Liberty University

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be 18 years old and currently employed by either [redacted]. Taking part in this research project is voluntary. Please take time to read this entire form and ask questions before deciding whether to take part in this research.

What is the study about and why is it being done?

The purpose of my research is to see if individuals' level of comfort using technology has any effect on how well they do when completing professional development online. This includes looking at performance and how long it takes people to complete professional development online.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following things:

Complete an online survey to measure how comfortable you are using technology. This survey will take about 10-15 minutes.

Grant permission for the researcher to receive your testing data, to information such as name, email, quiz name, quiz status, quiz score, and quiz date.

How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include a deeper understanding of how technology readiness can affect people's performance when completing professional development online.

What risks might you experience from being in this study?

The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records. Data collected from you may be shared for use in future research studies or with other researchers. If data collected from you is shared, any information that could identify you, if applicable, will be removed before the data is shared.

Participant responses will be kept confidential by removing identifying information and replacing names with codes.

Data will be stored in a private Google Drive folder protected by 2-factor authentication and may be used in future presentations. After three years, all electronic records will be deleted.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University[redacted]. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you will be destroyed immediately and will not be included in this study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Scott Ringkamp. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at [redacted] or [redacted]. You may also contact the researcher's faculty sponsor, Dr. Kevin Struble, at [redacted].

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, [redacted]

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

_____

Printed Subject Name Signature and Date

APPENDIX G

Greetings:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. The purpose of my research is to determine if there is a relationship between educator technology readiness and grades, the number of attempts taken, or the time it took to complete online professional development training, and I am writing to invite eligible participants to join my study.

Participants must be 18 years of age or older and must be current employees of the [redacted]. Participants, if willing, will be asked to complete an online survey consisting of 16 questions. Participants will also need to consent to the release of their testing data to the researcher, to include information such as name, email, quiz name, quiz status, quiz score, and quiz date. It should take approximately 10–15 minutes to complete the survey. Names and emails will be requested as part of this study, but the information will remain confidential.

To participate, please click here (Link to survey).

A consent document is provided as the first page of the survey. The consent document contains additional information about my research. After you have read the consent form, please type your name and the date and click the button to proceed to the survey. Doing so will indicate that you have read the consent information and would like to take part in the survey.

Sincerely,

Scott Ringkamp
Liberty University Doctoral Candidate

[redacted]

[redacted]

Greetings:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a doctoral degree. Two weeks ago, an email was sent to you inviting you to participate in a research study. This follow-up email is being sent to remind you to complete the survey if you would like to participate and have not already done so. The deadline for participation is [provide exact date upon IRB approval].

Participants, if willing, will be asked to complete a survey consisting of 16 questions. It should take approximately 10-15 minutes to complete the survey. Participants will also need to consent to the release of their testing data to the researcher, to include information such as name, email, quiz name, quiz status, quiz score, and quiz date. Names and emails will be requested as part of this study, but the information will remain confidential.

To participate, please click here (Link to survey)

A consent document is provided as the first page of the survey. The consent document contains additional information about my research. After you have read the consent form, please type your name and the date and click the button to proceed to the survey. Doing so will indicate that you have read the consent information and would like to take part in the survey.

Sincerely,

Scott Ringkamp
Liberty University Doctoral Candidate

[redacted]

[redacted]